MEETINGS

Advancing the Integration of Marine Ecosystem Dynamics and Biogeochemistry

Second Annual Ocean Carbon and Biogeochemistry Summer Workshop; Woods Hole, Massachusetts, 23–26 July 2007

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The Ocean Carbon and Biogeochemistry (OCB) program, a scientific community-driven coordinating body designed to promote U.S. research and international cooperation, focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology to advance our understanding of ocean biogeochemistry. The second annual OCB summer science workshop, sponsored by the National Science Foundation, took place at Woods Hole Oceanographic Institution, convening 155 participants.

Plenary sessions focused on three broad interdisciplinary themes: (1) interplay between biotic structure and biogeochemical cycles, (2) changing ocean biogeochemistry, and (3) terrestrial/coastal ocean cross-boundary fluxes.

In the first session, workshop presenters summarized what is currently known about the role of marine organisms in nutrient and trace element cycling, and described novel modeling techniques and population genetics tools to better characterize and predict ecosystem response to environmental changes.

The second session focused on the impacts of rising atmospheric CO_2 levels on ocean biogeochemistry. Speakers showed recent observational trends in ocean pH, discussed the impacts of ocean acidification on marine organisms, summarized the challenges and recent advances of carbon system modeling and prediction, and explored the application of satellite data to assess changes in ocean biogeochemistry.

In the final session, on linking terrestrial and coastal ocean carbon cycles, speakers discussed observational capabilities for comparing terrestrial and coastal ocean carbon fluxes and identified primary carbon sources and sinks in the coastal zone. Speakers also discussed ongoing observational and modeling efforts to characterize and quantify the role of rivers as conduits between land and ocean in cross-boundary carbon and nitrogen fluxes.

Daily breakout sessions addressing high-priority subtopics within each workshop theme were held to identify important knowledge gaps, brainstorm effective observational and modeling strategies, and define OCB's role in forging ahead. Several common themes pertaining to OCB's scientific priorities emerged from the breakout sessions, including (1) impacts of climate change and ocean acidification on ecosystem structure and trophic dynamics; (2) integration of observational and modeling studies, with a need for more effective model assessment and metrics; (3) field test beds for perturbation experiments (e.g., ocean acidification); (4) new time series sites spanning broad biogeochemical domains; and (5) support for new (and leveraging existing) ocean observing systems.

Current OCB projects include individual principal investigator grants and midsized projects (multiple PIs), with a view toward supporting even larger, coordinated studies. In addition to its summer science workshop, OCB will support annual scoping workshops starting in spring 2008 that target specific OCB research priorities, providing a public venue for research planning and multidisciplinary collaborations.

To access live webcasts and presentations from the meeting, visit http://www.us-ocb.org/OCB_webcast_2007.html.

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Climate-Induced Forest Dieback as an Emergent Global Phenomenon

Organized Oral Session at the Ecological Society of America/Society of Ecological Restoration Joint Meeting; San Jose, California, 5–10 August 2007

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An organized oral session at the annual meeting of the Ecological Society of America in San Jose, Calif., posed this question: Is climate-induced drought stress triggering increasing rates and unusual patterns of forest die-off at a global scale? Twenty-nine researchers representing five continents reported on patterns, mechanisms, and projections of forest mortality.

Observations include widespread forest dieback or reductions in tree cover and biodiversity in response to drought and warmer temperatures in the African Sahel (Patrick Gonzalez, The Nature Conservancy), Mediterranean and alpine Europe (Jorge Castro, Universidad de Granada), and Argentinean Patagonia (Thomas Kitzberger, Universidad Nacional del Comahue). In contrast, although much *Eucalyptus* mortality has resulted from recent droughts in Australia, warming trends have been less pronounced in the Southern Hemisphere and it is unclear if contemporary climate-induced tree mortality differs from previous historical drought impacts (Rod Fensham, Queensland Herbarium).

Die-off in North American ecosystems, especially semiarid woodlands and forests of the southwestern United States, received particular focus. Contemporary tree mortality across millions of hectares is often associated with multiple stress factors, including biotic agents—especially bark beetles—but mortality of other life-forms (grasses, cacti, shrubs) can be attributed to abiotic water stress from climate alone, suggesting that recent warm drought conditions are the primary driver of the forest die-off (Neil Cobb, Northern Arizona University). This perspective was supported by intensive analysis of regional forest inventory data documenting maximum temperature as the key explanatory variable for tree mortality during the recent drought (Amanda White, Los Alamos National Laboratory).

The consequences of such drought-triggered ecosystem changes could fundamentally alter species associations like the current codominance of piñon and juniper species in southwestern U.S. woodlands; these species are projected to become spatially disassociated in the future, consistent with paleoecological patterns under previous climate conditions (Ken Cole, U.S. Geological Survey). More robust understanding of nonlinear physiological threshold responses to both chronic and acute water stress is required to improve future projections of tree mortality, which can result from hydraulic failure for some species and carbon starvation for others, as in the recent piñon-juniper die-offs (Nate McDowell, Los Alamos National Laboratory).

Despite the need for calibrations with additional field observations and experiments, global vegetation simulations generally indicate an increasing risk of large-