



ECOSYSTEMS + SOCIETY

Final Project Outcomes Report

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The New Hampshire NSF EPSCoR RII Track-1 award (#1101245), “Interactions Among Climate, Land Use, Ecosystem Services, and Society,” integrated ecosystem measurements, process-based models and social science to better understand how climate and land cover change affect key terrestrial and aquatic ecosystems across multiple scales. The project’s goals were: 1) To understand how climate variability, climate change and human land use affect the ability of NH landscapes to provide essential aquatic and terrestrial ecosystem services across multiple scales, 2) To build capacity for competitive research in interdisciplinary ecosystem-related natural and social sciences, 3) To strengthen and diversify the STEM workforce pipeline in NH, and 4) To strengthen management and policy decision capacity in NH regarding ecosystems and their services to, and interactions with, society.

Led by the University of New Hampshire, the “Ecosystems & Society” project engaged researchers and educators from institutions of higher education, formal and informal science education providers, and citizen science networks. Academic partners included Dartmouth College, Plymouth State University, Keene State College, St. Anselm College, Great Bay Community College, and White Mountains Community College.

A new climate dataset was created for New England, dynamically downscaling Earth-system model projections using the Weather Research and Forecasting Model. The resulting high-resolution dataset contains hourly output for the highest resolution domain and is the first climate projections for the region with such high frequency output for a long (55-year) time period. The dataset provides critical inputs for regional impact studies of climate change in such areas as climate extremes, water resources, economic impacts, and other decision-making elements crucial for sound regional planning.

An aquatic sensor network was installed at stream headwater sites, large river sites and at a spatially extensive statewide aquatic network, integrated with a soil sensor system to provide coupled measurements of vegetation, soil conditions, snow cover and headwater stream

response. Terrestrial and aquatic ecosystem process models were linked to simulate hydrologic and water quality characteristics related to ecosystem services at regional scales. For the first time, a sensor network was used to estimate whole river network nitrate removal, indicating the potential of sensor networks to improve understanding of water quality controls.

Coupling a terrestrial and aquatic ecosystem model to understand the coupled effects of atmospheric change and land use change as they propagate through terrestrial and into aquatic ecosystems revealed how water quality may potentially change in the future under different scenarios. Climate scenarios, land use scenarios, and model biogeophysical results were translated into a suite of environmental indicators that represent conditions of the climate, land, and water domains relevant to important ecosystem services and designed to be readily understood by the general public.

Human perceptions and response to ecosystems were measured to understand how decision makers and other residents perceive and value a range of ecosystem services. Researchers developed an integrated ecological-economic model on the tradeoffs between timber harvests, carbon uptake and storage, and surface albedo in the evaluation of forest management strategies. A novel use of deliberative multicriteria decision analysis assessed public attitudes and preferences concerning the ecosystem services generated by the upper Merrimack River watershed.

The NH EPSCoR Data Discovery Center (ddc.unh.edu), established by this project, is a comprehensive data management system, delivering a suite of data ingestion, hosting, query, visualization, and analysis tools directly to the project research teams. In addition, the DDC extends the visibility and utility of the project data sets to stakeholders throughout the state and region.

This project produced 165 publications in peer-reviewed journals. It provided support to 299 individuals, including 52 faculty, 13 post-docs, 17 Ph.D students, 29 M.S. students, 108 undergraduate students, 56 technical staff and 24 other staff. New faculty were installed at two community colleges and two four-year colleges, and faculty from several other colleges were engaged in research and education projects supported by seed funds from this award.

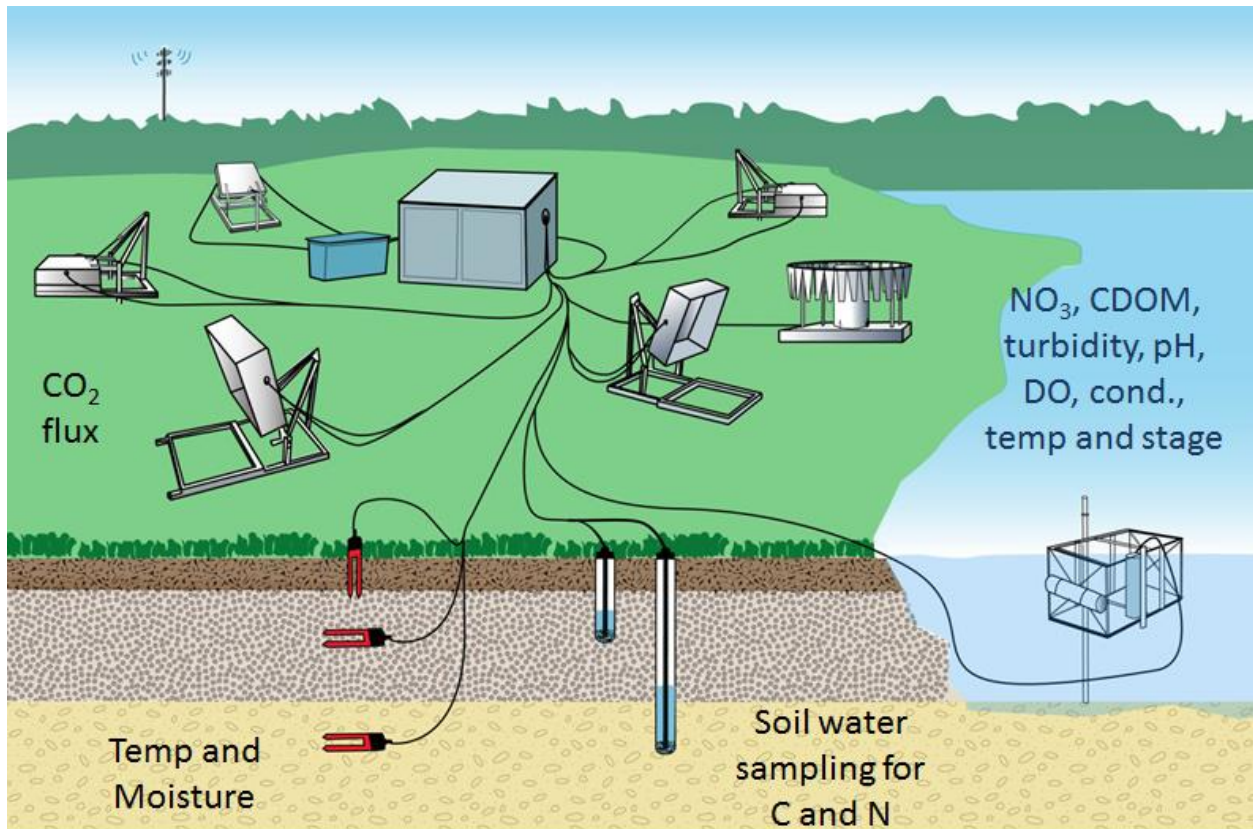
The Ecosystems & Society project sponsored 17 initiatives to provide research or research training experiences such as citizen science networks, specialized data and GIS training for teachers, support and mentoring of community college students transferring to UNH, and sponsorship of outreach programs for middle school and high school students. This project provided educational outreach programs, including research experiences for undergraduates and teachers, to 24,202 people. Over 19,000 students were reached through teacher training programs, including 2,537 students underrepresented in STEM.

Research snapshots from the Ecosystem & Society project can be viewed here: <https://www.nhepscor.org/news/11>.



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Integrated aquatic and soil sensor system

The integrated sensor network developed and deployed through NH EPSCoR's Ecosystem & Society project links aquatic response in headwater streams to conditions in the watersheds they drain.

Illustration by Janice Farmer