NE CSC
Northeast Climate Science Center

Improving the way climate science informs resource management

The Northeast Climate Science Center (NE CSC) is created to provide scientific information, tools, and techniques that managers and other parties interested in land, water, wildlife and cultural resources can use to anticipate, monitor, and adapt to climate change in the Northeast region. It is part of a federal network of 8 CSCs.

2013 NE CSC highlights...

- Funded over $2 million in stakeholder-driven climate research

- Trained 18 Graduate and Postdoctoral Fellows in the stakeholder driven research paradigm

- Finalized Strategic Science Agenda

- Hired Science Coordinator to support the Federal Director in science delivery, operations, and management of the NE CSC.

- Formalized stakeholder outreach methods, including monthly NE CSC-LCC science coordination calls

- Presented more than 100 papers at professional conferences and meetings

- Maintained active webinar series and bi-weekly e-newsletters

Who we are...

The NE CSC, with its core of seven consortium institutions, assembles outstanding expertise in climate science and natural and cultural resources management. The NE CSC provides resource managers with deep and diverse knowledge and research skills for successfully meeting the regional needs for climate scenarios, impact assessments, decision frameworks, models (ecological, hydrological, physical), education and stakeholder outreach throughout the region. The NE CSC works closely with natural resource management partners including Landscape Conservation Cooperatives (LCCs), as well as federal, state, and tribal partners that lie within the NE CSC domain.

NE CSC Earth Day Climate and Energy poster session, Apr 2013
Photo: Kayla Marchetti

** Updated! **
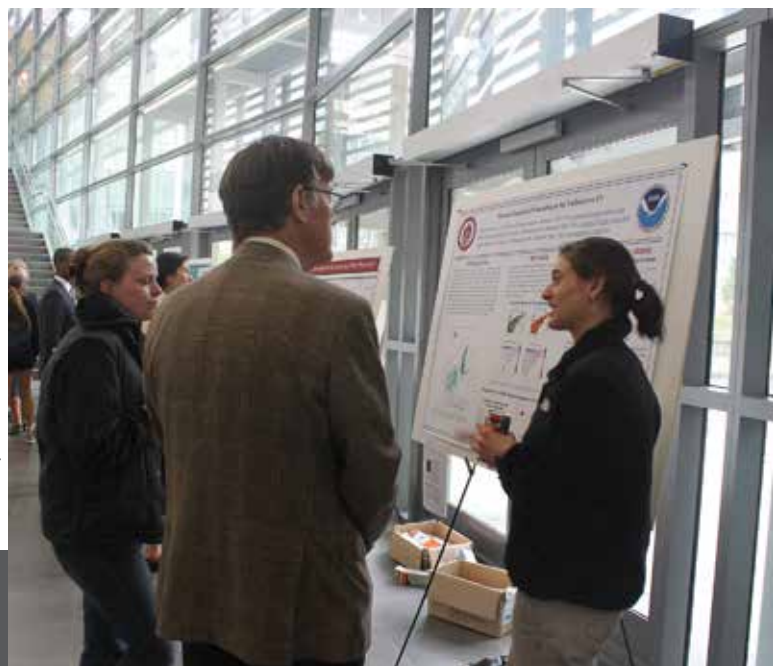
Priority Science Themes

1: Climate change projections and assessments

2: Climate impacts on land-use and land-cover

3: Climate impacts on freshwater resources and ecosystems

4: Climate impacts on Atlantic and Great Lakes coastal and nearshore environments

5: Ecosystem vulnerability and species response to climate variability and change

6: Impacts of climate variability and change on cultural resources

7: Decision frameworks for evaluating risk and managing natural resources under climate change

Outreach: NE CSC-LCC Monthly Coordination Calls

In August of 2013, the NE CSC initiated a monthly meeting with the six Landscape Conservation Cooperatives (LCC) encompassed within the bounds of the NE CSC region (See map). The purpose of the calls has been to increase awareness of science activities and priorities of the NE CSC and LCCs, provide a platform to exchange ideas, discuss ways to collaborate on mutual challenges, and identify areas where NE CSC Consortium expertise can assist the LCCs in addressing climate change impacts. Group discussions have helped improve the NE CSC's understanding of National LCC priorities on topics such as Landscape Conservation Design, provided a foundation for potential co-funded projects in the future, and ultimately shaped the FY15 NE CSC RFP Priorities and Workplan.

"The calls are a great way to share ideas and keep up with where the two DOI enterprises are headed. They remind us we're a team of diverse scientists reaching out through a complex network of managers and end users to identify and fulfill critical science needs. Calls provide frequent two-way feedback to synchronize complementary and fast-moving efforts--which is especially vital, considering how rapidly things are changing within the environment and within our organizations"

– Glen Salmon and Gwen White
Eastern Tallgrass Prairie & Big Rivers LCC

EXPLANATION

Approximate boundary of Climate Science Center (CSC)
Landscape Conservation Cooperatives in the Northeast CSC area

1 Appalachian
4 Eastern Tallgrass Prairie and Big Rivers
9 South Atlantic
10 North Atlantic
13 Plains and Prairie Potholes
16 Upper Midwest and Great Lakes
9 Gulf Coastal Plains and Ozarks

Featured Research: Past, present, and future climate to inform the impacts of climate change on the Northeastern and Midwestern U.S.

NE CSC Principal Investigator Raymond Bradley and his Climate Systems Research Cluster at the University of Massachusetts are working on understanding climate variability across a wide range of time scales. Dr. Bradley and his NE CSC Fellows, including postdoctoral researcher Liang Ning and graduate student Dan Miller, focus on three sources to assess the potential changes in climate: paleoclimate analysis, instrumental data analysis, and climate simulations.

Paleoclimate analysis is particularly important in placing rare extreme events such as droughts, floods, and hurricanes in a longer term perspective. The goal is to create a database of existing chronologies and proxy data as a starting point to target lakes where high resolution records can be recovered, to place modern extreme weather events in the perspective of the last 2,000 years. To understand the relationship between circulation patterns and winter climate extremes across the northeastern US, Dr. Bradley's research group is also examining three important modes of climate variability: the North Atlantic Oscillation, Pacific-North American pattern, and the El Niño–Southern Oscillation.

Finally, their work with high resolution regional climate models shows a statistically significant increase in surface air temperature in the northeastern region as greenhouse gas concentrations continue to increase. Greater magnitude of the projected temperature increase by the end of the twenty-first century under the higher emissions scenario emphasizes the essential role of emissions choices in determining potential future climate changes. Most parts of the northeastern US region will experience increasing winter precipitation and decreasing summer precipitation, but the magnitudes are not statistically significantly different from current precipitation amounts.

Core from Basin Pond covers the last 2,000 years. (photo: Mike Retelle, Bates College)
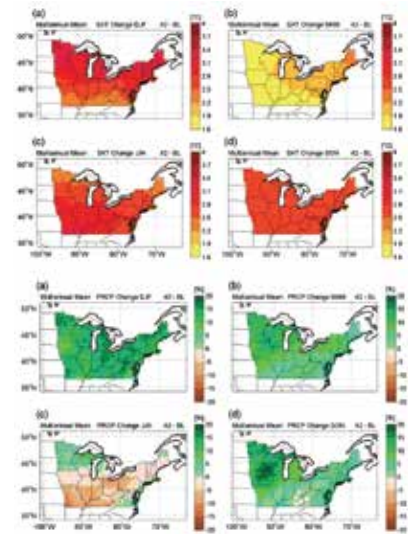
Multi-model mean estimates of seasonal temperature & precipitation changes between baseline simulations and the A2 scenario simulations. (Fan et al., in review)

Pine-Birch transition, north central MN
Photo: Kyle Gill, UMN

Graduate Research Profile: Evan Murdock, PhD Candidate, University of Wisconsin

How rising temperatures impact water resources planning in Wisconsin


There is considerable interest in the scientific and planning communities to understand the impacts of climate change on water resources. Changes in evapotranspiration, runoff, recharge, and other key hydrologic variables appear likely; however, in many parts of the world there remains considerable uncertainty about how the precipitation patterns that underlie these variables will change in coming years. In order to address these questions in Wisconsin, Evan Murdock's NE CSC-supported Ph.D. research analyzes how rising temperatures will impact winter and spring processes such as soil frost formation, snowfall, and spring snowmelt, and how these changes in turn will alter the partitioning of winter precipitation into runoff and recharge. This research promises key insights into the ways climate change will alter streamflow regimes, groundwater levels, spring flooding, and similar variables of ecological and economic importance.

Impacts of Sea Level Rise on Ecosystems
Radley Horton, Columbia University

Columbia University is studying how climate extremes will impact human and natural ecosystems in the Northeast. PI Radley Horton and graduate student Ethan Coffel are analyzing the latest global climate models and regional models to assess how extreme temperature and precipitation events may change in the future. Their selection of extreme event thresholds has been informed by stakeholder feedback gleaned through a variety of media, including Dr. Horton's role as a Convening Lead Author of the 2014 National Climate Assessment. Dr. Horton has also led the development of updated sea level rise projections for the entire East Coast. Stakeholder engagement focuses on the fact that coastal flood frequency could double or triple this century due to sea level rise alone. Horton and Coffel are also applying their research to the National Park Service and DOI-funded Jamaica Bay Science and Resilience Institute, of which Columbia is a partner.

East coast cities Boston, New York, and Philadelphia (L to R) are vulnerable to sea level rise. Photo credit: CCRUN
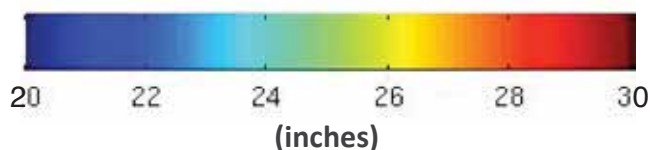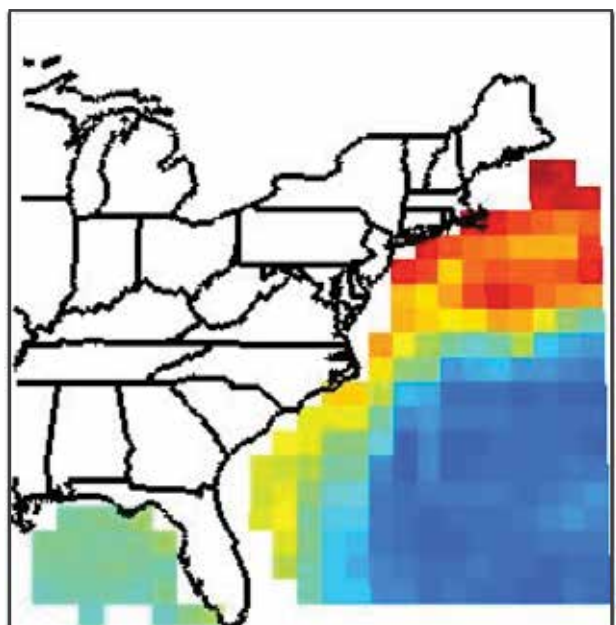
2050s 90th percentile SLR

Methods for Projecting Sea Level Rise Changes

- Used 24 Global Climate Models (CMIP5) with 2 Representative Concentration Pathways (RCP 4.5 and RCP 8.5)

- Included meltwater and land-subsidence terms

- Additional components include land water storage and gravitational, isostatic, rotational terms

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A team of researchers led by Rob Thieler, Nathaniel Plant, Dean Gesch (USGS), and NE CSC Principal Investigator Radley Horton (Columbia University) are collaborating on a reconnaissance study to distinguish areas in the northeastern U.S. that will experience a predominantly inundation (flooding) response to sea-level rise from those where the physical environment will respond dynamically by moving or changing in order to retain their current landcover state. The project's approach uses future sea-level rise projections, coastal land cover, coastal elevation and vertical land movement as inputs, and provides land cover-specific forecasts of the probability of inundation or dynamic change as outputs. Areas that are dominated by inundation generally include urban regions of intense development and/or coastal engineering, as well as bedrock coasts. Areas that respond dynamically include beaches, unconsolidated cliffs, barrier islands, wetlands, and shallow subtidal zones (See Insert). By distinguishing which processes are relevant to sea-level rise impacts in these areas, appropriate scientific research and decision support efforts can inform future work and adaptation responses.

Photo credit: Jane Thomas, IAN Image Library at ian.umces.edu/imagelibrary/

This project has been jointly funded by the NE CSC and the North Atlantic Landscape Conservation Cooperative (NA LCC), and partners with the Designing Sustainable Landscapes (DSL) project led by Kevin McGarigal (UMass Amherst) to forecast the probability of static and dynamic coastal change in response to sea-level rise projections. This interdisciplinary and collaborative effort has developed a new approach to coastal vulnerability assessment that uses probability-based estimates of future sea-level rise to produce probabilistic forecasts of coastal change at the landscape level. In addition, the project has helped understand the impacts of Hurricane Sandy, and supported post-storm science activities. Results will inform future coastal projects and provide decision support for regional managers.

Static: bedrock coasts, highly developed or engineered shorelines

Dynamic: beaches, unconsolidated cliffs, barrier islands, and wetlands

nd Horton define the coastal response of an area to sea level daptability of the land class category to predicted water level

as are those able to adapt to water level increases and ir initial land class state.

cannot adapt to such increases and therefore inundate or another land cover type.

2013 Fellows Retreat: Sea Level Rise Impacts and Climate Science Translation

The first annual NE CSC Fellows Retreat was held near Plum Island, off the North Shore of Massachusetts, during the week of October 28, 2013. The event was well-attended, with 17 of our 18 graduate and postdoctoral fellows arriving from across the CSC region to advance their skills in communicating and translating climate science for resource management. Three of the NE CSC PIs, as well as both the Federal and University Directors, gave presentations and facilitated interactive exercises in which Fellows practiced science communication and engaging stakeholders in the

NE CSC Fellows retreat, Plum Island, Massachusetts

research design process. Through field trips and interactive activities, they learned from federal and state managers and scientists from the Parker River National Wildlife Refuge, the State of Massachusetts Coastal Zone Management office, the Division of Ecological Restoration, and the Union of Concerned Scientists about climate challenges to coastal and salt marsh habitats.

"The NECSC Fellows Retreat was an excellent event that fostered the development of a personal support network and professional contacts. In addition to forging great friendships and useful research connections with the other fellows, I was able to develop very relevant professional contacts through the interactions we had with stakeholders."

- NE CSC Graduate Fellow Lynn Brennan

Featured Research: Developing Fish Trophic Interaction Indicators of Climate Change for the Great Lakes

Under NE CSC funding, Dr. Richard Kraus of the USGS Great Lakes Science Center is spearheading an examination of climate-induced changes in seasonal food webs in the Great Lakes. The primary goals of the project are to identify fish species, especially those of commercial value, that are most at risk to climate change, and to provide Lake Erie Fishery Managers and the US EPA with a better understanding of how ecological relationships may be altered under forecasted climate conditions. Results are intended to inform decisions on how to adaptively maintain sustainable fisheries in the region.

Lake Erie was chosen as a focus of this project because it represents a window to future trophic interactions across the Great Lakes as seasonal changes displace fish guilds due to temperature trends, thermal stratification, and hypoxia. Furthermore, the most valuable and productive fisheries in the Great Lakes are contained within Lake Erie. Dr. Kraus and his team have been conducting seasonal field investigations of the spatial distribution, diets, and biochemical trophic markers of fishes from three distinct ecotones in Lake Erie to contrast communities affected by hypoxia and deeper offshore cold-water communities.

Yellow perch. Photo: Richard Kraus

This project has joint funding with the Upper Midwest and Great Lakes Land-scape Conservation Cooperative and will be completed in early 2015.

• Downscaling and validating current and future climate models for the region, as well as assessing paleoclimate resources for studies of climate extremes (see page 3)
Led by Raymond Bradley, University of Massachusetts

• Conducting assessments of climate change projections over the Northeast to understand extreme events and sea level rise and to improve the downscaling of climate models for impacts assessments   (see page 4)
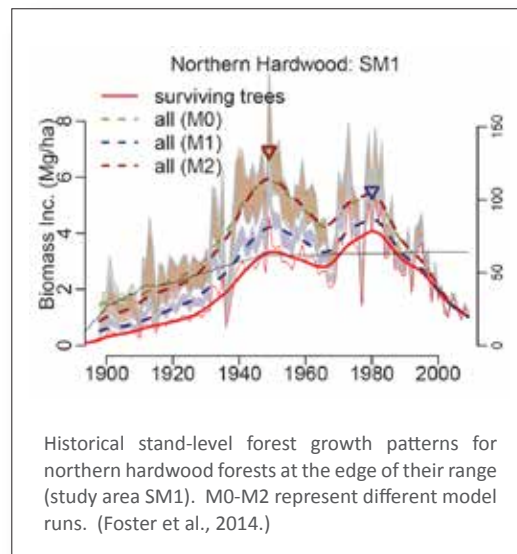Led by Radley Horton, Columbia University

• Evaluating impacts of climate change on water resources, including streamflow, stream temperature, stream health, and water supply systems to aid resource management decisions
Led by Richard Palmer, University of Massachusetts

• Predicting the impact of climate change on stream temperatures in the Driftless Area; understanding the role of soil frost on climate change impacts on groundwater recharge; assessing vulnerability to extreme rainfalls through storm transposition
Led by Ken Potter, University of Wisconsin

Historical stand-level forest growth patterns for northern hardwood forests at the edge of their range (study area SM1). M0-M2 represent different model runs. (Foster et al., 2014.)

Chippewa National Forest Resource Management Staff.
(Photo: Anthony D'Amato)

• Encouraging cross-cultural/cross-forest exchange, trainings, and outreach
Led by Chris Caldwell, College of Menominee Nation

• Developing modeling approaches to link climate to ecosystem and landscape models, predicting fire frequency with chemistry and climate, and examining effects of alternative climate scenarios on forested landscapes and avian demographics in the central United States
Led by Frank Thompson, University of Missouri

• Using geospatial analysis, species distribution modeling, occupancy modeling, and population and landscape genetics techniques to facilitate natural resource management and habitat and species conservation in the face of climate and land use change
Led by Toni Lyn Morelli, University of Massachusetts

• Understanding the effects of eutrophication and changes to freshwater input on food webs, habitats and top predators in estuaries and freshwater rivers
Led by Linda Deegan, Marine Biological Laboratory

• Studying the effects of climate, disturbance, and management decisions on forest biomes and associated priority bird populations as well as the ecological and hydrological impacts of the emerald ash borer on black ash forests
Led by Tony D'Amato, University of Minnesota

• Assessing the capability of current and potential future landscapes to provide integral ecosystems and suitable habitat for representative species, as well as forecasting wildlife vulnerabilities to climate change
Led by Curt Griffin, University of Massachusetts

• Analyzing the effects of hydrologic change and climate variability on the distributional changes of spruce-fir forests, forest-dependent wildlife, and stream fish, as well as policy responses to extreme flow events in relation to climate resilience
Led by Keith Nislow, University of Massachusetts

• Understanding how climate change, fishing pressure, and pollution impact biodiversity and ecosystems, particularly in marine and aquatic food-webs
Led by Michelle Staudinger, USGS

•   Studying the impacts of climate change and other environmental drivers on population dynamics, mammalian ecology and conservation, endangered species management and conservation policy
Led by Mary Ratnaswamy, USGS

Where we're headed...

Project Awards in FY'13:

Modeling Effects of Climate Change on Spruce-Fir Forest Ecosystems and Associated Priority Bird Populations.
Lead PI: Anthony D'Amato, University of Minnesota

Making Decisions in Complex Landscapes: Headwater Stream Management Across Multiple Agencies.
Lead PI: Evan Grant, Conte Anadromous Fish Laboratory/UMass Amherst

A Decisions Support Mapper for Conserving Stream Fish Habitats of the NE CSC Region.
Lead PI: Craig Paukert, Missouri Cooperative Fish & Wildlife Research Unit/Univ. Missouri

NorEaST - Stream Temperature Web Portal Demonstration and Application.
Lead PI: Jana Stewart, USGS WI Water Science Center

Changes in Forested Landscapes of the Northeastern U.S. Under Alternative Climate Scenarios.
Lead PI: Frank Thompson, U.S. Forest Service/University of Missouri

Fitting the Climate Lens to Grassland Bird Conservation: Assessing Climate Change Vulnerability Using Demographically-Informed Species Distribution Models.
Lead PI: Benjamin Zuckerberg, University of Wisconsin-Madison

Shifting Seasons: Tribal Climate Adaptation Training for Northeastern Tribes.
Lead PI: Chris Caldwell, College of Menominee Nation

Facilitating Regional and Local Decision-making for Managing Coastal Wetlands and Waterbird Habitats: Responding to Sea Level Rise and Increased Coastal Flooding.
Lead PI: Richard Palmer, University of Massachusetts-Amherst

Desmognathus fuscus (northern dusky salamander) female with eggs, Shenandoah National Park, VA (photo: Evan Grant)

Learn more:

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