



Improving the way climate science informs resource management

The Northeast Climate Science Center (NE CSC) is part of a federal network of 8 CSCs 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.

Climate fast facts for 2012...

- Record warmth in contiguous US
- Record low water levels in Great Lakes
- 2nd costliest year for weather and climate-related disasters in US
- Earliest spring across NE region
- Record warm sea surface temperatures in the Northeast

More info at necsc.umass.edu

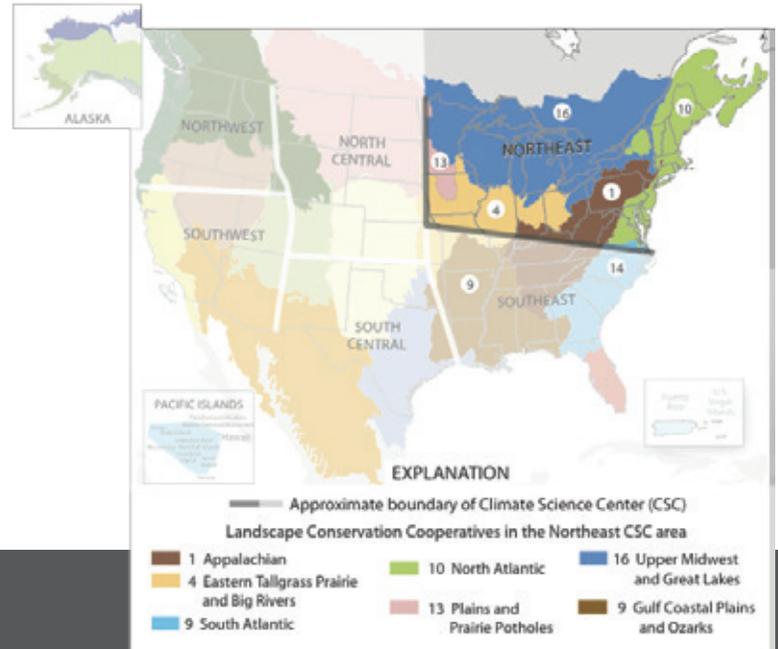
2012 NE CSC highlights...

- Completed Draft Strategic Science Agenda
- Established a Stakeholder Advisory Committee
- Funded \$550,000 in stakeholder-driven climate research
- Hosted 2 Stakeholder Outreach and Science Planning Meetings
- Trained 15 Graduate and Postdoctoral Fellows in user-driven climate science techniques
- Hired 3 staff and assembled leadership team to guide the NE CSC in expanding our stakeholder base and delivering high quality science



Who we are...

The NE CSC, with its core of seven consortium institutions, assembles unparalleled 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.



Priority Science Themes

- 1: Climate change assessments and projections
- 2: Climate impacts on freshwater resources and ecosystems
- 3: Coastal and nearshore response to climate variability and change
- 4: Climate impacts on land-use and land-cover change
- 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: Stakeholder Outreach and Science Planning Meetings

Two Stakeholder Outreach and Science Planning meetings were hosted by the NE CSC in January 2013 in Amherst, MA and Minneapolis, MN. Both meetings attracted more than 150 natural resource management stakeholders from a wide array of institutions, including federal agencies (such as US Fish & Wildlife, NPS, EPA, and NOAA), state agencies, municipal leaders, non-governmental organizations, and tribal representatives. The meetings contained paired presentations from both Consortium scientists and representative stakeholders presenting on the seven science themes, all related to climate change adaptation through natural resource management. All participants provided comments on specific science needs essential to their organization in planning for climate change. The NE CSC is incorporating this valuable feedback into the 5-year Strategic Science Agenda, which will guide the future science directions of the Center.

"Of the many take home messages for me, what stood out [at the meeting] was the strong commitment among all to work together to advance our climate science efforts. There were an amazing number of stakeholders ... all talking with each other, all informing each other, and all building relationships. I believe the NE CSC has already proven its value with this effort and look forward to continuing with our interactions."

*- Thomas L. Schmidt, Assistant Director,
Northern Research Station, USDA Forest Service*



Science prioritization discussions at the NE CSC Stakeholder Outreach and Science Planning Meeting in Minneapolis, MN. (Photo: Toni Lyn Morelli)

Featured Research: The impacts of climate change on estuarine food webs and fish species

Linda Deegan and her team at Marine Biological Laboratory, including Climate Science Center Research Fellow James Nelson, are assessing the effects of many dimensions of global change on estuarine ecosystems and the fish species that use these areas as nurseries and feeding grounds. Striped bass, abundant in northern estuaries in the summer as they feed on a variety of smaller estuarine fish and invertebrates, are a valuable marine fishery resource. To understand striped bass habitat use and food requirements, the team is using acoustic tags to monitor fine scale movements and examining diets in different habitats. One important food item for striped bass is the small fish, mummichog, which is a key species connecting saltmarshes and striped bass abundance. They are examining the impacts of moderate nutrient enrichment on the production of mummichog. They have shown that long-term nutrient enrichment can have complex impacts on food webs and that eutrophication and climate change induced sea level rise may have synergistic negative effects on the production of saltmarsh fish through habitat alteration and changes to food webs. Finally, they are looking at how long-term data can help infer how changes in flow may alter the source of production and community composition in the transitional zone where nutrients and organic matter from the upper watershed first enter an estuary. As climate change shifts the timing and amount of freshwater inputs to estuaries, results suggest that the source of production to the estuary will also be impacted. These projects are targeted to the climate science needs of fishery managers, coastal zone managers, local conservation commissioners, and other individuals and groups charged with the management of freshwater systems, as well as recreational and commercial fishermen.



Striped Bass (photo: Jimmy Nelson)



Marsh sampling (photo: Jimmy Nelson)

Graduate Research Profile: Thomas W. Bonnot, PhD Candidate, University of Missouri

Novel approaches to assess the viability of regional wildlife populations in response to landscape and climate change

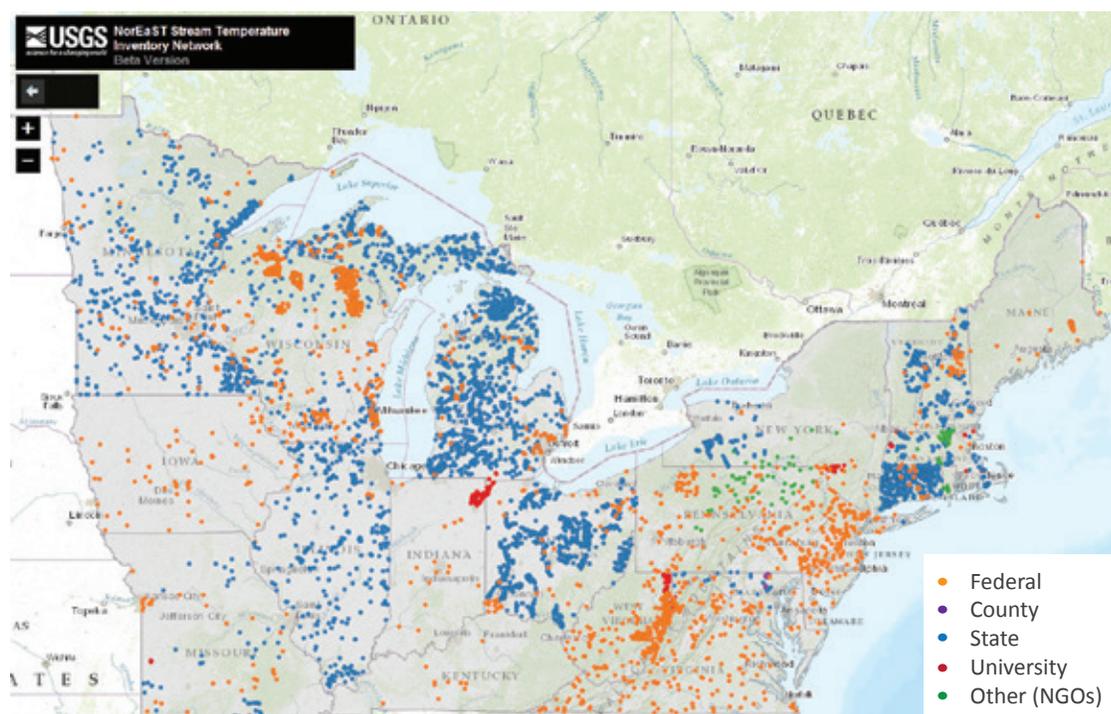


One of the most significant challenges facing wildlife conservation is the impact of climate change on biodiversity. As conservation planners and managers focus on increasingly larger spatial scales to address threats of climate change, they require tools to assess the viability of regional wildlife populations. Such approaches must incorporate not only climate and landscape changes, but also the demographic processes that are critical drivers of population growth at regional scales. With the support of the NE CSC, Thomas's Ph.D. research is developing landscape-based population viability models that assess the response of regional wildlife populations to predicted changes in climate and landscape conditions. Thomas will also attend a Structured Decision Making workshop in August 2013 at NCTC, where he will learn how to interpret population viability results from several species in the face of climate change and conservation scenarios to best aid regional planners as they safeguard biodiversity.

Stakeholder-driven project highlights:

NorEaST – Stream Temperature Web Portal Demonstration, Application, and Modeling

In the coming decades, climate change will increasingly alter stream temperature and flow regimes; consequently, conservation and management practitioners will need access to the best available data and tools to make decisions on how these physical changes will influence the distribution of aquatic species in freshwater ecosystems. To address this need, Dr. Jana Stewart of the USGS Wisconsin Water Science Center, and Dr. Austin Polebitski of the University of Massachusetts, have developed the NorEaST project, a data portal to serve as a coordinated, multi-agency framework to map and store continuous stream temperature locations and data for the NECSC region. The project has been working collaboratively with the Wisconsin DNR, USFS Districts, USGS Conte Anadromous Fish Lab, and Trout Unlimited New England Chapter to deploy data loggers for stream temperature monitoring. In addition, the project is identifying gaps in stream monitoring sites, and comparing different stream temperature modeling techniques. A literature review of existing stream temperature models has been prepared and describes the current status of stream temperature modeling in the NECSC region. The review has already informed the selection of three initial stream temperature modeling frameworks that will undergo further evaluation and climate change analysis as the project progresses. Project results will be made available through the NorEaST web portal (wim.usgs.gov/NorEaST); potential applications include calculating stream thermal metrics to facilitate regional comparisons, analysis, and modeling, as well as determining relationships between stream thermal metrics and fish assemblages to identify thermally responsive fishes and temperature regimes for use in designing adaptation strategies.



The NorEaST web portal is currently mapping over 7,000 continuous stream temperature monitoring locations and associated metadata contributed by 41 different organizations across 22 states.

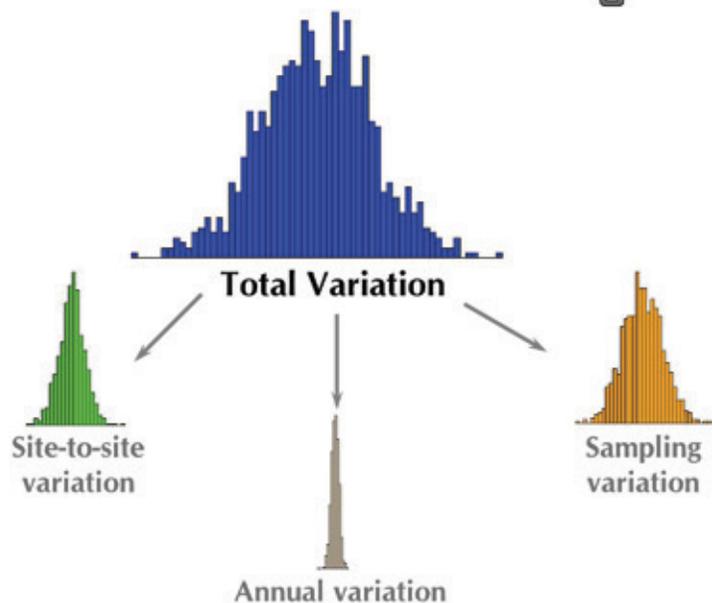
Characterization of Spatial and Temporal Variability in Fishes in Response to Climate Change

Predicting fish and wildlife population responses to climate change and other environmental stressors requires an understanding of how their population dynamics vary over space and time. However, it is often difficult to interpret the underlying signals contained within many complex datasets as anything other than “noise”. In this project, led by Dr. Brian Irwin at the USGS Georgia Cooperative Fish and Wildlife Research Unit, investigators are taking a novel approach by using a statistical framework to partition different sources of variance, for example stemming from data collected across locations, seasons, years, and sampling techniques, to better understand population responses of ecologically and commercially important fishes in the Great Lakes Basin to climate change. The project, which is an extension of recent research lead by Irwin and colleagues, focuses on the predatory fish walleye and their primary prey yellow perch, to quantify how their population distributions are changing across both temporal (for example seasonally) and spatial (for example vertically within the water column) scales to changing environmental conditions. Investigators will utilize established relationships with state, federal, provincial, and tribal fisheries management agencies in the Great Lakes basin to assemble or update existing long-term data series for walleye and yellow perch. Results will help managers better detect and predict when and why fish populations are responding to climate change and other environmental stressors, and may provide an early warning system for large-scale changes in the Great Lakes ecosystem.



Walleye is an ecologically and commercially important predatory fish in the Great Lakes and their primary prey yellow perch are the focus of population analyses in this study. (Photo: CBFS)

Variance Partitioning



Depiction of different potential sources of variation within fish and wildlife population data.

Featured Consortium Member: College of Menominee Nation

The College of Menominee Nation (CMN) through its outreach efforts, is engaging a wide variety of stakeholders in climate change adaptation issues. CMN's Sustainable Development Institute and the Menominee Nation as a whole are working to promote sustainable forestry practices within the Menominee community and beyond to other tribal communities and forest managers. Their mission is to foster an understanding of sustainability values through promoting sustainability education, development, and actions, which guides the goal for CMN to be a global leader in sustainability scholarship and practice.

CMN is also a leader in recognizing the value and importance of protecting cultural resources in the face of climate change, and has developed an outreach event dedicated to the experience of tribal climate adaptation. "Shifting Seasons: Great Lakes Climate Change Summit" in August 2011 provided a forum to share climate change projections and experiences and begin discussing a climate change research agenda for Great Lake Tribal Nations. CMN plans to continue the momentum started by this event with another Summit in 2013.



Summit participants take a tour of the Menominee reservation. (Photo: CMN SDI)

Featured Research: Assessing management strategies for resilience of forest ecosystems to climate and disturbance impacts

Tony D'Amato and his team at University of Minnesota are quantifying the range in variability in forest dynamics and climate responses for range-margin populations of *Pinus banksiana* (Jack Pine) and *Picea mariana* (Black Spruce) so as to generate management guidelines for conserving these forests on the landscape in an uncertain climatic future. They also use tree-ring patterns and long-term data collections from natural and managed forests across New England and Great Lakes states to identify forest management strategies and forest conditions that have conferred the greatest levels of resistance and resilience to past stressors and their relevance in addressing future environmental change. They also combine long-term forest and bird population data to develop tools to identify refugia sites most likely to support spruce-fir forest and its associated high-priority obligate spruce-fir bird species over the long-term under projected climate change scenarios. Finally, they are examining strategies for mitigating the impacts of the introduced emerald ash borer and climate change on ash-dominated wetlands across the Lake States. This research is in close collaboration with scientists from the USFS Northern Research Station and will benefit a range of stakeholders, including state land managers in the Lake States, New England, and New York, National Forests in the upper Midwest and New England states, Tribal land management organizations, the National Park Service, the Upper Midwest and Great Lakes, Plains and Prairie Pothole, Appalachian, and North Atlantic LCCs, and the US Fish and Wildlife Service.

An example of an adaptation strategy for black ash forests. Researchers are underplanting Emerald Ash Borer (EAB) non-host species in an attempt to increase the resilience of these wetland areas to EAB and other stressors. (Photo: Mitch Slater)

Research Expertise at the NE CSC:

- Downscaling and validating current and future climate models for the region, as well as assessing paleoclimate resources for studies of climate extremes

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

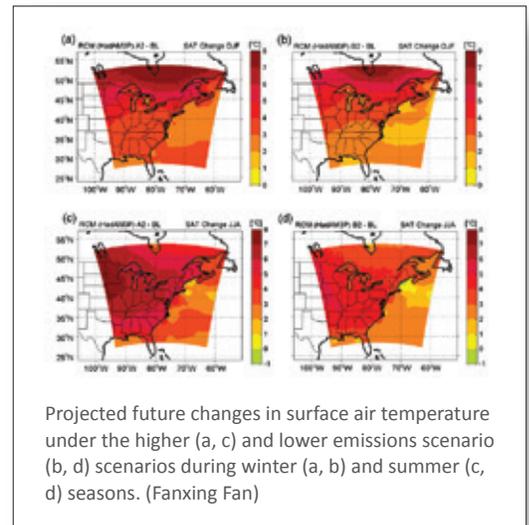
Led by Radley Horton, Columbia University

- 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 stream temperatures, assessing vulnerability through storm transposition, and studying frost and groundwater recharge in the midwestern U.S.

Led by Ken Potter, University of Wisconsin



Acadian Flycatcher sitting on her nest. (Photo: W. Andrew Cox)

- Encouraging cross-cultural/cross-forest exchange, trainings, and outreach (see page 7)

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 (see page 3)

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 (see page 7)

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 songbird vulnerabilities to climate change and interactions with wind energy development

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 population ecology, mammalian predator biology and conservation, endangered species management, conservation policy

Led by Mary Ratnaswamy, USGS

Projects funded in FY'13 will cover the following stakeholder-identified science priorities:

Effects of climate change and land-use patterns on stream and river flow, stream temperature, and environmental extremes with implications for aquatic and riparian biota

Effects of climate change and land-use changes on forest distribution, composition, condition, vulnerability to disturbance, and resilience of forest ecological functions and ecosystem services

Effects of climate change and environmental stressors on prairie ecosystems with implications for adaptive management of grassland bird communities and restoration of prairie ecosystems/landscapes

Effects of climate change on forests and headwaters with implications for vulnerability and adaptive management of migratory bird communities, aquatic and riparian forest biota, migratory bats, or other forest-dependent biota

Development of decision frameworks such as structured decision making to advance the understanding of climate change uncertainties and enhance planning and communication tools for climate adaptation strategies

Cross-CSC collaboration:

- Sea Level Rise and Coastal Resiliency
- Tribal Engagement and Sustainability
- Ecological Flow/Drought
- Stream Temperature and Aquatic Resources
- Climate Projections and Models

This is the first Annual Report of the NE CSC, established on March 1, 2012. This report covers the activities of 2012 and January 2013. Future reports will cover January - December. Front page photo credits (L to R): USFWS/Rachel Samerdyke; USFWS/Joel Trick; NOAA/Roger Simmons.

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UNIVERSITY
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Mizzou
University of Missouri - Columbia



COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK



Directors

Mary Ratnaswamy, Ph.D., USGS
NE CSC Federal Director
mratnaswamy@usgs.gov

Richard Palmer, Ph.D., UMass Amherst
NE CSC Academic Director
palmer@ecs.umass.edu

Staff

Toni Lyn Morelli, Ph.D., Program Manager, morelli@umass.edu

Michelle Staudinger, Ph.D., Science Coordinator, mstaudinger@usgs.gov

Addie Rose Holland, M.S., Communications and Outreach Manager, aholland@geo.umass.edu

Northeast Climate Science Center

233 Morrill Science Center, 611 North Pleasant Street

University of Massachusetts, Amherst, MA 01003-9297

Learn more: necsc.umass.edu