# NE CSC
**Northeast Climate Science Center**

*Improving the way climate science informs resource management*



Photo: V. Pasquarella

## 2017 in Numbers

- Shared our science at nearly **150** professional conferences, workshops, and stakeholder meetings

- **24** web tools to support science delivery and decision-making created to date

- **55** peer-reviewed publications funded by the NE CSC this year

- **7** additional projects came to completion this year

- **156** people attended the 1st NE CSC Regional Science Meeting

- NE CSC welcomed **2** regional Tribal Climate Science Liaisons

- **28** Fellows trained on the co-production of actionable climate science with stakeholders

# Update from the Directors...

This was a productive year for the NE CSC in several areas of research. Thanks to the work of **Ambarish Karmalkar** and **Ray Bradley**, we better understand the vulnerability of the Northeast due to global climate change. **Emily Powell, Michelle Staudinger**, and colleagues assessed tipping points and projected habitat loss by coastal fish, wildlife, and plants to inform adaptation to sea level rise and flooding. **Chris Caldwell** and colleagues launched the Northeast Indigenous Climate Resilience Network, a website with tools and resources to promote dialogue among indigenous peoples and scientists.

In July, **Bethany Bradley, Toni Lyn Morelli**, and colleagues hosted the first Regional Invasive Species and Climate Change symposium to discuss synergistic threats and opportunities to inform management. We also welcomed two Tribal Climate Resilience Liaisons, **Sara Smith** and **Casey Thornbrugh**, who will support outreach and capacity building to accelerate tribal climate resilience. Because of work led by **Tony D'Amato**, forest managers can evaluate options and make informed decisions about the management of black ash threatened by emerald ash borer. We hope that you dig deeper and explore our new publications, tools, and partnerships on the website, necsc.umass.edu. In 2018, we look forward to increasing the engagement with Tribes and practitioners to build upon the adaption science we've produced thus far.

**Richard Palmer**
*University Director,
UMass Amherst*

**Mary Ratnaswamy**
*USGS Director*

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*The Northeast Climate Science Center works with natural and cultural resource managers in the Northeast and Midwest regions to apply future climate scenarios to decision making and co-produce information and tools for climate change adaptation.*

### Priority Science Themes
- **Climate change projections and assessments**
- **Climate impacts on land-use and land-cover**
- **Climate impacts on freshwater resources and ecosystems**
- **Climate impacts on Atlantic and Great Lakes coastal and nearshore environments**
- **Ecosystem vulnerability and species response to climate variability and change**
- **Impacts of climate variability and change on cultural resources**
- **Decision frameworks for evaluating risk and managing natural resources under climate change**
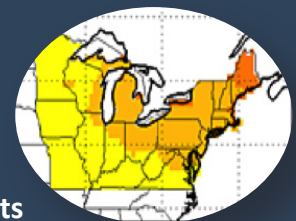
# REGIONAL SCIENCE MEETING

In May 2017, the NE CSC convened a Regional Science Meeting that explored the collaborative research of our scientists and partners to incorporate climate science in the management of natural and cultural resources in the Northeast and Midwest.

Bruce Stein of the National Wildlife Federation delivered the keynote address, "Preparing for Change—Ecological and Institutional." The meeting consisted of talks, panel discussions, poster presentations, tool demos, and opportunities to network. During the *two and a half days*, there were *18* sessions, *40* presentations, *2* poster sessions, and an *"actionable science cafe."*

Since the inception of the NE CSC in 2012, our stakeholder partners have guided our science priorities, improving the way our climate science informs decisions and actions in adapting to a changing climate. **With a culmination of five years of research, tools and product development, decision and adaptation planning support, we had a broad portfolio to share.** By coming together to share each other's experience and showcasing innovations in research, decision support tools, and communication and outreach, we are finding solutions to climate change impacts with more effective and efficient collaborations, research and organizational strategies, conservation decisions, and adaptation actions.

## Highlights

- The **breadth and regional coverage** of projects conducted by the NE CSC demonstrated the cross-cutting and integrative framework of our Center;
- Interdisciplinary collaborations between scientists and a diverse array of partners have led to **on-the-ground application** of the climate and ecosystem science for management decisions, adaptation measures, and conservation actions that result in benefits to the natural and cultural resources of our region;
- Future directions include the integration of **infrastructure planning** (such as for culverts) with ecological integrity and climate change impacts, and developing a greater **understanding of economic and social benefits** of climate-informed decisions.

## Actionable Science Café

In this session, we dug deeper into what is next for actionable science, co-production of science, adaptation planning and implementation. Smaller groups of participants reflected on the meeting and provided answers to discussion questions:

- **What are the metrics of success in demonstrating actionable science and co-production of knowledge?**
  Participants outlined metrics that can be used to assess success in process (co-production), products (actionable science) and discussed how to measure our success.
- **What are our best examples of success (or near success) in actionable science?**
  Participants identified what they felt embodied success (some examples include: State Wildlife Action Plan synthesis report, Designing Sustainable Landscapes project, the MA Climate Action Tool, support for Tribal vulnerability and adaptation), and noted the ways these efforts were successful.
- **How can we strengthen relationships with partners and stakeholders?**
  Commonly-shared answers entailed building trust, developing an action plan for projects, and going to stakeholders' place of work, meetings, and workshops.

Photos this page: J. Brown, NE CASC

## Seven projects that came to completion this year:

### FishTail Interactive Tool

**Craig Paukert** and colleagues at the USGS, MO Cooperative Fish & Wildlife Research Unit completed "A Decision Support Mapper for Conserving Stream Fish Habitats of the NE CSC Region," which resulted in a spatially-explicit, web-based viewer known as FishTail. With this tool, managers can evaluate the simultaneous impacts of land use, fragmentation, water quality, and climate change on Northeast streams to enhance decision-making.
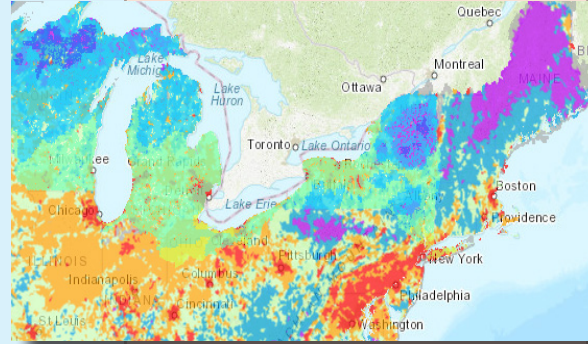
### Thresholds and Adaptation for Coastal Species

NE CSC Fellow **Emily Powell** synthesized quantitative threshold information for 45 priority coastal fish, wildlife, plant species and habitats in response to sea level rise and storm projections for the project "Critical Thresholds and Ecosystem Services for Coastal Ecological and Human Climate Adaptation." Results, which also include an assessment of coastal management approaches to support socio-ecological community planning for climate change, are available in multiple formats. The MA Wildlife Climate Action Tool informs management decisions on how best to respond and prepare for tipping points in coastal systems.

### Thermal Changes to Lakes and Streams

**Jordan Read** (USGS CIDA) and **Gretchen Hansen** (WI DNR) modeled historical and future fish thermal habitat for over 10,000 lakes as part of the project "An Integrated Assessment of Lake and Stream Thermal Habitat Under Climate Change." An award-winning interactive visualization tool produced by the team will assist stakeholders in prioritizing adaptation and restoration strategies for freshwater resources.
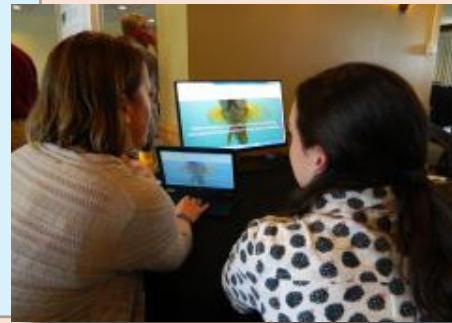
### Variability in Fishes

As part of the project "Characterization of Spatial and Temporal Variability in Fishes in Response to Climate Change," **Brian Irwin** of the USGS GA Cooperative Fish & Wildlife Research Unit and colleagues used existing data from the Great Lakes to consider how spatial and temporal variation in fish populations (walleye in Oneida Lake and alewife in Lake Michigan) may respond to climate change and other important drivers. The result will inform adaptation strategies related to monitoring and management of dynamic ecological systems.

### Winter Severity and Wildlife

In the Great Lakes, **Michael Notaro** (University of Wisconsin-Madison) and collaborators addressed a major gap in global climate models and assessments as part of the project "Development of Dynamically-based 21st Century Projections of Snow, Lake Ice and Winter Severity for the Great Lakes Basin to Guide Wildlife-based Adaptation Planning, with Emphasis on Deer and Waterfowl." Their high-resolution climate projections for weather severity in the Great Lakes were used to assess impacts on dabbling duck migration and white-tailed deer survival.
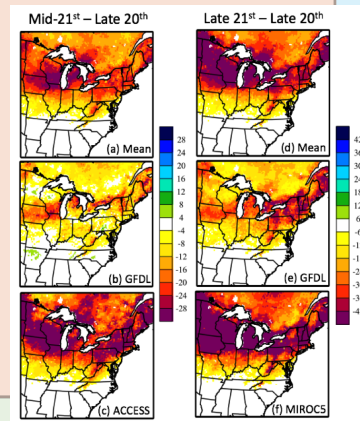
### Preparing for Change in Floodplains

As part of the project "Science to Inform Management of Floodplain Conservation Lands under Non-Stationary Conditions," **Robb Jacobson** and others from the USGS CERC and MO Cooperative Fish & Wildlife Research Unit worked with floodplain managers to identify what information was important in making decisions relative to climate-induced changes in seasonal patterns of floodplain inundation. The team developed a suite of recommendations and tools to support climate adaptation in Mississippi and MO River floodplains.

### Using Drones to Understand Coastal Processes

**Erika Lentz, Rob Thieler** (USGS Woods Hole Science Center), and **David Remsen** (Marine Biological Laboratory) explored scientific research opportunities for Unmanned Aerial Systems (UAS) in habitat mapping applications in coastal beach and marsh systems. The team demonstrated that landscape information obtained from UAS is of high quality and resolution, in some cases surpasses traditional mapping methods. The PI's conclude UAS is an ideal tool to improve our understanding of process-based coastal change over multiple timescales.

## Notable Ongoing Projects:

### Capstones Projects: Biological Thresholds and Slowing the Flow

In 2016, two new "capstone" projects were initiated seeking to integrate information across NE CSC funded projects. The two projects focused on critical thresholds across multiple systems and species (PIs Griffin, Horton, Morelli, Thompson), and increasing resilience to extreme floods and droughts by evaluating the potential benefits of green infrastructure and other techniques (Palmer, Nislow, Deegan, Neil, Caldwell, McIntyre, Staudinger). In the coming year, the "slow the flow" team is planning for multiple stakeholder engagement workshops, while the thresholds team will be integrating their different case studies and expertise to demonstrate how incorporating biological thresholds to climate change can aid management outcomes.

### Supporting Climate Adaption Planning at the Local Level

In September 2016, Governor Baker of Massachusetts signed Executive Order No. 569 in which he committed the Commonwealth to publish a statewide adaptation strategy that would incorporate observed and projected climate trends to provide guidance on the topics of "extreme weather events, drought, coastal and inland flooding, sea level rise and increased storm surge, wildfire, and extreme temperatures." Since that time, the MA Executive Office of Energy and Environmental Affairs engaged members of the faculty and staff at UMass, including the NE CSC, to collaboratively develop models and information that can be used to at the local level. A primary goal of this research was to develop information that can be appropriately communicated and that can inform the state and its partners in achieving the goals of EO 596. The NE CSC provided projections of changes in climate, changes in water resources, and estimates in sea level rise to state agencies, local planners, managers, and the general public.

Photo: R. Crumpton, USFWS

Photo: J. Brown, NE CASC

Photo: E. Childress, USFWS

Photo: D. Daniels

Photo: L. Sturdivant, USGS

Mid-21st – Late 20th    Late 21st – Late 20th
(a) Mean    (d) Mean
(b) GFDL    (e) GFDL
(c) ACCESS    (f) MIROC5

# PARTNERS PAGE

## Working with partners, engaging, and delivering science

### Tribal Engagement

This year, the NE CSC welcomed two Tribal Climate Science Liaisons who will provide current climate science information to Tribal Nations, identify climate research needs and priorities, and provide climate adaptation planning support for the Tribes. **Sara Smith**, the Midwest Tribal Climate Science Liaison hired by the College of Menominee Nation as part of the Sustainable Development Institute, is stationed at the US Forest Service's Northern Forest Research Station on the University of Minnesota campus in St. Paul, Minnesota along with our Deputy Director, Olivia LeDee. **Casey C. Thornbrugh** is the Northeast and Southeast Tribal Climate Science Liaison with the United South and Eastern Tribes (USET), based in at UMass, Amherst. Learn more at http://www.nicrn.org


Photo: C. Caldwell

*Sara Smith*   *Casey Thornbrugh*

### Refugia Coalition

The **Northeast Refugia Research Coalition** officially launched at the Regional Science Meeting in May. The goal of the group is to coordinate natural resource managers and scientists from across the region who use (or are interested in learning more about) climate change refugia management as a tactic for conserving species in the face of climate change. Groups assembled based on species and ecosystem expertise and interest to discuss potential management plans or decisions for which prioritization would be helpful, and what information exists related to environmental layers, species surveys, to inform refugia identification and mapping of:

- Spruce-fir forests
- Coldwater streams
- Glacial Lakes
- Vernal Pools
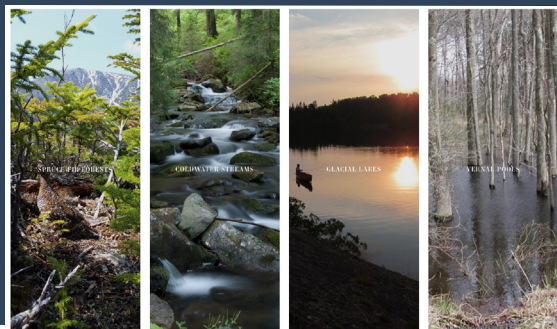

climaterefugia.org

### Training for Minnesota Resource Managers

**Olivia LeDee** worked with **Kenny Blumenfeld** (State Climatology Office, Minnesota Department of Natural Resources) and **Amanda Kueper** (MN DNR) to plan and lead two climate trainings in St. Paul and Duluth in the winter of 2017. The purpose of the training was to increase climate literacy of professionals and support the integration of the best available climate science in programs, plans, and operations. In addition to interactive sessions on climate trends and adaptation, participants heard about current, climate-informed work in the agency and worked in small groups to consider management options for focal resources. One-hundred professionals from the Divisions of Fish and Wildlife, Forestry, Parks and Trails, Ecological and Water Resources, Operations Services, and Lands and Minerals were trained.

### Decision Support

Northeast Association of Fish and Wildlife Agencies (NEAFWA) State Wildlife Action Plan (SWAP) Coordinators met in the Spring of 2017 to foster communication and increase cross-state efficiency in implementing actions from their 2015 plans. NE CSC staff attended and presented new information on on-going efforts to address climate impacts in the **coastal zone, threshold-based adaptation and ecosystem services, climate change refugia and habitat connectivity, and invasive species.** Topics were selected based on SWAP coordinators' feedback and a threat assessment conducted by Terwilliger Consulting. NE CSC staff provided resources and crafted a plan of immediate and long-term actions to address key management issues focused on regional climate change impacts on fish, wildlife, and their habitats as identified by NEAFWA Technical Committees.

## Where are they now?

*Here are some of the positions our former Fellows have taken:*

- Andrew Cox, Florida Fish and Wildlife Conservation Commission
- David Johnson, Assistant Professor, Virginia Tech
- Eleonora Demaria, Southwest Watershed Research, USDA
- Emily Powell, National Wildlife Federation
- James Nelson, Associate Professor, University of Louisiana
- Joel Ralston, Assistant Professor, Saint Mary's College
- Jonathan Winter, Assistant Professor, Dartmouth College
- Justin Mankin, Assistant Professor, Dartmouth College
- Katie Booras, Water Resources Engineer, CDM-Smith
- Kyle Gill, Forest Manager for Research and Experimental Forests, University of Minnesota
- Kyle O'Neill, USGS Conte Anadromous Fish Research Center
- Miranda Curzon, Assistant Professor, Iowa State
- Nicholas Hayden, Water Resources Engineer, Montgomery Associates Resources Solution
- Peal May, Project Engineer and Landscape Architect, Duffield Associates



Photo: T. Bonnot

The NE CSC Fellows program builds capacity to co-produce actionable adaptation science with scientists and managers.

## NE CSC Graduate Fellow Profile

### Amanda Davis
University of Massachusetts, Amherst



Under-appreciated species, also known as "trash fish," are abundantly-caught fish that are commonly discarded because of their low market demand and low value despite showing promise in the culinary industry. Managers and policy-makers seek pathways that reduce fishing pressure on vulnerable and high-value fish populations, sustainably feed consumers' demand for seafood, and resuscitate opportunities for fishermen. **Amanda Davis** is evaluating fishermen's access to under-appreciated species in a changing climate and collaborating with restaurants to measure consumer demand for different under-appreciated species. The results will help fishermen, seafood distributors, restaurants, and fishery managers collectively strategize sustainable seafood supply and demand relationships for New England in a changing climate. Amanda joined the NE CSC after assisting Linda Deegan, NE CSC PI, with the TIDE Project, and developing coastal adaptation strategies for the Massachusetts Wildlife Climate Action Tool.



## NE CSC Post-doc Fellow Profile

### Marcello Somos-Valenzuela
Now at Universidad de La Frontera, Chile



Historical data suggest that extreme events in terrestrial hydrology associated with streamflow are more common and low flow events last longer. The northeastern region of the US is vulnerable to changes in timing and magnitude of river flows; therefore, a comprehensive study of the hydrology for the late part of the previous century and this century is important for adapting to climate change. While a postdoctoral research associate at UMass, Amherst, **Marcelo Somos-Valenzuela** worked with NE CSC Director Richard Palmer to contribute to an understanding of changes in streamflow timing and magnitude in the northeast of the US by using a regional hydrology model (WRF-Hydro). This information will be useful not only for stakeholders that are interested in understanding how climate change will affect streamflow but also how streamflow changes will affect their specific interest such as fish phenology, habitat, floodplain conservation, or infrastructure design.



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*The NE CSC, with its core of seven consortium institutions, assembles climatologists, biologists, ecologists, and hydrologists, working together to inform natural and cultural resource management.*

Coastal processes • estuaries • eutrophication • freshwater input • food web interactions.
  Led by Linda Deegan, Woods Hole Research Center

Temperate and boreal forests • adaptive management • silviculture • forest disturbance.
  Led by Tony D'Amato, University of Minnesota

Ecological integrity • species responses • ecosystem risk management • ecological thresholds.
  Led by Curt Griffin, University of Massachusetts

Hydrology • stream temperature • aquatic habitat • stream fish • extreme flow • ecological drought.
  Led by Keith Nislow, University of Massachusetts

Landscape conservation design • forest management and succession • avian demographics and population dynamics.
  Led by Frank Thompson, University of Missouri

Mammalian ecology • vulnerable species and habitats • landscape conservation design • conservation biology.
  Led by Mary Ratnaswamy, USGS

Great Lakes • aquatic connectivity • temperature and flow regimes • fish migrations • coastal fisheries.
  Led by Peter McIntyre, University of Wisconsin

Landscape and species conservation • climate adaptation • translational ecology • mammal vulnerability • decision analysis.
  Led by Toni Lyn Morelli, USGS

Tribal resilience • connecting tribes and climate scientists • cross-cultural and cross-disciplinary education, applied research and outreach.
  Led by Chris Caldwell, College of Menominee Nation

Aquatic and marine species vulnerability and adaptive capacity • phenology • adaptation and conservation strategies.
  Led by Michelle Staudinger, USGS

Climate model assessment and future climate scenarios • paleoclimate • climate extremes.
  Led by Raymond Bradley, University of Massachusetts

Climate extremes • risk assessment • combined impacts of multiple extremes • natural and built systems • science of adaptation.
  Led by Radley Horton, Columbia University

Water resources • streamflow • stream temperature • stream health • water supply systems • decision analysis.
  Led by Richard Palmer, University of Massachusetts

Climate model assessment for ecological applications • climate science communication • air quality.
  Led by Alex Bryan, USGS

Wildlife impacts • adaptation planning • decision analysis • natural resource policy • conservation funding.
  Led by Olivia LeDee, USGS



Photo: B. Smith

THE UNIVERSITY of **WISCONSIN** MADISON

**COLUMBIA UNIVERSITY** IN THE CITY OF NEW YORK

**MBL** Biological Discovery in Woods Hole

COLLEGE OF MENOMINEE NATION KESHENA, WISCONSIN

**UNIVERSITY OF MINNESOTA**

**Mizzou** University of Missouri - Columbia

**UMASS** AMHERST

**USGS** science for a changing world

U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849

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*\*New name as of FY18.  The NE CASC is supported by the Department of the Interior and managed by the USGS National Climate Adaptation Science Center.  This is the sixth Annual Report of the NE CASC and covers the activities of* **Jan-Dec 2017.**