



## Workshop Proceedings: Biological Thresholds in the Context of Climate Change

### Workshop Overview

To better predict the response of plants and wildlife to climate change, natural and cultural resource managers seek to understand the mechanisms that drive changes in the distribution and abundance of plant and animal species, including any thresholds (non-linear responses) that might soon be crossed. Through the *Biological Thresholds in the Context of Climate Change Workshop*, NE CASC researchers identified climate-driven or management thresholds for populations, ecosystems, and landscapes to inform climate change adaptation and cultural/natural management plans while also exploring research opportunities for future work.

The workshop was organized to achieve the following goals:

- Introduce the concept of biological thresholds through the lens of NE CASC science
- Explore biological thresholds through case studies
- Engage cultural/natural resource management perspectives and priorities
- Provide a forum for discussing adaptation strategies and research opportunities

Approximately 160 members of the climate adaptation community attended at least one *Biological Thresholds* session. Registrants represented 21 states and more than 50 federal, state, county, or municipal agencies.

### Conclusions

- The Thresholds Workshop was able to bring together a tremendous diversity of existing and new stakeholders across the footprint of the NECASC. We are excited to use this workshop and other activities to both strengthen and broaden our partnerships with stakeholders spanning our diverse geography and adaptation science needs.
- Given the undesirable ecological, cultural, social, and economic conditions often associated with crossing a given threshold, a key science need is to increase our ability to recognize and anticipate the crossing of undesirable thresholds (e.g., ecosystem state changes, proliferation of invasives). This recognition would allow for more targeted application of adaptation actions that could assist with transitioning to



conditions that still sustain key attributes and benefits associated with a given ecosystem or resource.

- Many of the strategies associated with addressing climate change impacts have drawn from historic management experience and an understanding of past ecosystems dynamics. As we approach more novel ecosystem conditions and thresholds, the need for science to inform and support adaptation strategies outside of these historic approaches increases greatly. Many of the current NECASC projects are using field experiments and modeling exercises to increase the level of science to support managers in this novel space.
- Adaptation strategies for addressing thresholds may include novel approaches, such as assisted migration, to sustain the structures, biota, and processes of a given ecosystem. Nevertheless, we have very little understanding regarding how these adaptation strategies will influence future ecosystem functions or the habitat needs for key taxa under climate change and other stressors. As such, there is a significant need for holistic evaluations of adaptation actions to inform strategies that are able to sustain key functions and species, despite the onset of novel ecological conditions.
- The impacts of climate change and undesirable thresholds on cultural resources represent a unique challenge given the access constraints imposed by reservation boundaries. There is a significant need to further recognize how thresholds may impact cultural lifeways and traditions in a given locale and to develop policies and strategies to allow for Tribal access to cultural resources when they can no longer be sustained within Tribal lands.

---

## **Session 1: October 7th**

**10:30-11:30 AM**

I) Welcome:

- Richard Palmer, NE CASC University Director & Professor, University of Massachusetts Amherst
- Katherine Smith, NE CASC Federal Director



# NECASC

Northeast Climate Adaptation Science Center

## II) Land Acknowledgment

- Casey Thornbrugh, NE CASC Tribal Climate Liaison

## III) Introduction to Thresholds and NE CASC Science:

- Thomas Bonnot, NE CASC Principal Investigator & Research Assistant Professor, University of Missouri
- Toni Lyn Morell, NE CASC Research Ecologist

## IV) Case Studies to Demonstrate Research on Thresholds

- Forests: Anthony D'Amato, NE CASC Principal Investigator & Professor, University of Vermont
- Atlantic coasts: Michelle Staudinger, NE CASC Science Coordinator
- Invasive plants: Bethany Bradley, NE CASC Principal Investigator & Professor, University of Massachusetts Amherst

## **Recording: Session 1**

<https://vimeo.com/468387284>

---

## **Session 2: October 7th**

**1:30-2:30 PM**

### I) Management of Thresholds: Panel Discussion

- Richard Palmer, NE CASC University Director & Professor, University of Massachusetts Amherst
- Amanda Babson, National Park Service
- Scott Covington, U.S. Fish & Wildlife Service
- Shavonne Smith, Shinnecock Indian Nation
- Tyler Kaspar, 1854 Treaty Authority
- Jean Lorber, The Nature Conservancy
- Maria Janowiak, Northern Institute for Applied Climate Science

## **Recording: Session 2**

<https://vimeo.com/468383593>

---



## **Session 3: October 8th**

**1:30-2:45 PM**

I) Welcome, Results of Biological Thresholds Survey

- General Results: Anthony D'Amato | View Slideshow: <https://www.umass.edu/necsc/workshop-proceedings-biological-thresholds-context-climate-change> (pdf attached at bottom of page)
- Results from Tribal Organizations: Casey Thornbrugh | View Slideshow: <https://www.umass.edu/necsc/workshop-proceedings-biological-thresholds-context-climate-change> (pdf attached at bottom of page)
- II) Facilitated Breakout Group Discussion on Thresholds science and management

III) Plenary Discussion of Breakout Group Findings

## **Recording: Session 3**

<https://vimeo.com/468407389>

---

## **Session 4: October 27th**

**1:30-3:00 PM**

This invitation-only session assembled resource managers from across the Northeast and NECASC scientists to identify key challenges and questions managers face in devising strategies for addressing biological thresholds. Four breakout discussions were conducted to address these issues in the following areas:

- Forests
  - Invasive Plants
  - Coasts
  - Freshwater Environments
-



## Conclusions: Breakout Groups

### Forests

- Given the undesirable ecological, cultural, social, and economic conditions often associated with crossing a given threshold, a key science need is to increase our ability to recognize and anticipate the crossing of undesirable thresholds (e.g., ecosystem state changes, proliferation of invasives). This recognition would allow for more targeted application of adaptation actions that could assist with transitioning to conditions that still sustain key attributes and benefits associated with a given ecosystem or resource.
- Adaptation strategies for addressing thresholds may include novel approaches, such as assisted migration, to sustain the structures, biota, and processes of a given ecosystem. Nevertheless, we have very little understanding regarding how these adaptation strategies will influence future ecosystem functions or the habitat needs for key taxa under climate change and other stressors. As such, there is a significant need for holistic evaluations of adaptation actions to inform strategies that are able to sustain key functions and species, despite the onset of novel ecological conditions.

### Invasive Plants

- Identifying dispersal corridors and likely mechanisms of introduction for range-shifting invasive species is critical for both prioritizing species and focusing monitoring on high risk areas.
- Managers need more opportunities to share resources and knowledge, such as species risk assessments and effective treatment methods. This is particularly critical across state borders, where there are few opportunities for interaction.
- Research projects that involve invasive species treatment and/or restoration would be very helpful for stakeholders who are at capacity - managers don't have enough people to conduct all priority management.



## Coastal Ecosystems

- Regional and general indicators and metrics are needed to inform threshold-based decisions, monitoring frameworks, and communications strategies across coastal systems; however, site-specific conditions, characteristics, gradual vs. acute stressors (e.g. SLR vs. storms) and histories are critically important to understand individual system threshold breakpoints, responses, and transferability.
- Actions are not universally applicable. Evaluation studies from a diverse suite of sentinel sites and the synthesis/comparison of subregional data are needed to understand the effectiveness of different actions (including 'no action' as an action) and why an action works in one place and not another. For example, is marsh migration better supported through cutting trees, mowing grasslands, controlling phragmites, grading soils, or other action(s)? Evaluation studies of systems that have already crossed tipping points are also needed. It may not always be possible to know exactly what caused a system to cross a threshold, but there could be useful precursor indicators.
- Good communication strategies, packaging, and visualization tools are needed to inform and motivate the public (e.g., municipalities, policy makers) of the most up-to-date science for taking action as well as related uncertainties.

## Freshwater Environments

Significant partnership and research opportunities exist in the following areas:

- Understanding how biological thresholds are impacted by climate variability and extremes (e.g., floods, droughts), particularly water quality impacts including impacts on stream temperatures and aquatic health.
- How to prioritize management actions and identify critical thresholds in different locations (e.g., strategic planning of land acquisition, dam/culvert removals).
- How biological thresholds are impacted by climate when there are multiple stressors.