



Cornell University

## Northeast Regional Invasive Species and Climate Change (RISCC) Management Workshop Report

*How can we manage for upcoming biological invasions in the light of climate change?*

### OVERVIEW

The first Northeast Regional Invasive Species and Climate Change (RISCC) Management Workshop (initially called the Northeast Invasive Species and Climate Change, or NISCC, workshop) was held on July 21, 2016, from 10:00 am-4:00 pm in the Morrill Science Center II at the University of Massachusetts in Amherst, MA. It was convened by the Department of Interior Northeast Climate Science Center (NE CSC), the New York Invasive Species Research Institute (NY ISRI), and the University of Massachusetts (UMass) as the first step in a conversation to address the question *“How can we manage for upcoming biological invasions in the light of climate change?”*. The objective of the workshop was to bring together a small group of climate scientists and invasive species scientists, managers, and policy makers from New York and New England to promote a two-way dialogue to 1) review the state of current research on the topic; 2) share regional knowledge about current management strategies; and 3) identify specific information needs of managers surrounding invasive species and climate change.

The workshop was attended by 19 individuals representing nine northeastern state/municipal natural resource agencies, the North Atlantic LCC, the US Forest Service Northern Research Station, The Nature Conservancy, the USA National Phenology Network, academic institutions, the NE CSC, NY ISRI, and UMass. The participant list can be found in Annex 1.

### WORKSHOP MOTIVATION AND OBJECTIVES

One of the emerging initiatives of the NE CSC is to work with resource management partners to develop new research projects and create products to improve invasive species management in the face of climate change. Similarly, NY ISRI's mission is to coordinate invasive species research to help prevent and manage the impact of invasive species in New York State and beyond, and managers in NY have stressed the need to understand how climate change will influence the distribution and abundance of invasive species. Thus our desired outcome for the workshop was to understand the information needs

of invasive species managers surrounding climate change and develop a strategy to address those needs through information sharing and targeted research.

## WORKSHOP STRUCTURE

To accomplish the objectives, scientists were invited to present on invasive species and climate change and participants were asked to come prepared to share information. The workshop was kicked off with overviews of recent and future climate change and on its impacts on invasive species from Dr. Alexander Bryan (NECSC) and Dr. Bethany Bradley (UMass). A copy of the presentation can be found [here](#). The presentation covered the following key points:

- 1. Temperatures and CO<sub>2</sub> are rising with climate change and these changes are likely to lead to more 'extreme' disturbances - including droughts, floods and heat.**  
*Carbon dioxide has been and is projected to continue to rise rapidly with ongoing heavy reliance on fossil fuels. In the Northeast U.S., the climate is getting warmer and wetter, with more heat waves and heavier rainfalls. Warming is also reducing winter snowfall and snowpack and creating a longer summer growing season. One of the more consequential impacts of climate change for ecosystems is the increased intensity and frequency of extreme weather events (e.g., heat waves, floods, droughts and wildfires, high winds, and lightning strikes).*
- 2. Invasive plants tend to respond quickly to early warming, which gives them a 'priority effect' over native, less responsive species.**  
*Long-term studies of changes in Massachusetts suggest that plants that shift their growing season earlier in response to temperature warming are more likely to persist under climate change. Unfortunately, most of these responsive plants were non-native and invasive. Invasive species responsiveness to early season warming is thought to create a 'priority effect', whereby the first species to arrive has more resources and can compete well with later arrivals because of its early growth advantage. On the other hand, warming temperatures, especially higher minimum temperatures in the winter, are providing advantage for several invasive insect pests.*
- 3. Climate warming and altered precipitation does not give a direct advantage to all invasive species, but it strongly advantages species that are able to disperse quickly.**  
*Invasive species' close association with people ensures that they are introduced much more rapidly than most native species into novel habitats, where they are poised to invade if climate change makes the recipient ecosystem suitable. Ongoing biogeographical research aims to identify how climatic suitability for various species shifts with climate change, but this approach is limited by the quality of spatial occurrence data. For invasive plants, recent research by Jenica Allen (UNH) and Bethany Bradley (UMass) assessed climatic susceptibility for ~900 US species - stay tuned for state level watch lists identifying current and future risk of invasive plant establishment.*
- 4. Climate extremes create disturbance, which favors invasion.**  
*Links between invasive species and disturbance have been known for a long time. Increasing extremes with climate change are a novel form of ecological disturbance. These climatic disturbances negatively affect native species, which provides an opportunity for invasive species to thrive.*
- 5. Rising CO<sub>2</sub> strongly favors invasive plants.**  
*All plants are favored by rising CO<sub>2</sub> (CO<sub>2</sub> fertilization), but in the large majority of comparative studies, invasive plants are more favored than native plants. Moreover, CO<sub>2</sub> fertilization means that invasives are hardier, grow larger, and are more difficult to kill.*
- 6. Known unknowns**  
*Major unknowns about invasive species & climate change are two-fold. First, we don't know what species will arrive next, although we know that trade (including deliberate introduction and release of ornamental plants*

*and pets) will continue to bring novel invaders to the US. Second, we don't know what the future holds for energy development and emissions. Human choices now and in coming decades will determine the severity of future climate change.*

Following the presentation, the discussion shifted to a roundtable format where participants were prompted to share their knowledge and experience on the following topics:

- How are invasive species currently being managed?
- How is climate change currently being considered in invasive species management? How would this change if you knew more about future climate patterns and species vulnerability?
- How have you successfully used research in the past? What have you found to be most effective for collaborating between research and management?

The final discussion period was dedicated to identifying research needs, synthesizing the day's discussion and defining a series of proposed next steps that could provide continuity to the interaction and meet the needs identified by the participants. (Workshop agenda can be found in Annex III.)

### **INVASIVE SPECIES MANAGEMENT AND CONSIDERATIONS/ACTIVITIES RELATED TO CLIMATE CHANGE**

Participants shared information about the following activities that they engage in to manage invasive species: Priority setting, Prevention, Early detection, Control (strategy setting, selection of control technique - mechanical, chemical, biological), Restoration, Resistance, and Education and Outreach (including citizen science).

This exercise of identifying how invasive species management takes place was then extended to how climate change considerations are currently being incorporated into invasive species management. Participants shared that they were adapting their management by:

- Actively managing pathways of invasion that are likely to bring species similar to existing problem species (e.g., Nun moth, related to gypsy moth)
- Prioritizing invasive species management in areas/habitats that were likely to be vulnerable to climate change and extreme weather event disturbance
- Modifying the list of early detection species (target invasive species that have not yet arrived in the location) based on those likely to expand their range due to climate change and educating staff, volunteers, partners and the public about their impending arrival
- Establishing demonstration plots to show climate change impacts
- Changing the management window/schedule based on how the climate is changing; earlier springs and longer season mean an earlier start to treatment and a longer period of treatment

Although some organizations have started to incorporate climate change into management activities, participants expressed a need for more information and support to make these efforts more widespread and effective. The following considerations in management activities were identified as important in the context of climate change:

- Considering the possibility that new invaders could come from old places (i.e., invasive species that could not have previously survived or spread in a location may become established with climate change);

- Identifying whether and how pathways of novel invasive species introduction might change with climate change (e.g., direct introduction to the Northeast of East Asian pests if ships can pass through an ice-free Arctic)
- Engage groups like the National Phenology Network and Audubon Native Plants for Birds initiative (<http://www.audubon.org/conservation/project/native-plants-birds-0>), as well as local nurseries and garden clubs, in order to increase knowledge on the detection, and thus prevention, end, and to encourage native plantings.
- Considering the effects of storms and other increased or novel disturbance on invasives and which species are most responsive to disturbance (e.g., Hurricane Sandy greatly increased invasives species in downstream riparian areas; lightning strikes causing widespread fire in areas that historically did not burn);
- Adapting invasive species control treatments based on a shifted phenology and extending invasive species control crew seasons (starting earlier and ending later) in response to longer growing seasons;
- Proactively treating present non-native species that have not yet behaved invasively but may under shifting climate conditions;
- Synthesizing known climate change information in management manuals and incorporating the topic into conference agendas for foresters.
- Determining a strategy (and even language) for how to deal with non-natives becoming invasive or native species becoming a nuisance due to climate change.
- Ultimately, climate change means we can no longer manage for past conditions, so what we manage for becomes much more a matter of human value, and that bears on most species of invasive management, including what is considered non-native.

## **RESEARCH AND INFORMATION NEEDS**

Participants indicated that when they incorporate science into their management decisions, it comes mainly from expert advice but that they also obtain information from research presented in scientific journals or conferences. Many participants expressed the need to better understand how to incorporate climate change and invasive species science into their management plans. All participants agreed that coordinating a stronger network of scientists and managers across the Northeast to support management questions as they arise would be a useful step.

Participants also suggested that it would be helpful to create or expand existing management tools (e.g., NatureServe, Natural Resource Navigator) to include invasive species as well as compiling existing risk assessments into a platform readily accessible to managers. The group also identified the need for specific risk assessments for species identified as future management concerns (e.g., Hardy Kiwi).

It was also clear from the conversation that managers could play a role in facilitating and assisting new research by identifying invasion fronts where research on invasive species impacts could be initiated, as nascent invasions provide a key (and often missing) 'before' stage for field ecologists.

There was a great deal of interest in monitoring/research on invasive species spread following an extreme weather event and a request to synthesize research that addressed this and then using this

data to predict future invasions and effective management strategies following extreme weather events. Managers would also like to know more about which invasive species will benefit from climate change and how the effective treatment periods for invasive species will shift.

## **OTHER RESEARCH IDEAS**

During a brainstorm session and throughout the day, participants suggested research topics that were of interest to them and their work.

- Determine whether models that give general trends and coarse predictions are useful for managing species-by-species
- Assess how biocontrol risk will change with changing temperatures and precipitation patterns
- Analyze whether there are climate thresholds at which species will become invasive
- Identify vulnerable habitats as a way to prioritize management
- Adapt Nature Serve Climate Vulnerability tool to be used for invasive species instead of vulnerable species
- Explore the relationship between invasive species and ticks/Lyme's Disease (which is expected to increase with climate change)
- Examine what is going to change and which species would benefit most from those changes (temperature, photoperiod, etc.)
- Determine how biogeochemical changes will affect invasion potential
- Determine the effect of snowmelt changes on invasive species
- Use past data on storms to predict future invasions

## **POTENTIAL NEXT STEPS**

In addition to writing a report on the outcomes of the current workshop, the group determined that the following actions would be useful next steps to address the climate change and invasive species management issues.

### ***Short-term goals:***

- Organize ourselves by formalizing and naming the group (suggested name: "Regional Invasive Species & Climate Change (RISCC) Management")
- Create a climate change and invasive species email listserve to share resources and information
- Engage other Northeastern states and key entities that were not represented at the workshop
- Find a home for the working group (e.g., the National Invasive Species Council)
- Compile available resources in the Northeast to support management of invasive species in the face of climate change

### ***Longer term goals:***

- Coordinate a regional (northeast) conference on invasives and climate change that is intended for both researchers and managers to attend with opportunities for interaction
- Develop cross-state collaborations and networks so invasive species managers can learn from each other and share information
- Create an expert advisory board on invasive species and climate change that can guide the effort

- Create a “positive” marketing strategy where showing success stories of how incorporating climate adaptation into invasive species plans (or vice versa) can reduce impacts
- Identify clear, short-term research needs that can be communicated to the scientific community
- Identify specific priority areas/invasion fronts as opportunities for research and communicate this to researchers interested in studying climate change and invasive species
- Synthesize existing climate change and invasive species research
- Compile a comprehensive list of funding opportunities to support research projects. Including less commonly considered sources with the agency, typical due date, and description of the niche of research they tend to support (ex: Public Health department is starting to support invasives research given disease impacts on humans.
- Incorporate climate vulnerability and prediction data in invasive species databases
- Integrate invasive species and climate change state programs and forest and marine ecosystem management

#### **EXISTING RELATED RESOURCES/INITIATIVES IDENTIFIED**

- Northeast Aquatic Nuisance Species Panel (NEANS) climate working group (<http://www.northeastans.org/>)
- Natural Resource Navigator (<http://www.naturalresourcenavigator.org/>)
- Sentinel Plant Network (<http://www.sentinelplantnetwork.org/>)
- NIACS (<http://www.nrs.fs.fed.us/niacs/>)
- NatureServe Climate Change Vulnerability Index (<http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index>)
- NE CSC Project Tool TranStorm (<http://necsc.umass.edu/biblio/project-flyer-transtorm-tool-help-communities-prepare-extreme-rainfall>)
- USFS Climate Change Tree Atlas (<http://www.fs.fed.us/nrs/atlas/>)
- Forest pest meeting including APHIS & ARS and Canada-US Forest Pest Council
- In-house scientists

Annex 1: 1<sup>st</sup> Northeast RISCC Management Workshop Participants

| Name              | Agency  | Email Address                         |
|-------------------|---|---------------------------------------|
| Carrie Brown-Lima | New York Invasive Species Research Institute                | cjb37@cornell.edu                     |
| Toni Lyn Morelli  | NECSC   | tmorelli@usgs.gov                     |
| Bethany Bradley   | UMass/NECSC   | bbradley@eco.umass.edu                |
| Alex Bryan        | NECSC   | abryan@usgs.gov                       |
| Jeanne Brown      | NECSC   | jeannebrown@umass.edu                 |
| Andy Cutko        | Maine Natural Areas Program                                 | andrew.cutko@maine.gov                |
| Jennifer Dean     | iMap Invasives/Natural Heritage Program                     | jennifer.dean@dec.ny.gov              |
| Melody Keena      | USDA Forest Service Northern Research Station (CT)          | mkeena@fs.fed.us                      |
| Cristina Kennedy  | Massachusetts Office of Coastal Zone Management             | Cristina.Kennedy@massmail.state.ma.us |
| Brendan Quirion   | Adirondack Park Partnership for Invasive Species Management | bquirion@TNC.ORG                      |
| Mary Ratnaswamy   | NECSC   | mratnaswamy@usgs.gov                  |
| Alyssa Rosemartin | USA National Phenology Network                              | alyssa@usanpn.org                     |
| Scott Schwenk     | North Atlantic LCC  | william_schwenk@fws.gov               |
| Rebecca Shirer    | NY Chapter of the Nature Conservancy, Albany NY             | rshirer@TNC.ORG                       |
| Meredith Taylor   | NYC Environmental Protection Bureau of Water Supply         | MeTaylor@dep.nyc.gov                  |
| R. Talbot Trotter | USDA Forest Service Northern Research Station (CT)          | rttrotter@fs.fed.us                   |
| Sandy Wilmot      | Vermont Dept Forests Parks & Recreation                     | Sandy.wilmot@vermont.gov              |
| David Wong        | Massachusetts Department of Environmental Protection        | david.w.wong@state.ma.us              |
| Jaclyn Harrison   | NEIWPCC   | JHarrison@neiwpcc.org                 |