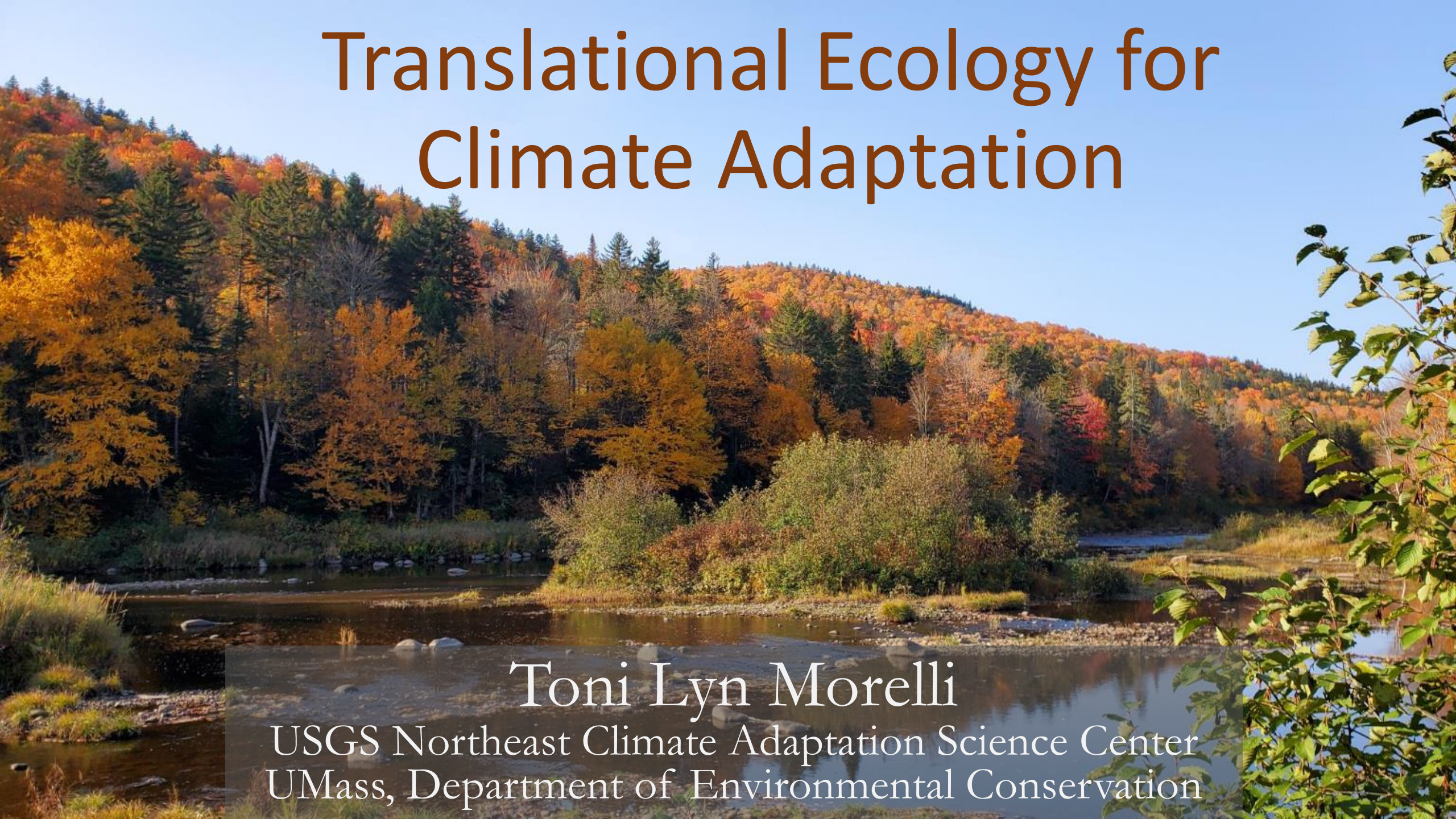
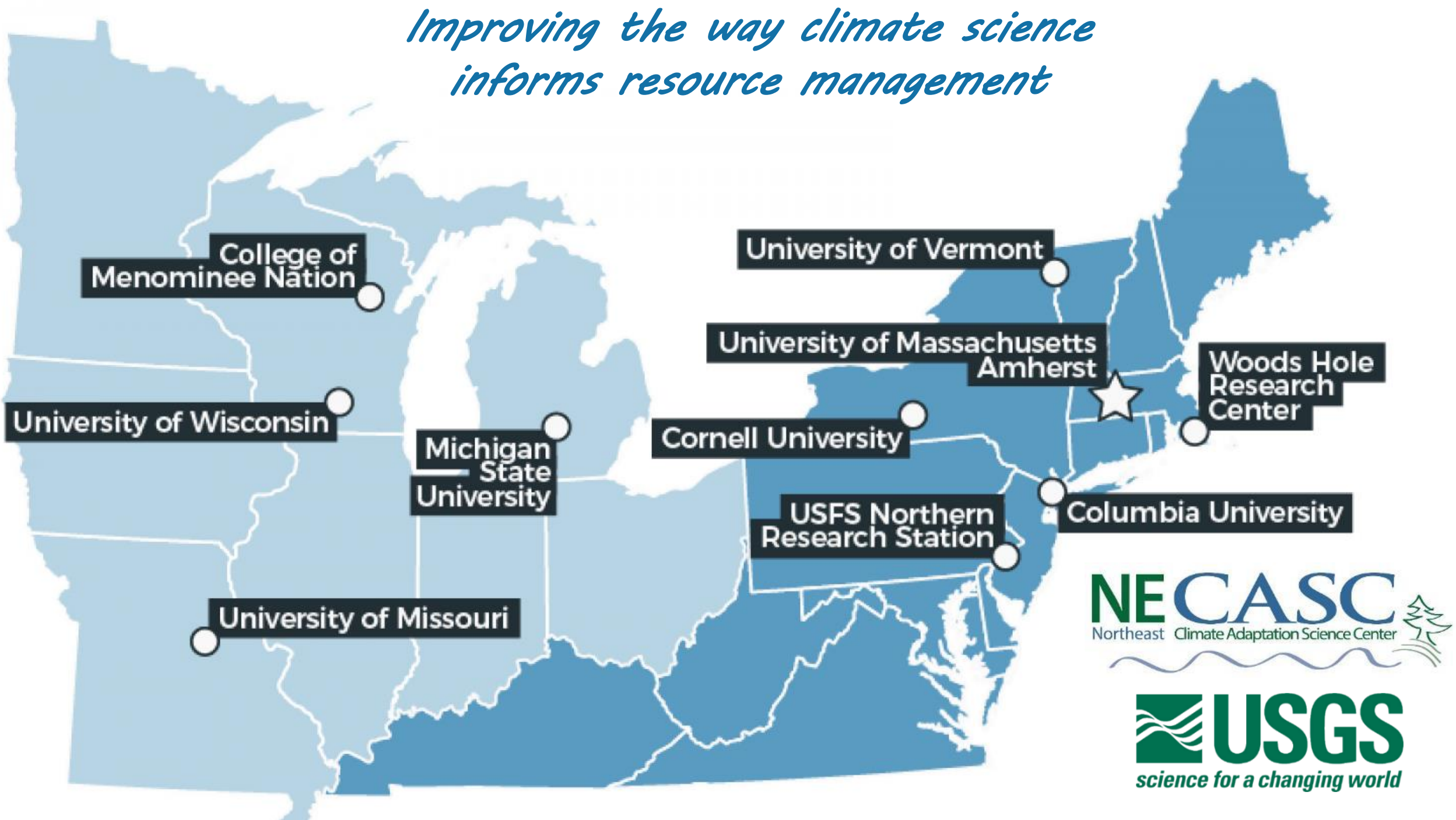
Translational Ecology for Climate Adaptation



Toni Lyn Morelli
USGS Northeast Climate Adaptation Science Center
UMass, Department of Environmental Conservation

Improving the way climate science informs resource management

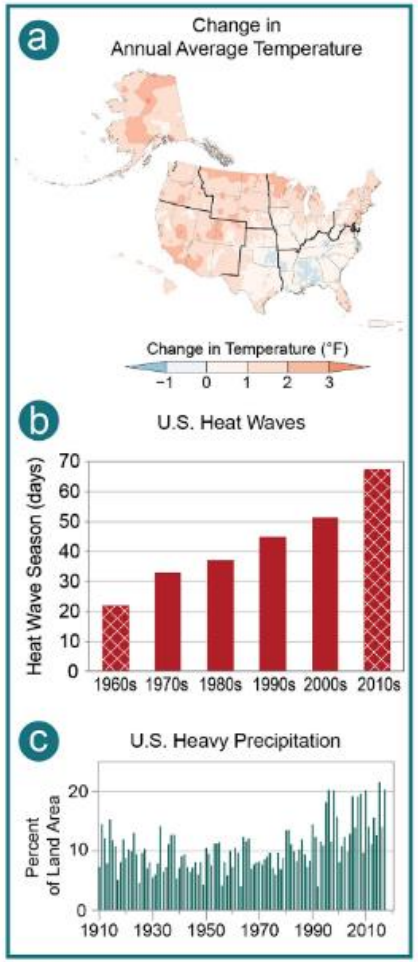


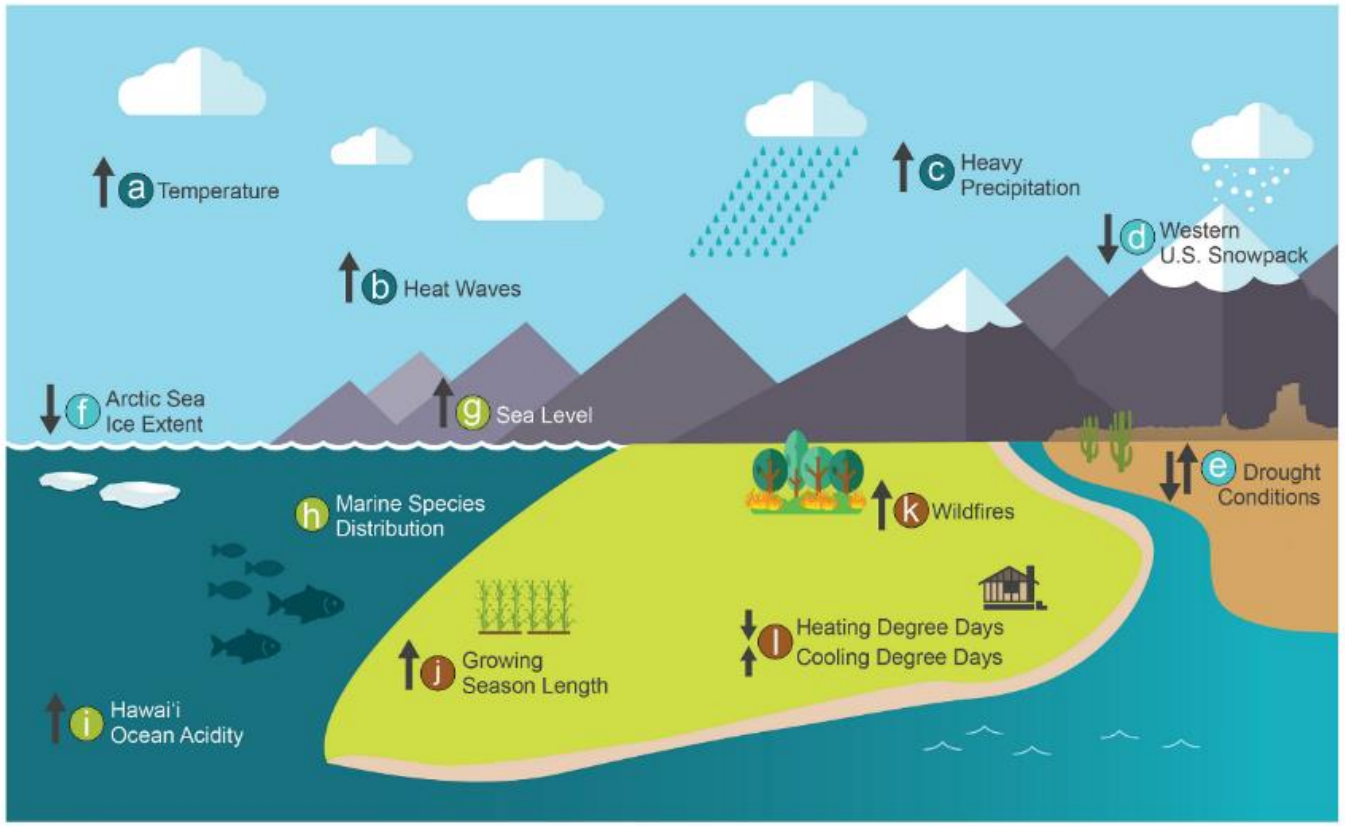
NE CASC
Northeast Climate Adaptation Science Center

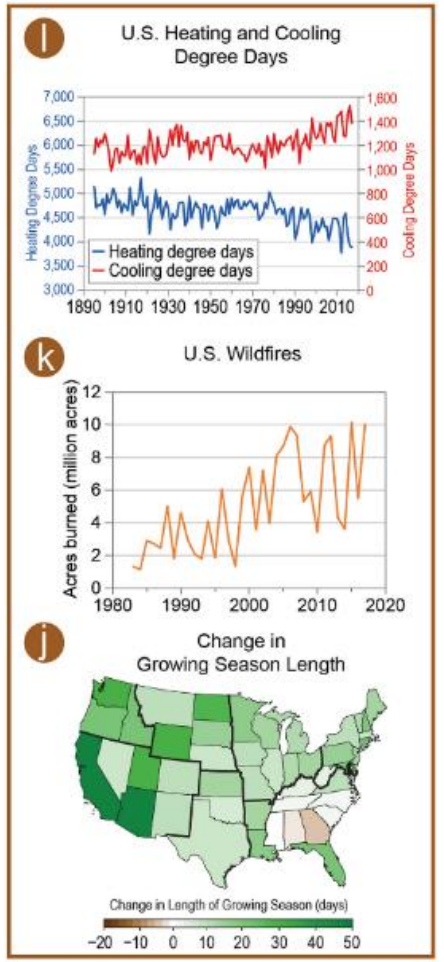
USGS
science for a changing world

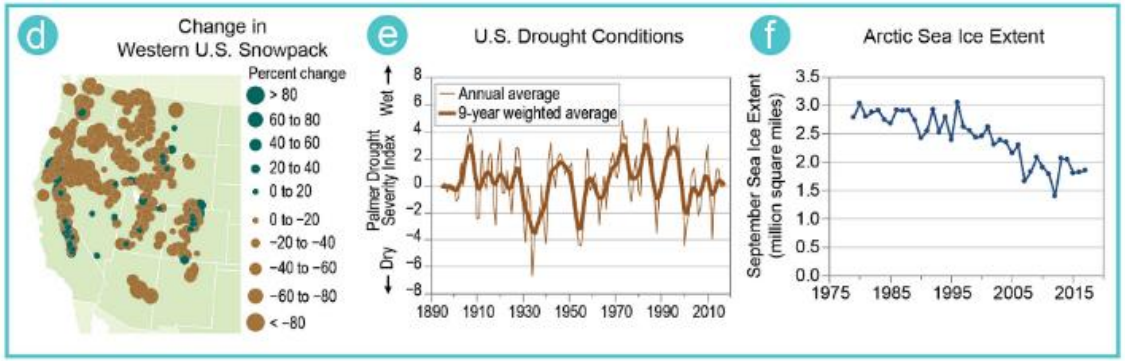
Golden/Devarajan et al. 2021 – 10 Simple Rules

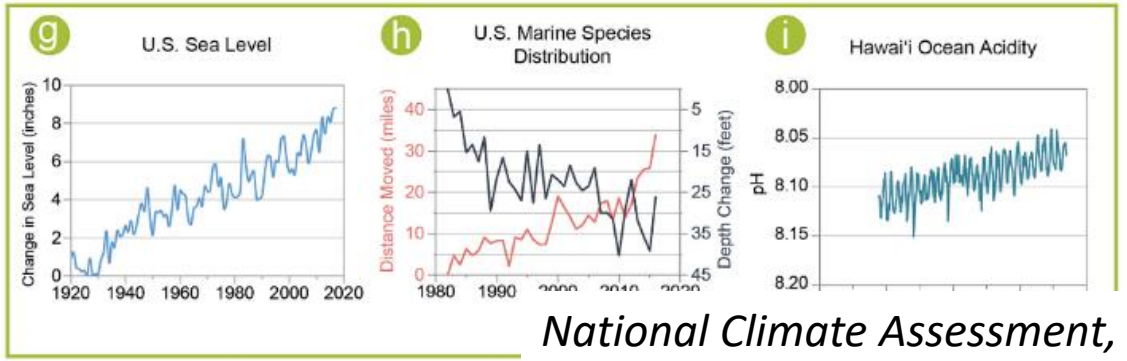
Indicators of Climate Change



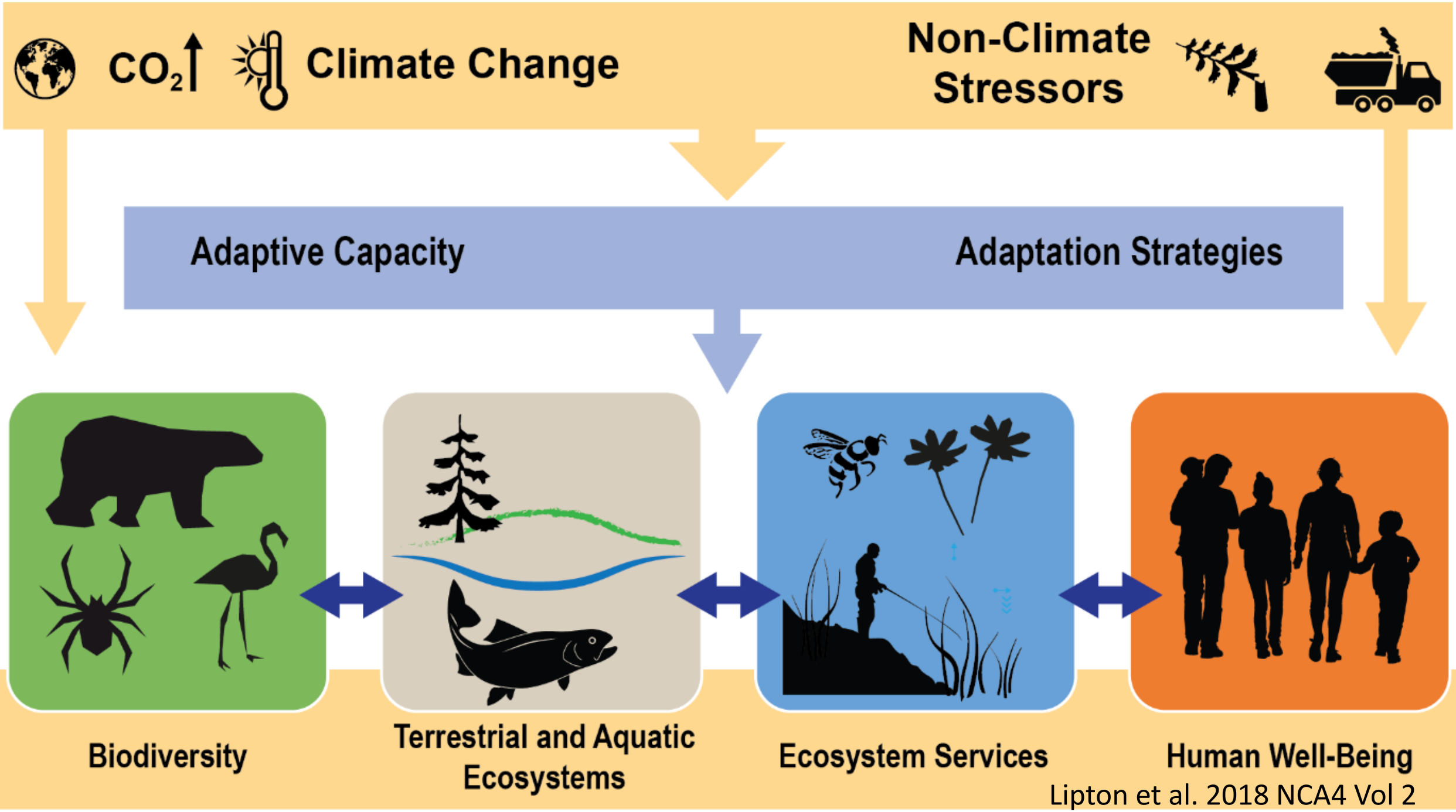








National Climate Assessment, 2018



Lipton et al. 2018 NCA4 Vol 2

A SPECTRUM OF ADAPTATION ACTIONS

RESIST CHANGE ← → **DIRECT CHANGE**

Resistance

Actions designed to maintain current or desired species composition, ecosystem structure, or functions.

example: Conserving climate refugia and controlling invasive species

Protect northern hardwoods refugia through early detection and control of invasive species.

Resilience

Actions that allow for some changes following a disturbance while enabling the system to return to a state similar to pre-disturbance.

example: Promoting and maintaining species or structural diversity

Prepare for increased forest disturbances using forestry practices that promote a diversity of species, age classes and seed sources.

Passive Transformation

Actions that allow a system to naturally transition to a new state characterized by new species, structure, or functions.

example: Land conservation and allowing change

Purchase or conserve land parcels adjacent to current salt marshes to allow for unassisted upland migration through natural processes.

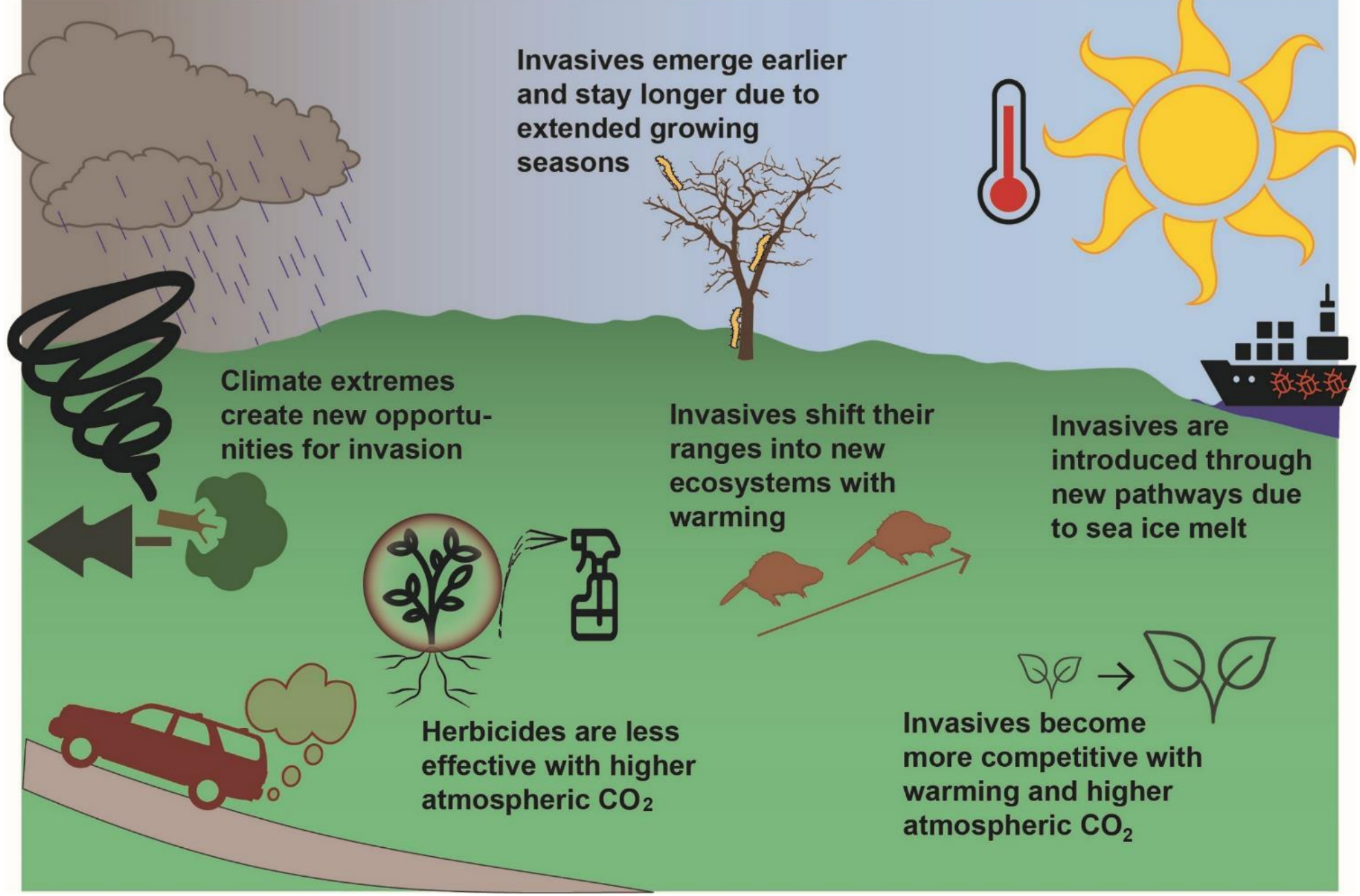
Active Transformation

Actions that facilitate or drive the transition of a system to a new state characterized by new species composition or functions with human assistance.

example: Assisted migration of species adapted to future climates

Facilitate upland marsh migration by planting native salt marsh species.

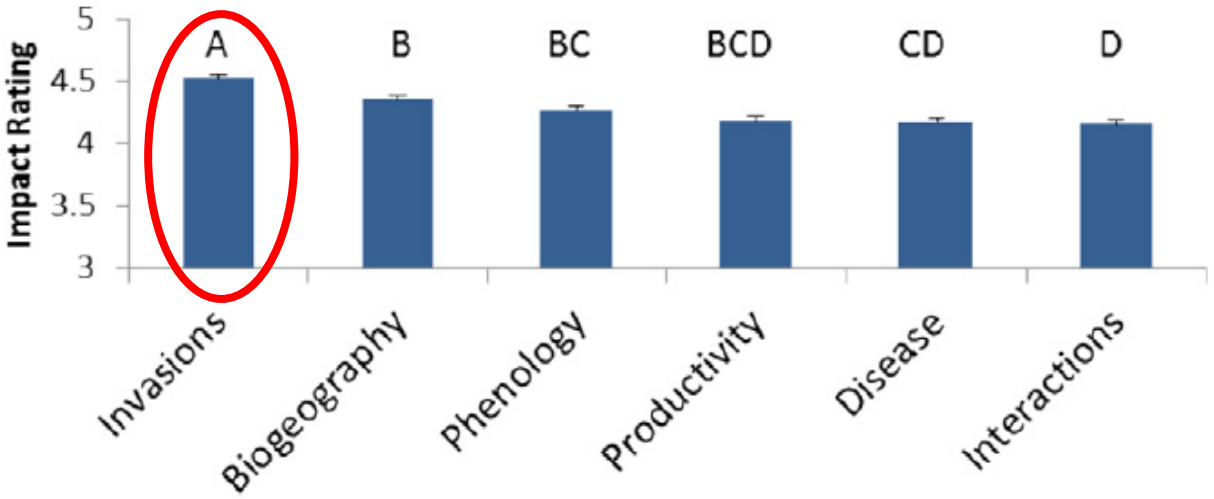
MASS ECAN



Northeast RISCC Management Regional Invasive Species & Climate Change

Bradley et al. 2019
https://doi.org/10.7275/mrf6-p616

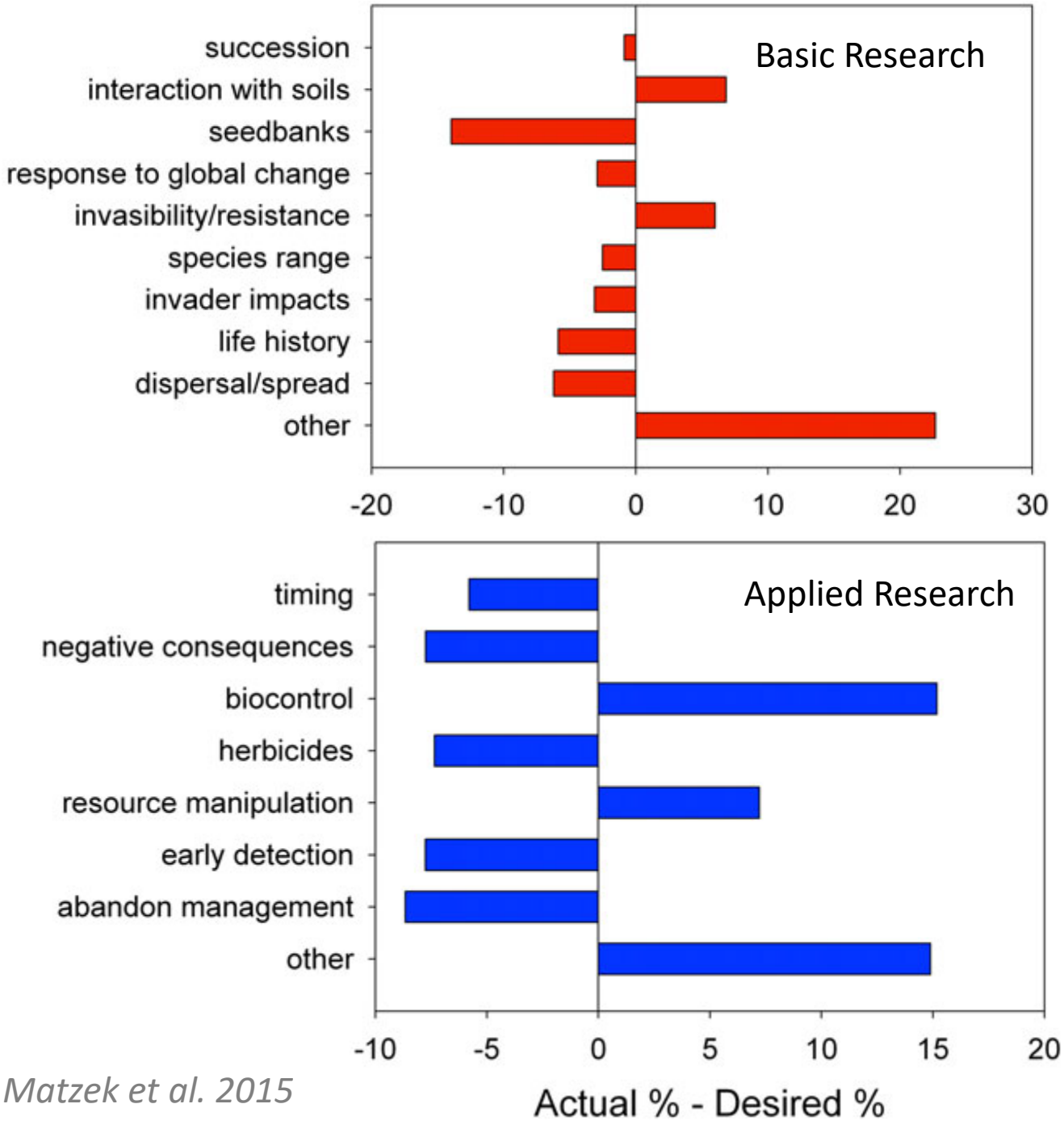
Invasives & climate change are top priorities for natural resource managers



Public land managers
Peters et al. 2018 *STOTEN*

AFWA Report 2020

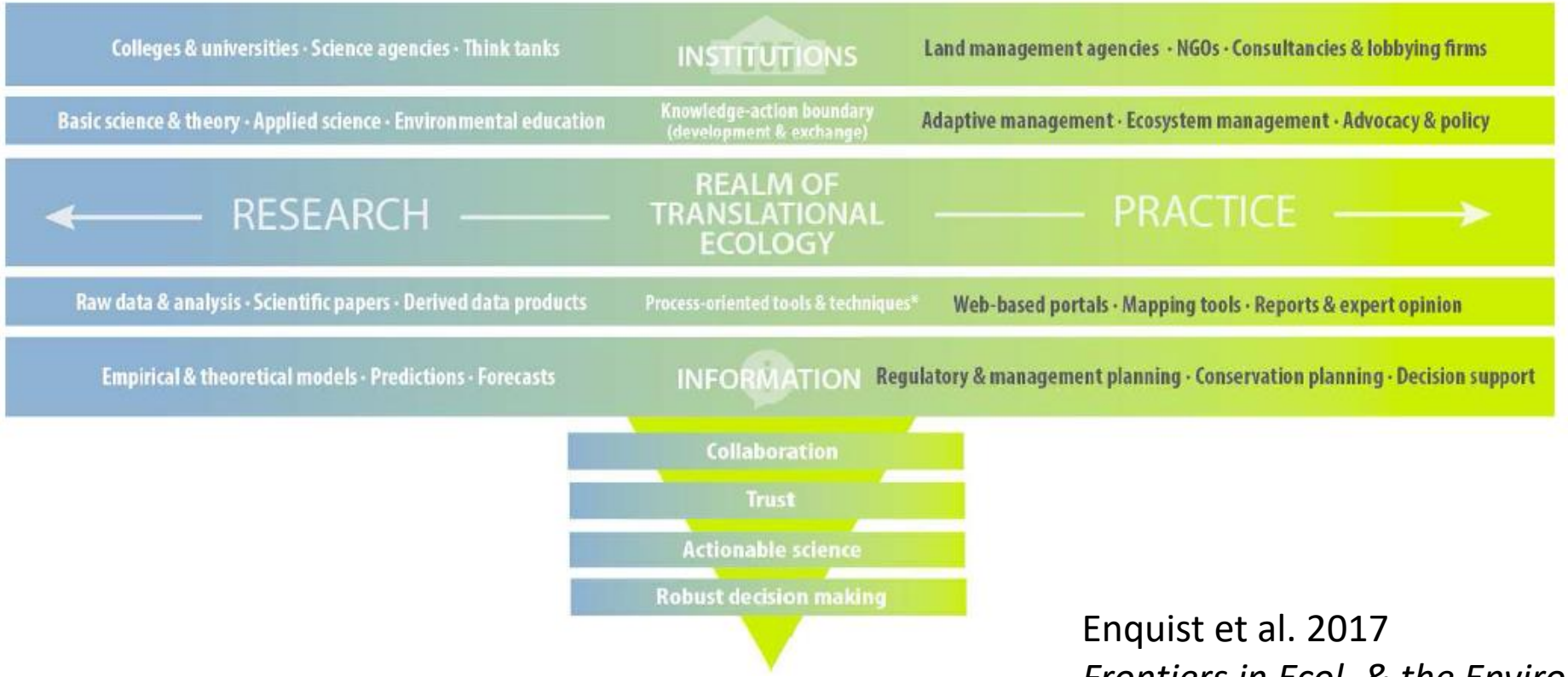
Mismatch between researchers and stakeholders



Matzek et al. 2015

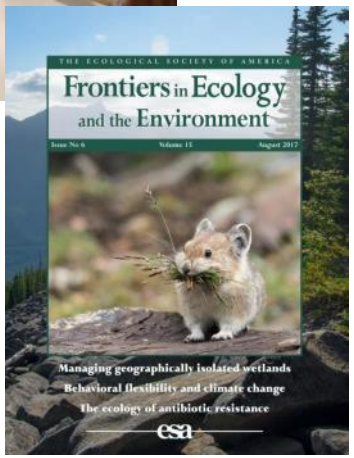
Translational Ecology

An intentional process by which ecologists, stakeholders, and decision-makers work collaboratively to develop scientific research via joint consideration of the sociological, ecological, & political contexts of an environmental problem that results in improved decision-making.

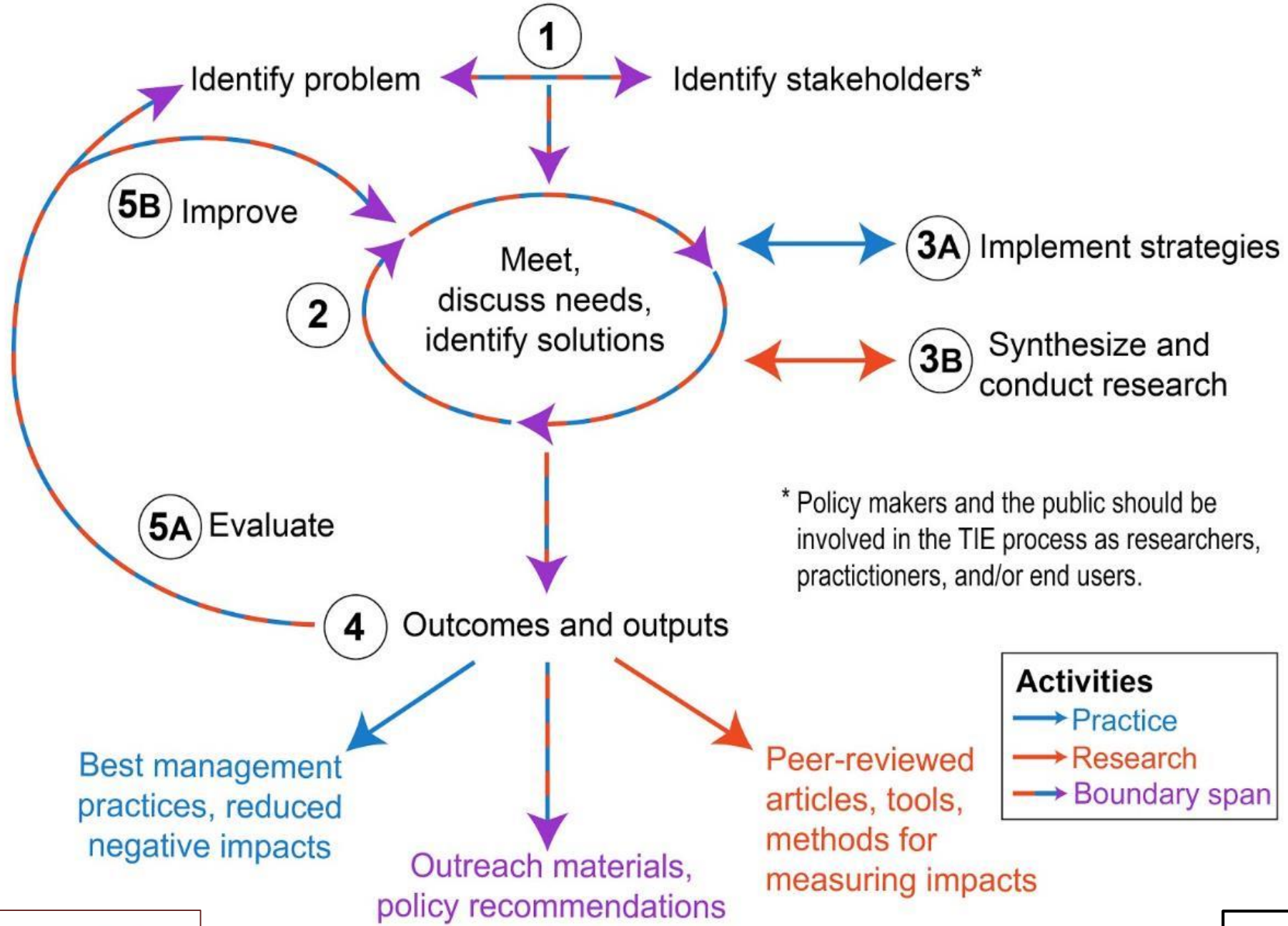


Enquist et al. 2017
Frontiers in Ecol. & the Environ.

Translational Ecology

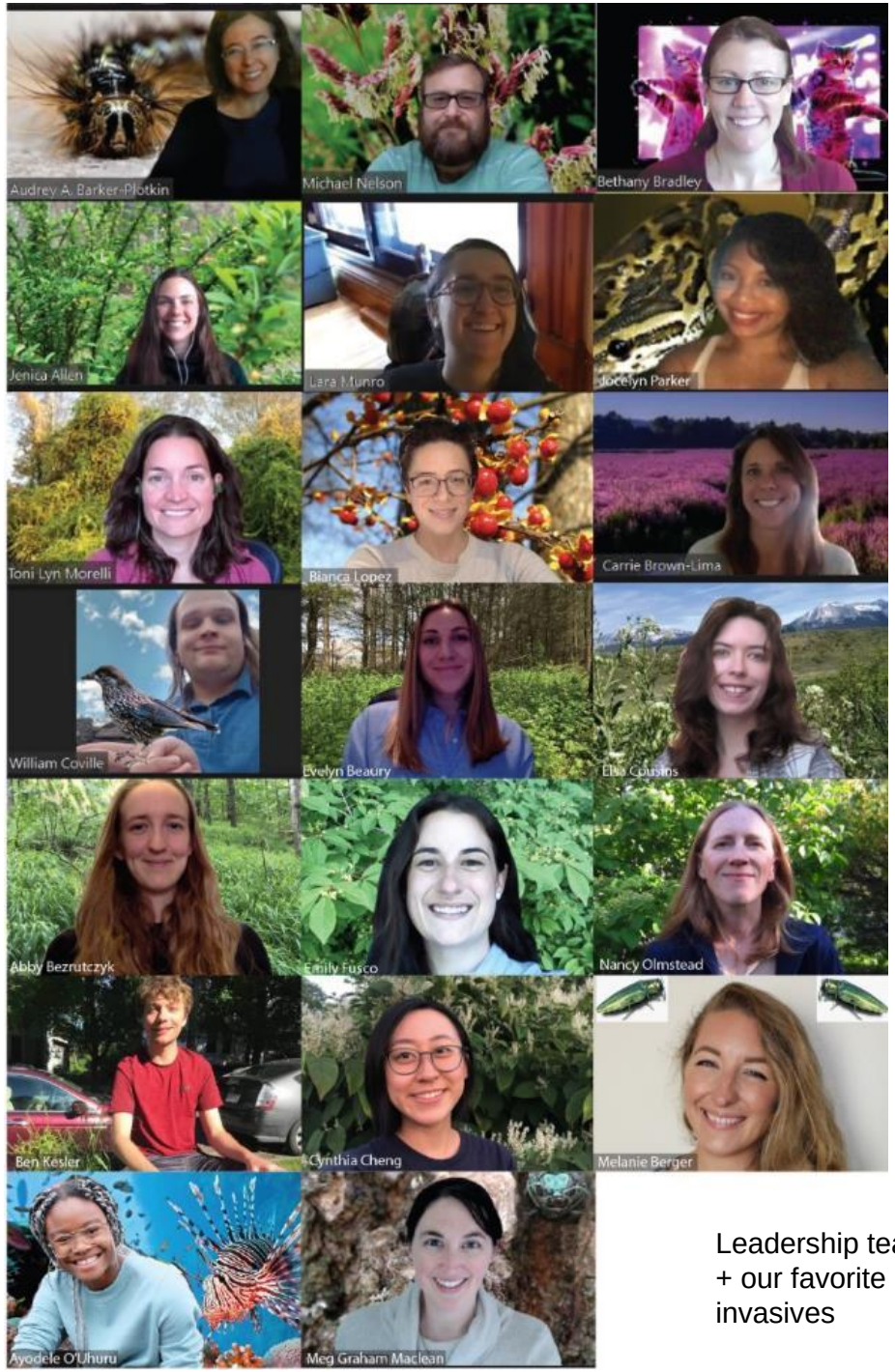


Enquist et al. 2017



Northeast RISCC Management Regional Invasive Species & Climate Change

Morelli et al 2021
Biological Invasions



Leadership team
+ our favorite
invasives

Northeast RISCC MANAGEMENT NETWORK

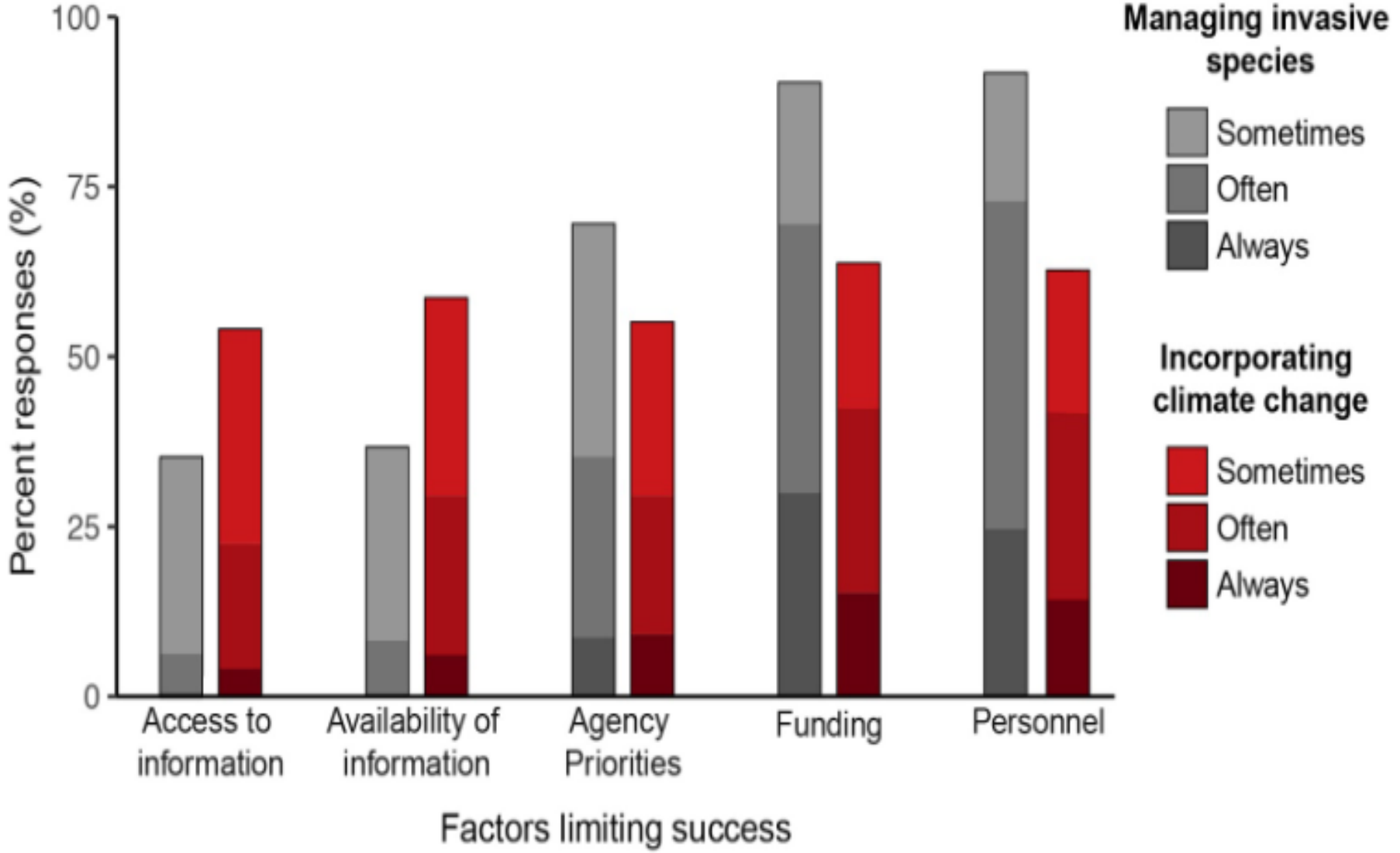
Founded in 2016

Mission Statement:

The Northeast Regional Invasive Species & Climate Change (RISCC) Management Network aims to reduce the compounding effects of invasive species and climate change by **synthesizing** relevant science, **sharing** the needs of managers to researchers, **building** stronger scientist-manager communities, and **conducting** priority **research**.

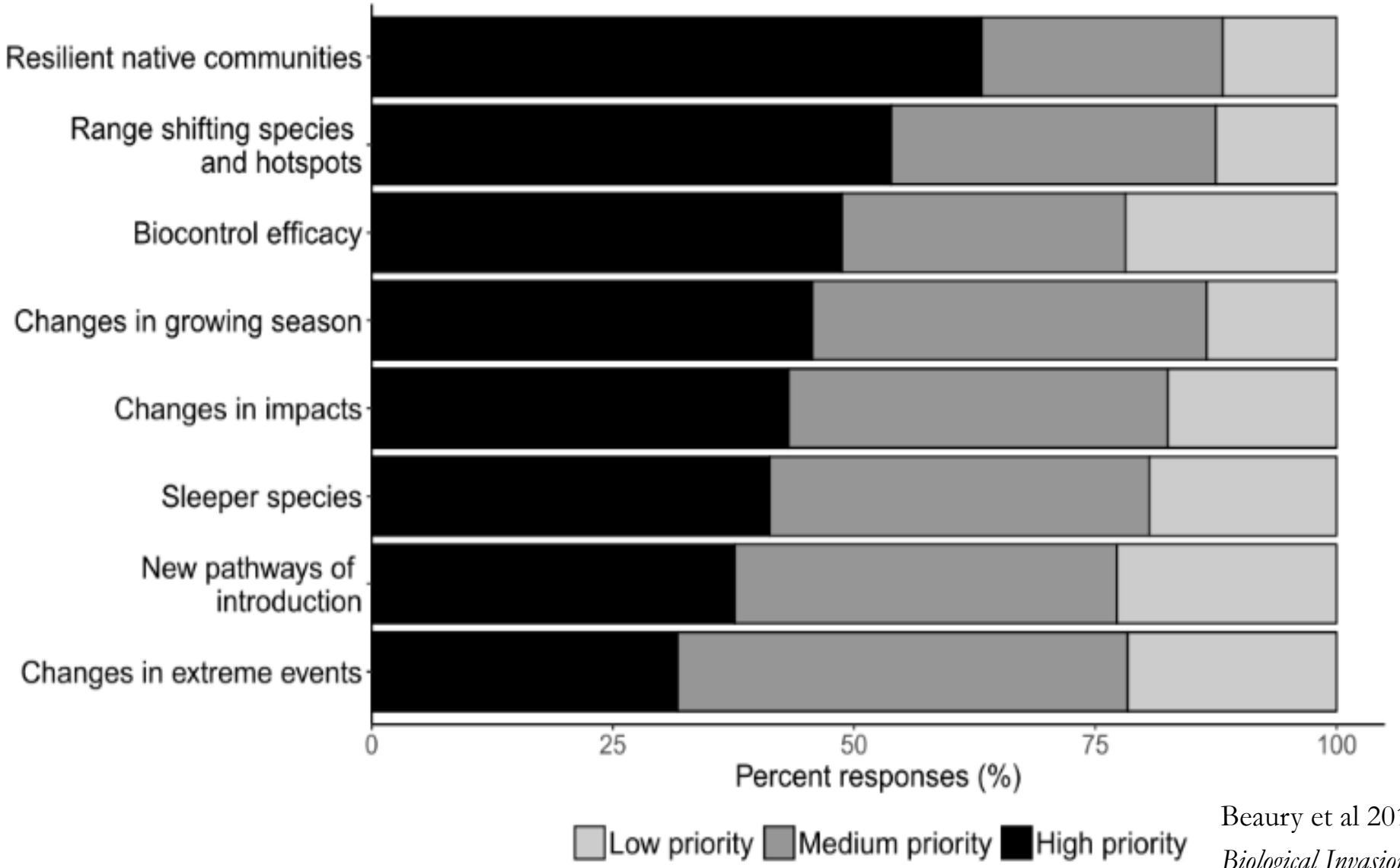
Foster and support a network of
>800 invasive species practitioners,
educators, and researchers

Lack of information is a barrier to including climate change in management actions



Understanding manager needs

Research priorities



Beaury et al 2019
Biological Invasions

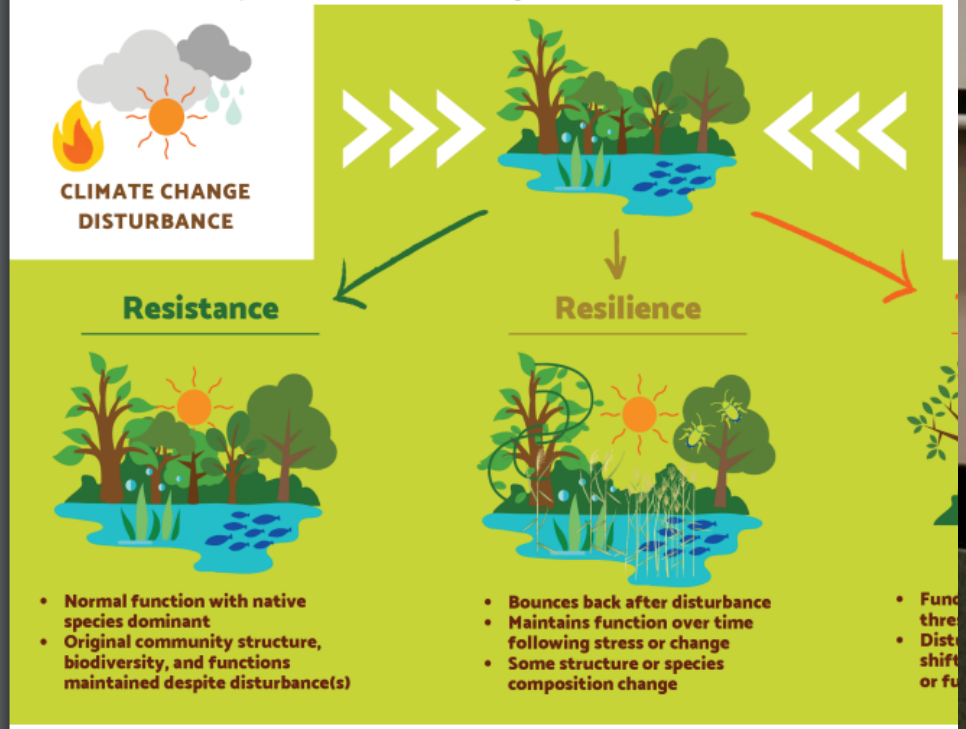
Embracing the Future:
Promoting adaptation and resilienc
to invasive species and climate chan

Summary

Climate change and invasive species can interact to increase disturbances and magnit
form and function (Double Trouble). Increasing resilience is one of several management
healthy ecosystems to persist despite these changes. While resilience can be com
forms, it can generally be thought of as the "ability [of an ecosystem] to experience distu
change without changing to a fundamentally different state" [Holling, 1973].

The accumulating effects of climate change, invasive species, or interacting effects of r
push an ecosystem past a tipping point and into a new ecological state. These
characterized by a different suite of species or functions, which are difficult or imp
(e.g. a shift from a closed-canopy to an open-canopy forested wetland). Actions to in
ecosystem to maintain or return to its fundamental structure or function after a disturbance

Resilience falls in the middle of a spectrum of management goals ranging from prever
to promoting change (transformation) in the species composition, structure, or fu
ecosystem. Clear management goals (See Table) and an understanding of the range of di
ecosystems are necessary for deciding between managing for resistance, resilience
what actions are required for successful management outcomes.



Authors: Bianca Lopez, Carrie Brown-Lima, Justin Dalaba, Annette Evans, Meghan Graham M

Regional Invasiv
Managemer

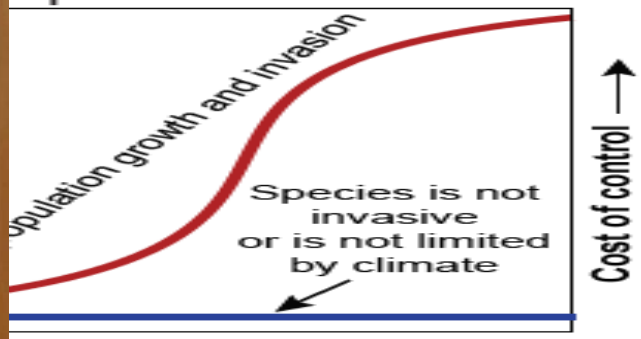
paring for sleeper spe
e could awaken some natu

ecies never become invasive and generally are not p
nate change could enhance the success of these sp
reassess the current pool of naturalized species to id

ecies?

in a region, potentially invasive, but not yet invasive
ralized species remain at low abundance and will ne
limate conditions. Climate change could create newly
enabling them to 'awaken' and resulting in rapid popu

eper to invasive



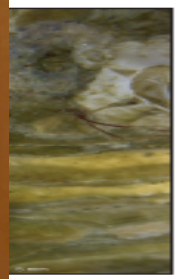
Non-native: A s
without human as

Naturalized: A n
populations but th
tive impacts.

Invasive: A non-
and is spreading
ecologic impacts.

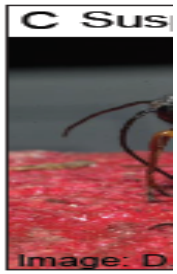
Climate change
precipitation, etc.
increase atmosph

species



B Suspected sleeper

C Susp



modestus), a cold-intolerant species first introduced a
s later after a series of mild winters. **B)** Mayweed cham
ntury ago. Its ability to respond quickly to climate chang
zed to invasive. **C)** First discovered in New York in 200
Increasingly frequent disturbance events due to clir

Science on Range Shifters

nature climate change

Review Article | Published: 30 April 2020

Adjusting the lens of invasion biology to focus on the impacts of climate-driven range shifts

Piper D. Wallingford, Toni Lyn Morelli ✉, Jenica M. Allen, Evelyn M. Beaury, Dana M. Blumenthal, Bethany A. Bradley, Jeffrey S. Dukes, Regan Early, Emily J. Fusco, Deborah E. Goldberg, Inés Ibáñez, Brittany B. Laginhas, Montserrat Vilà & Cascade J. B. Sorte

Nature Climate Change (2020) | Cite this article

Metrics

Abstract

As Earth's climate rapidly changes, species range shifts are considered key to species persistence. However, some range-shifting species will alter community structure and ecosystem processes. By adapting existing invasion risk assessment frameworks, we can identify characteristics shared with high-impact introductions and thus predict

Northeast RISCC Management

Regional Invasive Species & Climate Change

Management Challenge

Nuisance Neonatives

Guidelines for Assessing Range-Shifting Species

Summary

Many North American native species will shift their ranges northward and upslope to keep pace with climate change. However, this may cause some range-shifting species to behave like invasives in their expanded range. We provide a framework to identify the likelihood that an incoming range-shifting species will become problematic and offer suggestions to minimize impacts from range-shifting species to the existing native ecosystem.

What are nuisance neonatives?

Neonatives are a type of range-shifting species that have established beyond their historical range. Unlike invasive species, neonatives disperse into new areas unassisted by humans. However, like invasive species, neonatives are expanding into novel environments at an accelerated rate due to human-induced climate change (see Figure 1 for an example of a range-shifting species). The impacts of their movement to a new, recipient community can vary from minimal to massive (e.g., species extinctions).

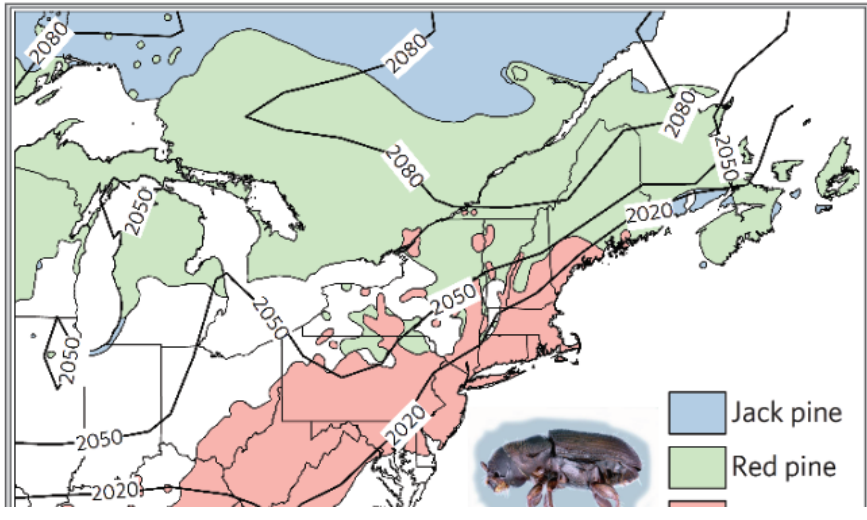
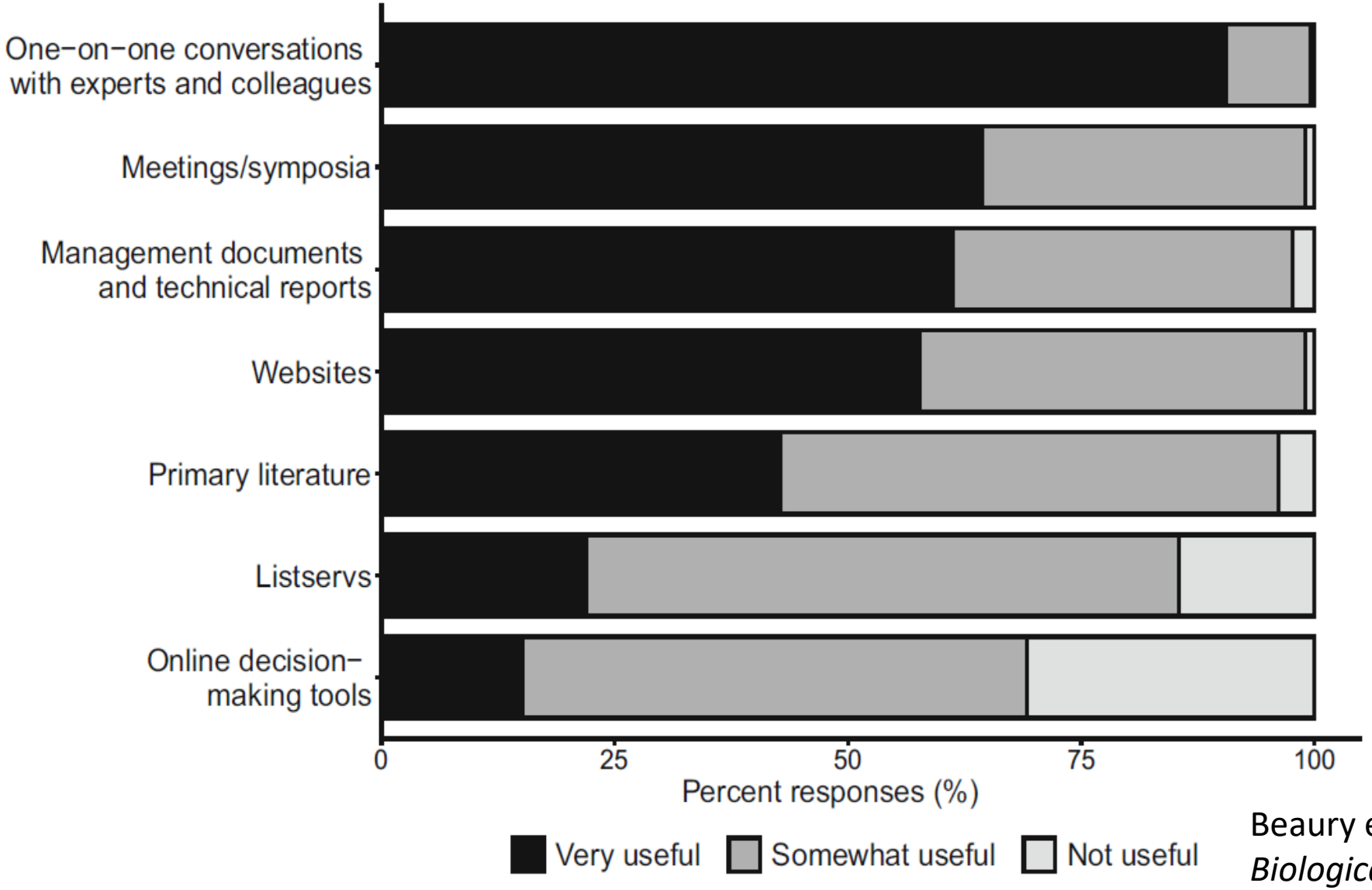


Figure 1. The southern pine beetle (SPB) is a forest pest native to the southeastern U.S. It is rapidly shifting north in response to warming, and is invading northeastern U.S. native forests with economic and ecological impacts. Black lines indicate projected year of arrival of SPB into vulnerable forest types.

Sources: Figure reprinted from

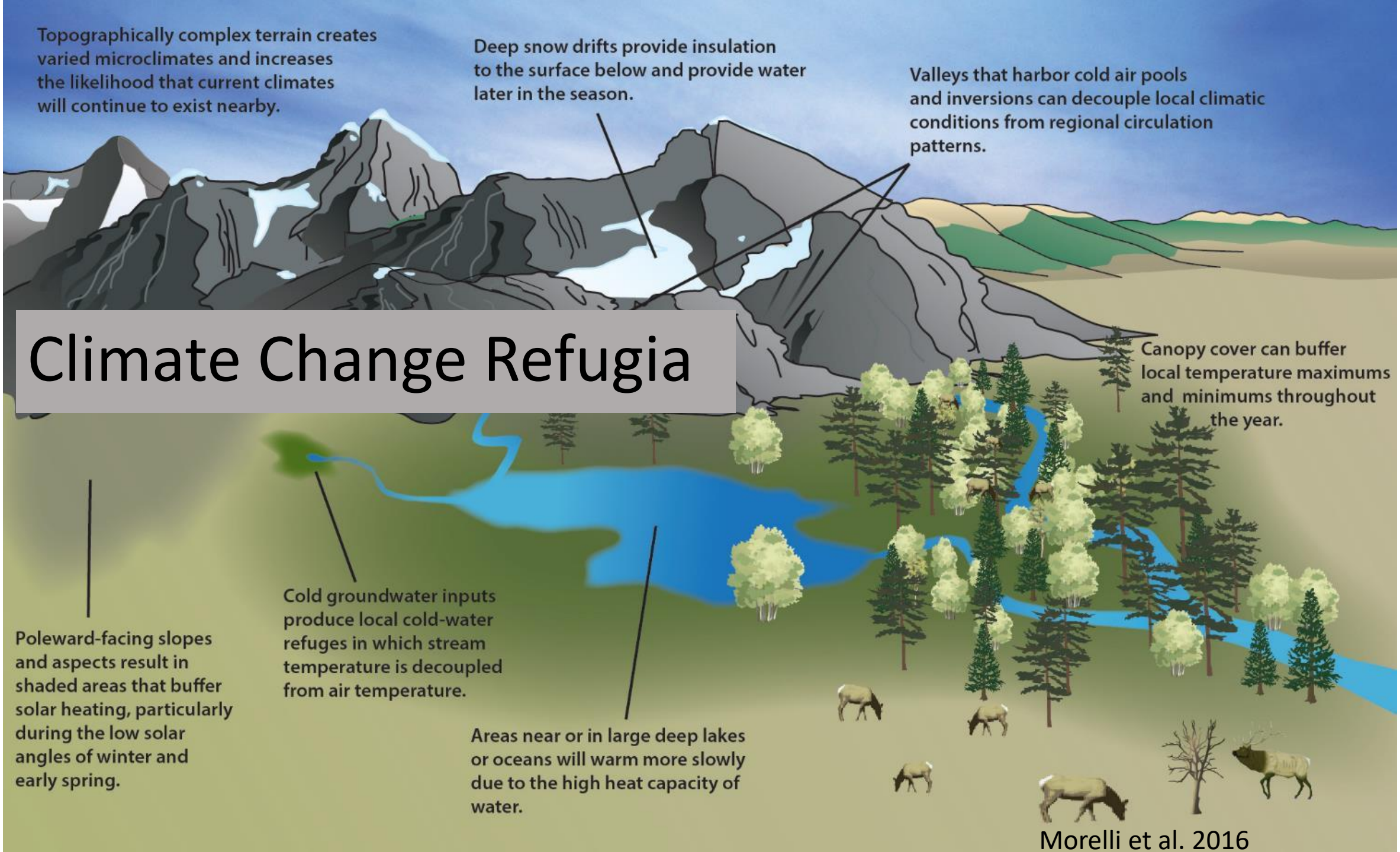
Understanding manager needs

Sources of information

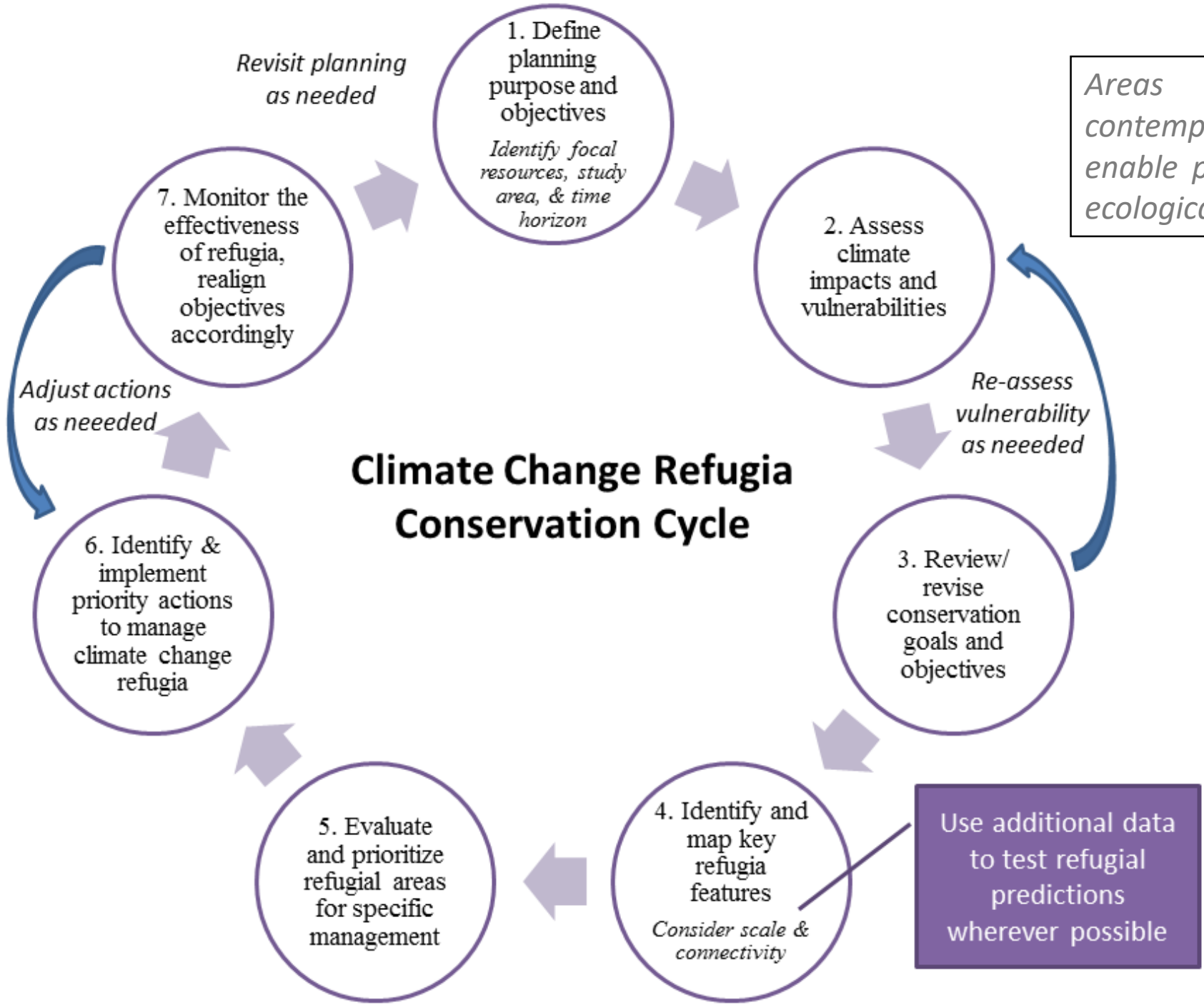


Beaury et al 2020
Biological Invasions

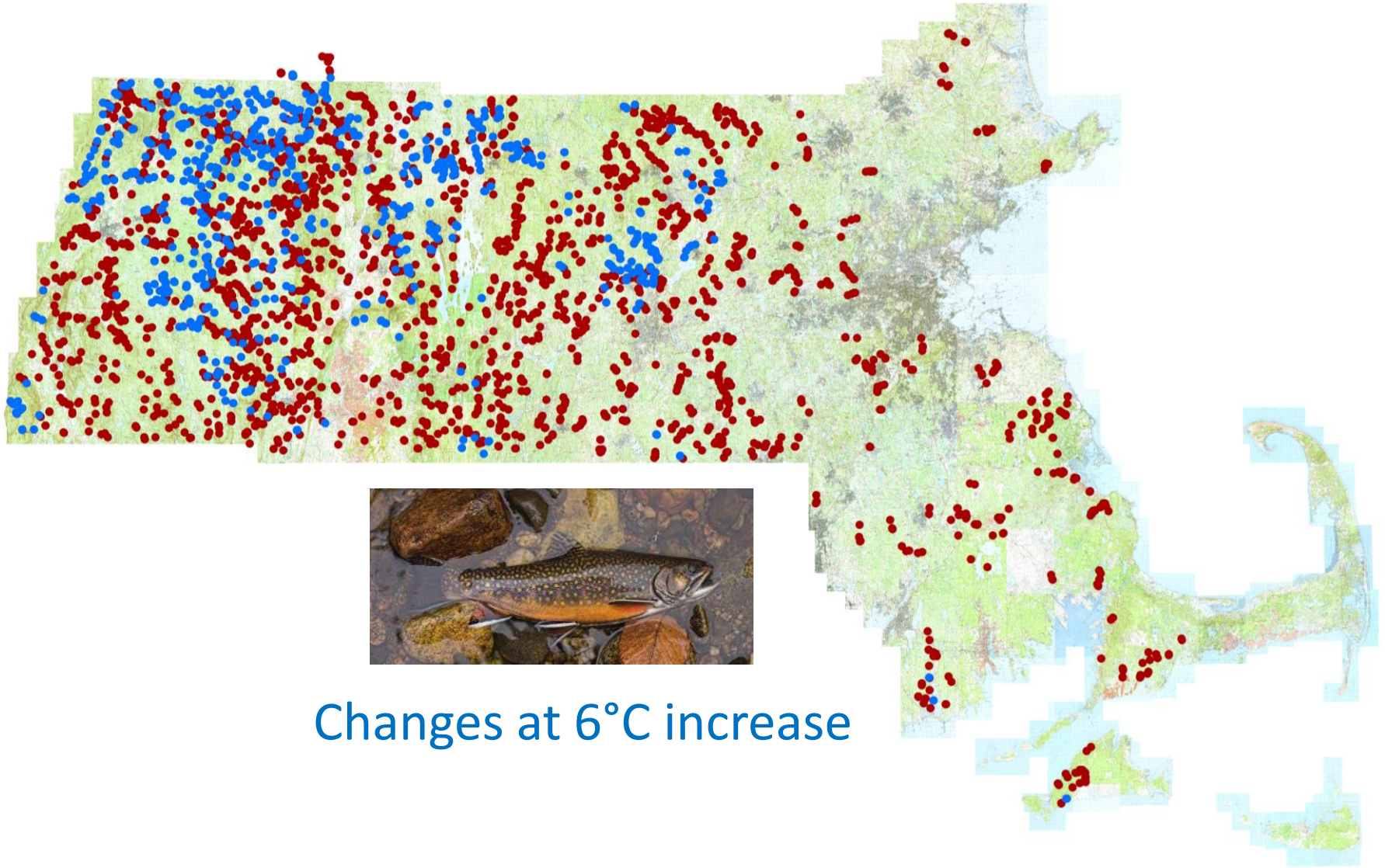
Climate Change Refugia



Morelli et al. 2016



Areas relatively buffered from contemporary climate change that enable persistence of valued physical, ecological, and socio-cultural resources



Changes at 6°C increase

Ebersole et al. 2020

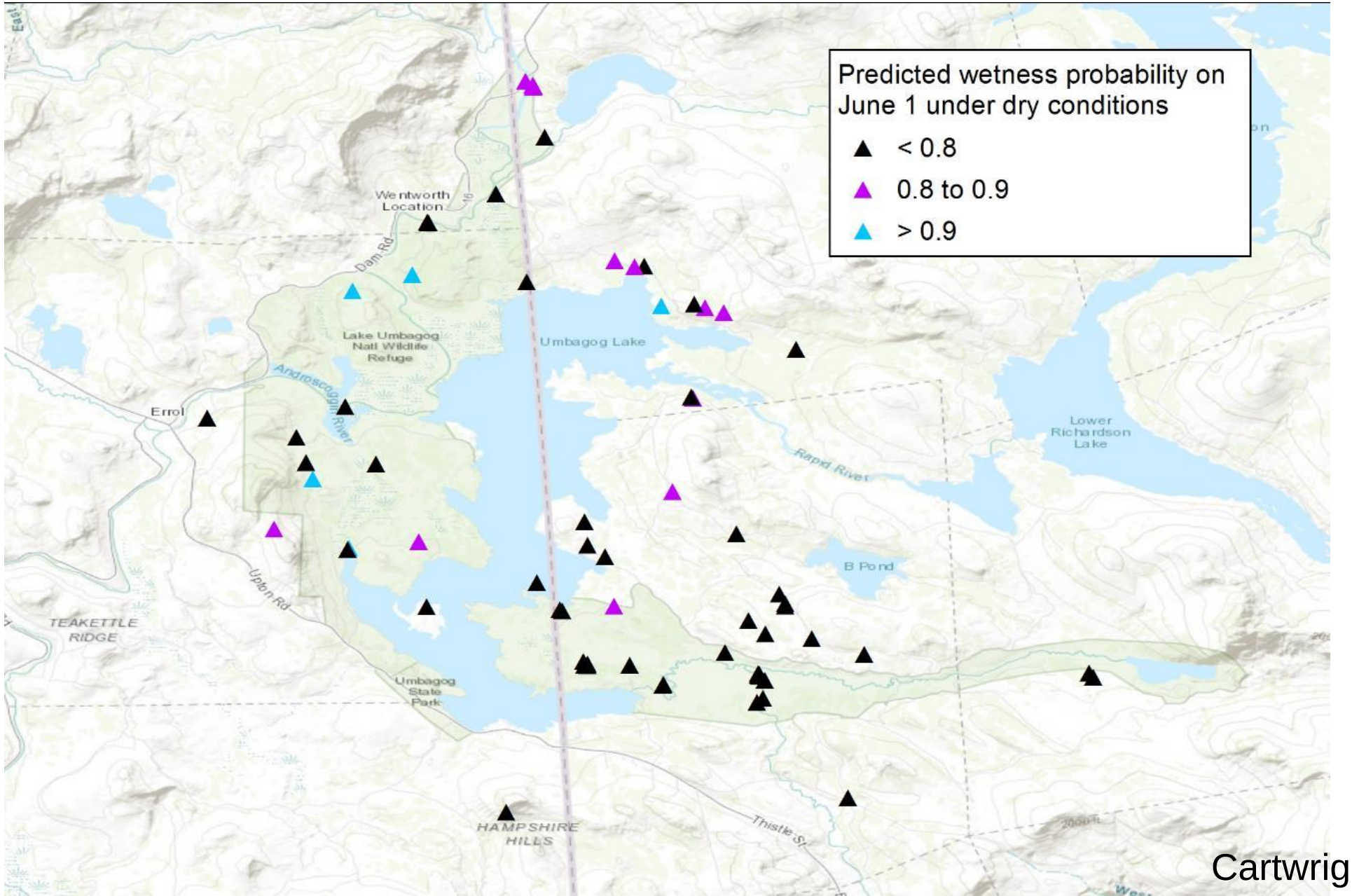
Frontiers in Ecology & the Environment

On-the-Ground Refugia Conservation

Management Category	Management tools
Land and watershed	Floodplain and riparian restoration and enhancement; Road and barrier removal or enhancement to manage hydrologic and biotic connectivity among stream segments and networks
Water quantity	Water storage, allocation, and release systems; conservation and efficiency measures
Water quality	Nutrient management frameworks
Fish and wildlife	Recreational fishery management (seasons, quotas, special management areas)

Ebersole et al. 2020
Frontiers in Ecology & the Environment

Hypothesized Vernal Pool Refugia



Cartwright et al. 2021

Prelim results show VPs are bigger, deeper, & wet longer w/ lower forest biomass. How could you use these results to inform VP conservation action?

Mentimeter

We are working to reduce deer density/ browse on several of our properties. We might deemphasize that where we have vernal pool clusters...

would help prioritize VPs that need protection/ conservationsince they should be less vulnerable to climate change

Suggest time to landscape and connectivity

Prioritize connectivity & target conservation

It might inform management around pools that host rare species that might benefit from longer hydroperiods. Otherwise, I don't think I would use this information to manage land around VPs because VP species vary in hydroperiod requirements.

Could try to identify larger and deeper VPs and make sure to protect these VPs across the landscape, esp. in areas with lower forest biomass

No use. People care about trees more than vernal pools. We aren·t going to purposefully reduce forest density to manage for pools

Helpful but forest cover is so critical for no period

Is low biomass a result of tree growth being limited water table....

Need to understand more on tree vs shrub biomass.

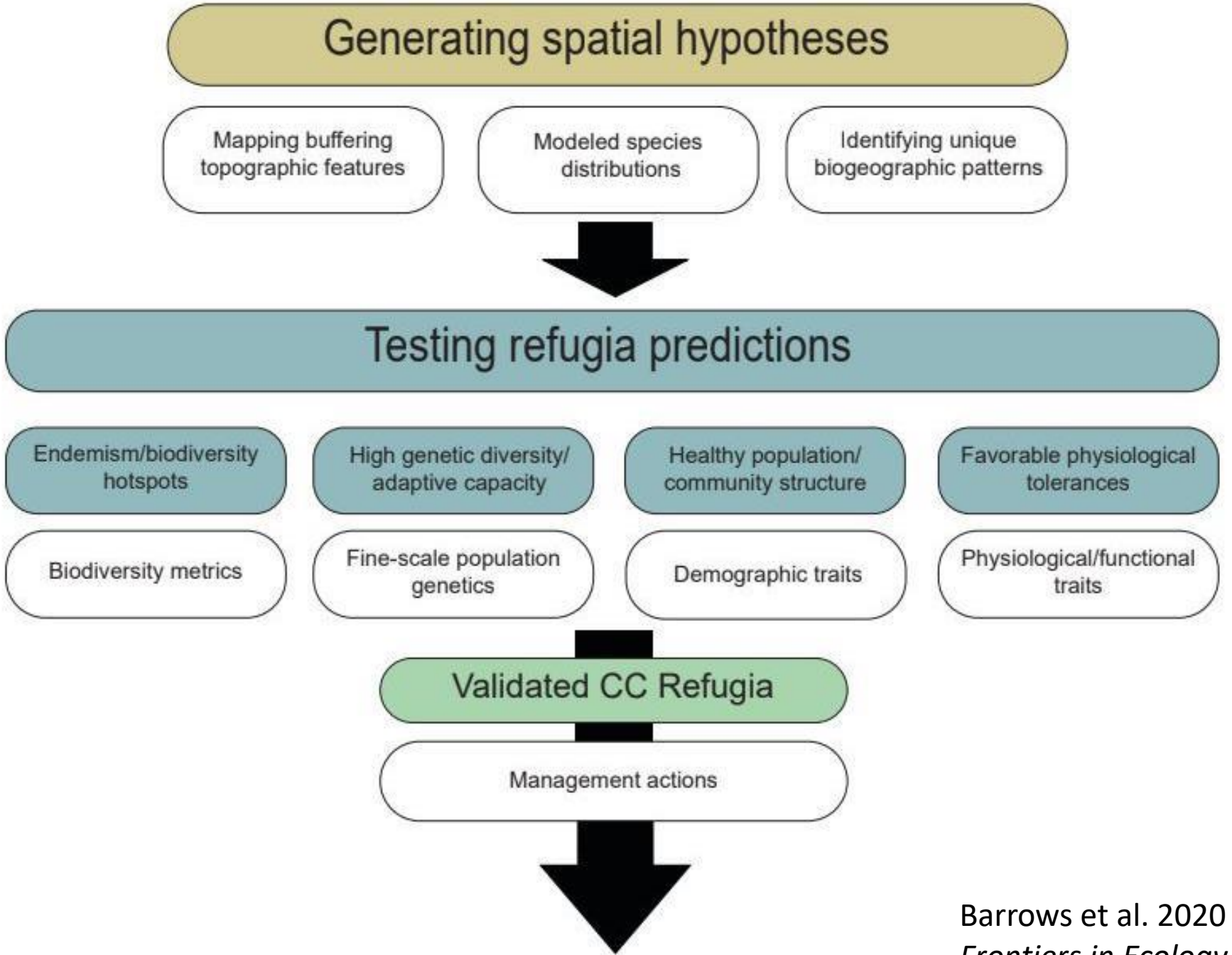
In discussions in my F&W organization, there was been reluctance to broadly protect vernal pools. This information would help us prioritize pools by their persistence and importance, which would be more palatable by our upper administn.

I am wondering the specifics of how this is calculated... a large vernal pool that hasno trees might be affecting the DSL biomass dataset

I wouldn't want to see this result used to justify thinning of forests important for amphibian habitat.

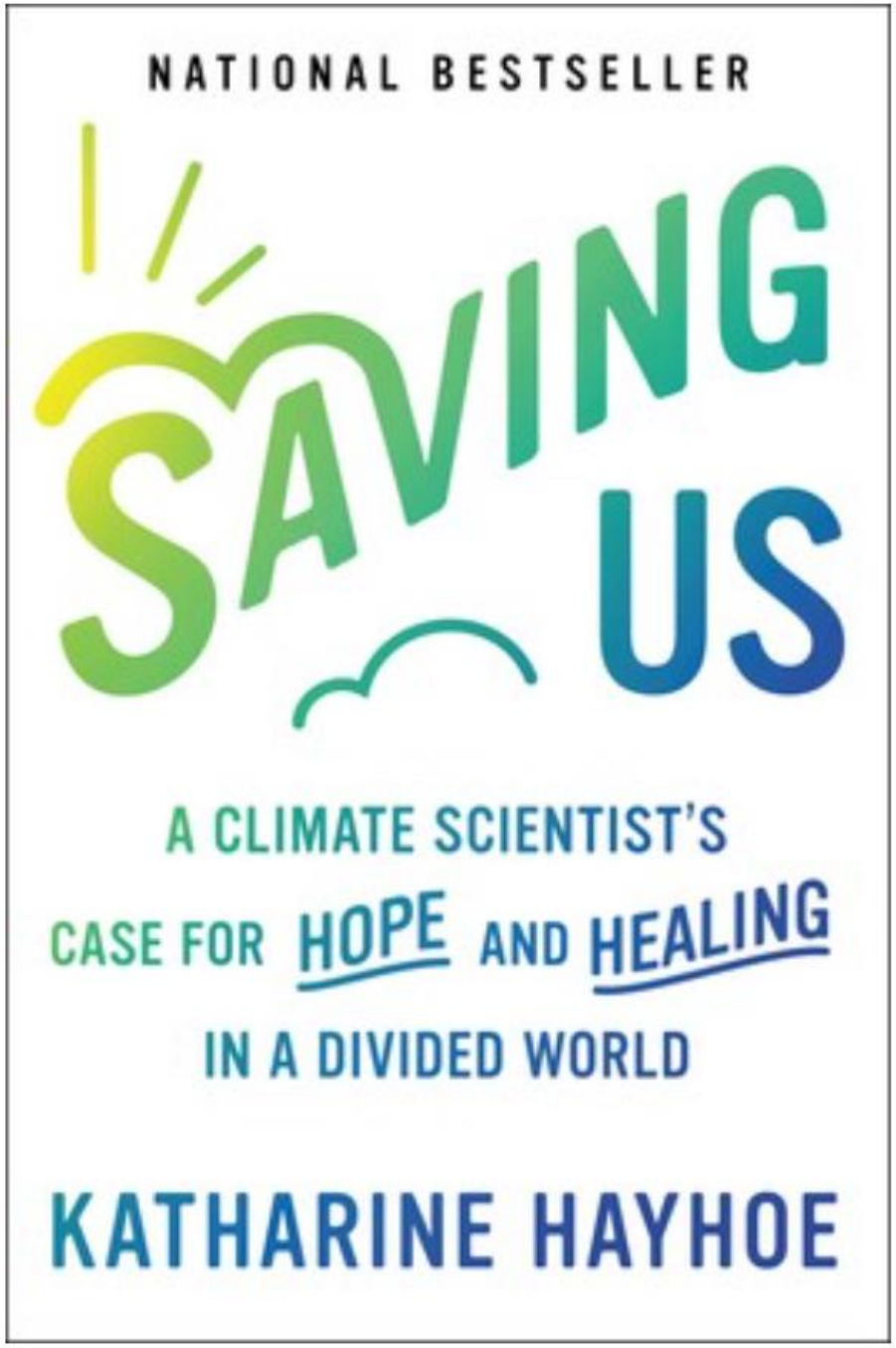
Stronger evidence for better protection of these (but considering need for vp network too).

Understand the attributes of pools that are currently VP refugia and then create VPs based on these attributes and the site characteristics that promote wetness

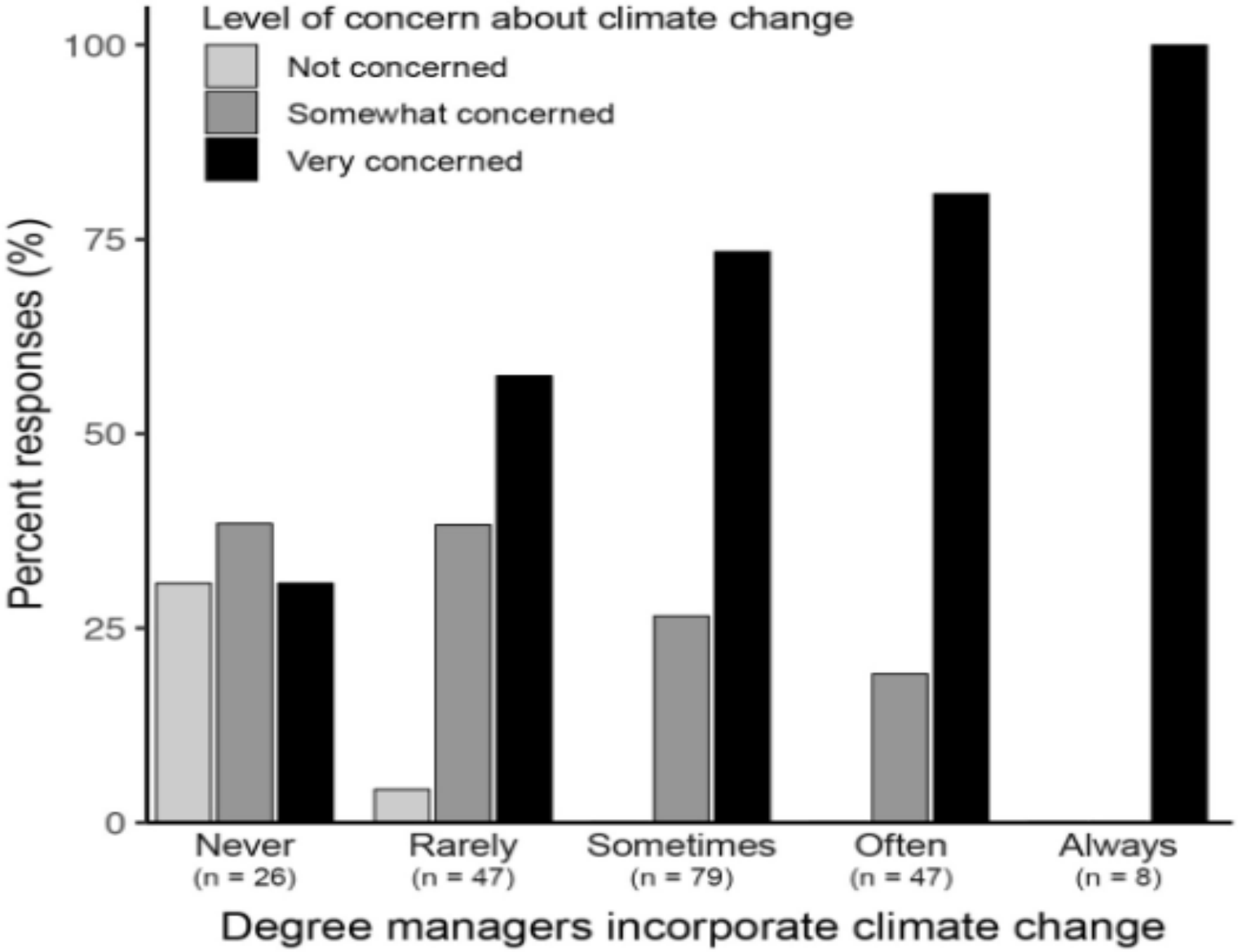


Barrows et al. 2020
Frontiers in Ecology & the Envt

Talk to Each Other

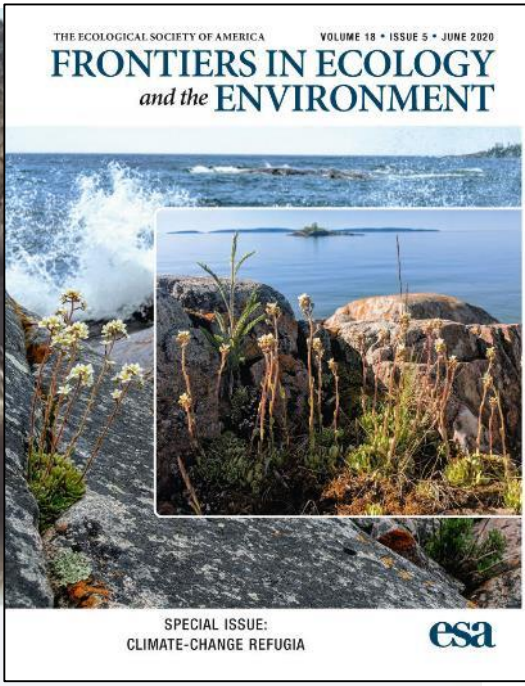


Concerned managers are taking action



Beaury et al 2019

Biological Invasions



Climaterefugia.org

CLIMATE CHANGE REFUGIA

Northeast RISCC MANAGEMENT NETWORK

HOME RESOURCES EVENTS ABOUT US OTHER RISCCS

risccnetwork.org

Northeast RISCC Network

It's time to mark your calendars - We're busy planning our next symposium that will take place virtually Feb 14-15t... https://t.co/FQj9hfBzw9

Nov 4, 2022, 10:00 AM

Northeast RISCC Network

RT @NY_ISRI: We recently

NEWS

- **Do Not Sell coffee talk recording - October 19** In this coffee talk, we discuss our latest management challenge **Do Not Sell! Ornamental Plants to Avoid with Climate Change**. Check out the recording here.
- **New Management Challenge - Do Not Sell! Ornamental Plants to Avoid with Climate Change.** This management challenge highlights a list of high-impact invasive plants that are commonly available as ornamentals and likely to expand into the Northeast with climate change. This resource aims to help you communicate the risks of invasion and climate change to nursery professionals.
- **Sleeper Species coffee talk recording - Sept 13** Ayodele O'Uhuru and the RISCC team discussed our management challenge: ***Are you Sleeping?*** View the recording here.
- **HWA & climate change talk recording - July 22** This pop-up discussion focused on current knowledge about hemlock woolly adelgid (HWA) interactions with climate change. View the recording here.