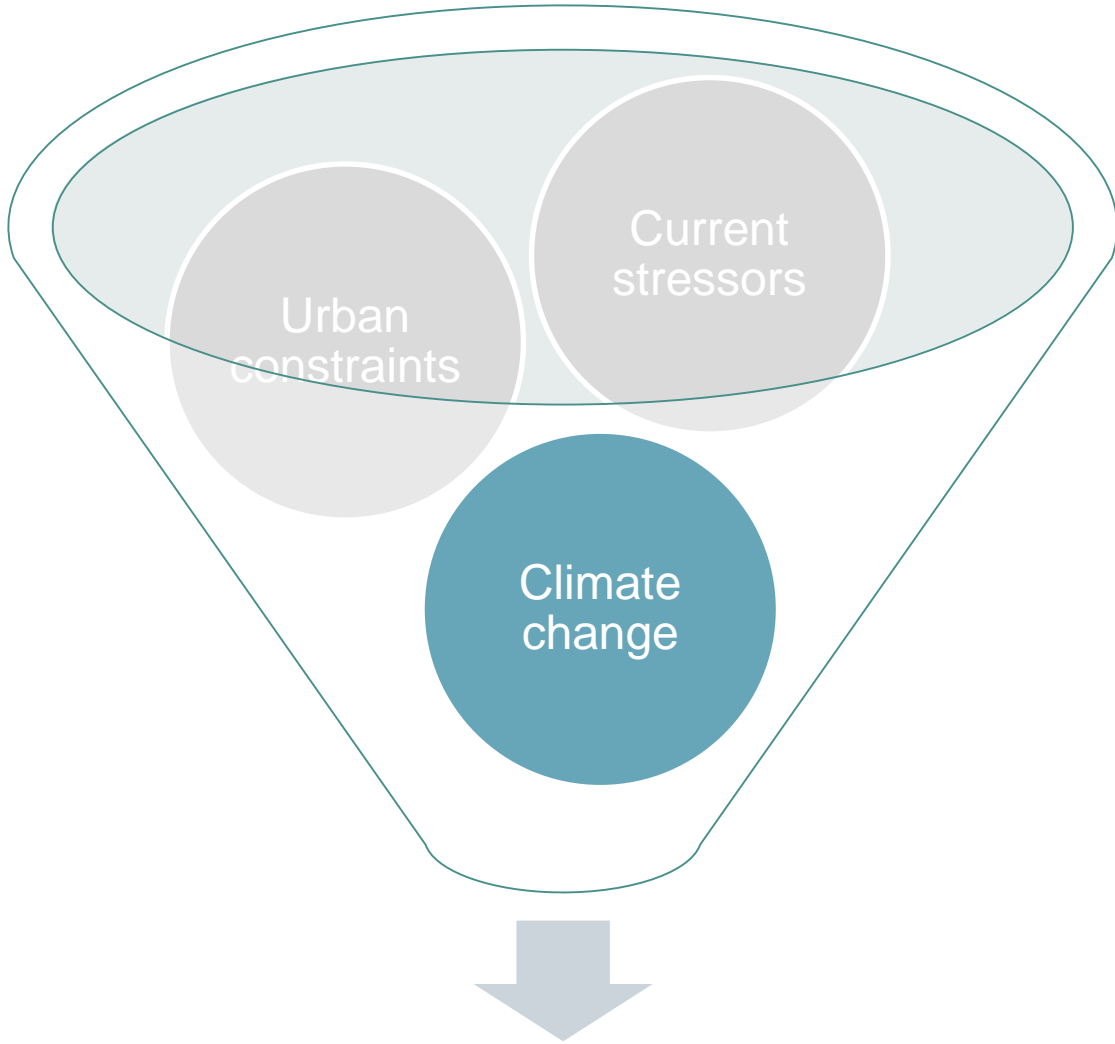


A FRAMEWORK FOR MANAGING OUR URBAN FORESTS IN A CHANGING CLIMATE

Leslie Brandt





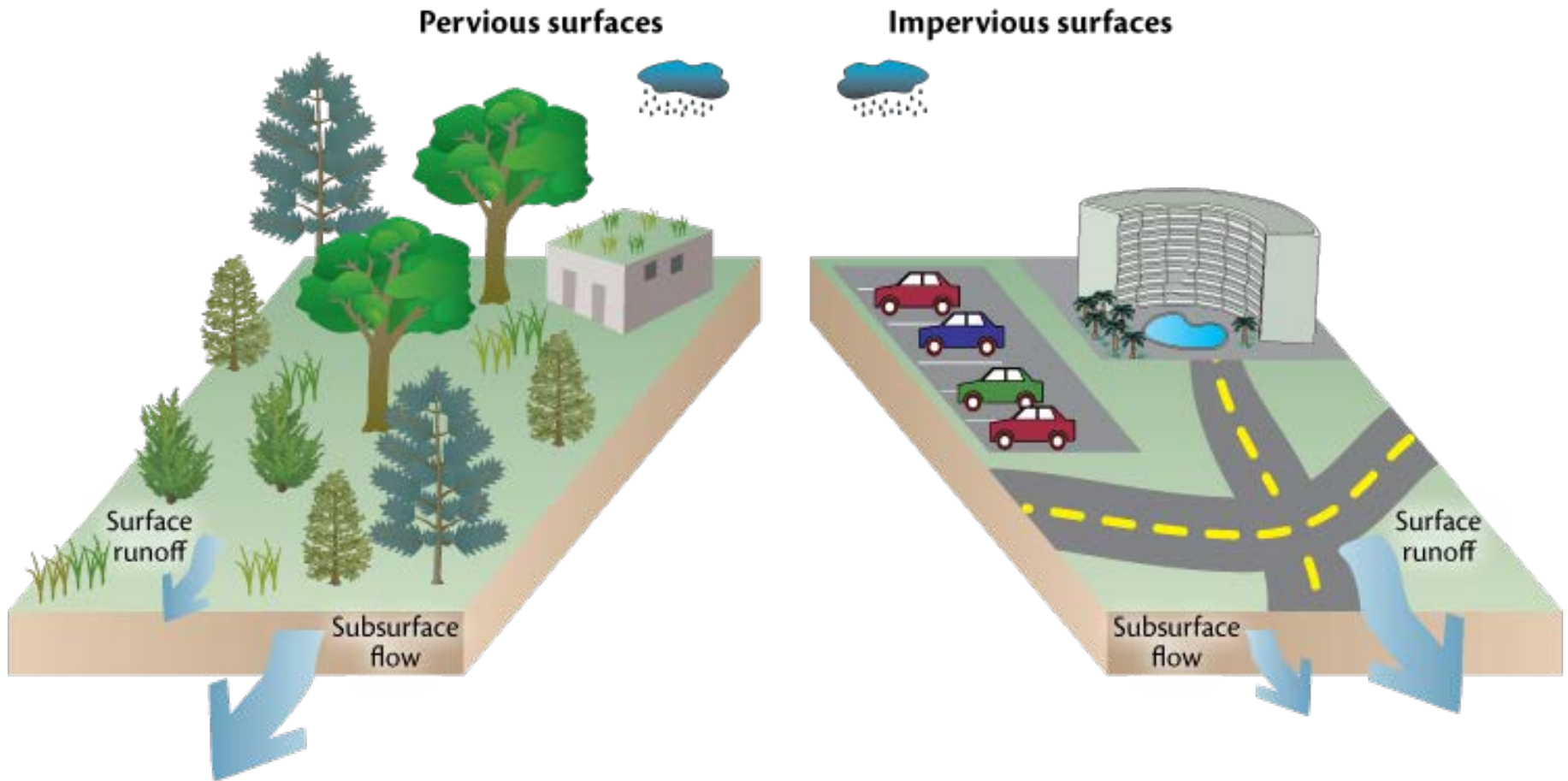
Vulnerable Urban Forests



POLLUTION



STORMWATER RUNOFF



STORM DAMAGE





PEST, DISEASE OUTBREAKS



Northern Institute of Applied Climate Science

Climate

Carbon

Bioenergy

NIACS is a regional multi-institutional partnership

Forest Service

- Northern Research Station
- Eastern Region
- Northeastern Area S&PF

Non-FS partners

- Michigan Technological University
- University of Minnesota
- National Council for Air & Stream Improvement
- Trust for Public Land



www.nrs.fs.fed.us/niacs



MichiganTech ncasi

UNIVERSITY OF MINNESOTA

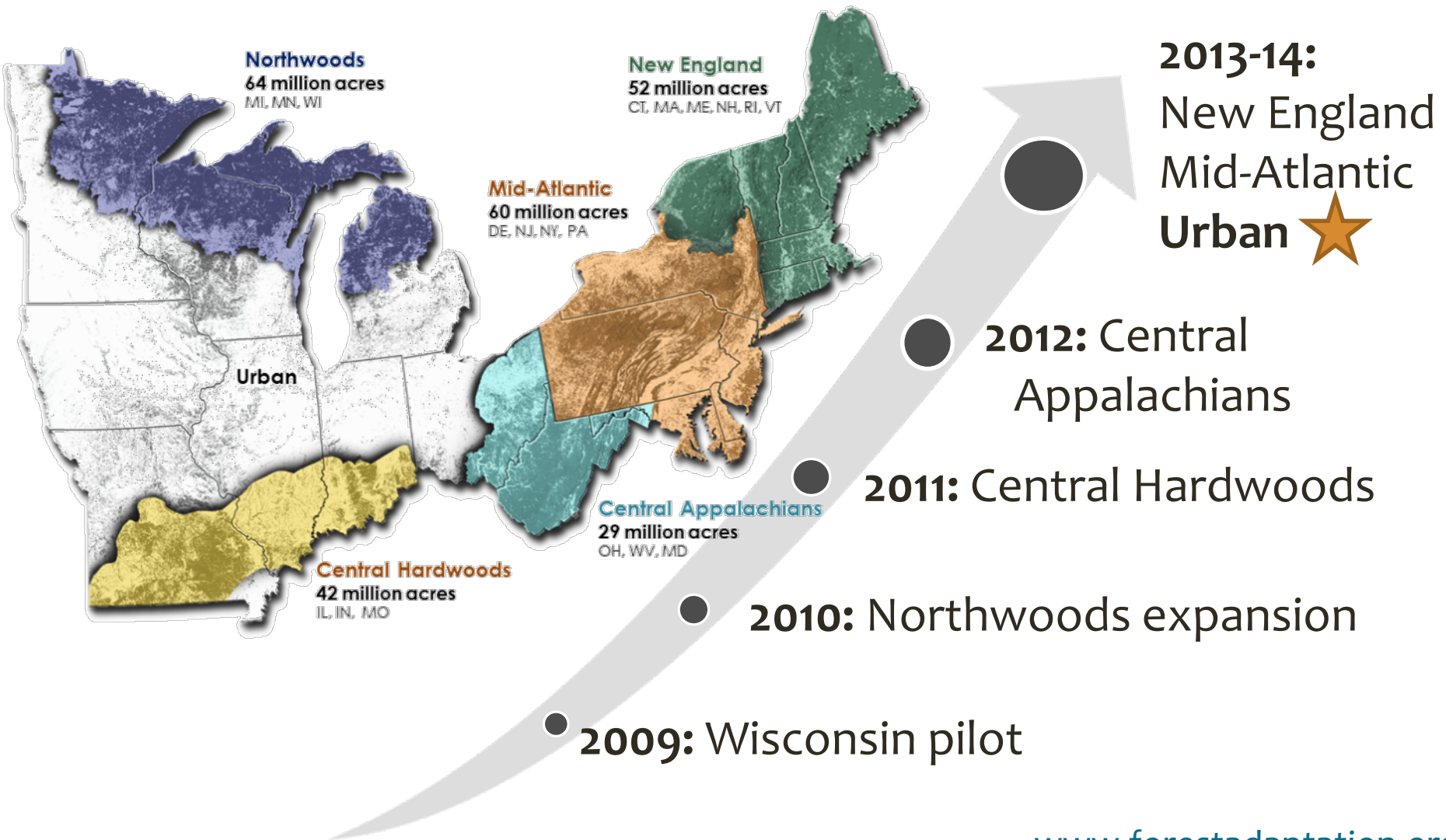




What does NIACS do?

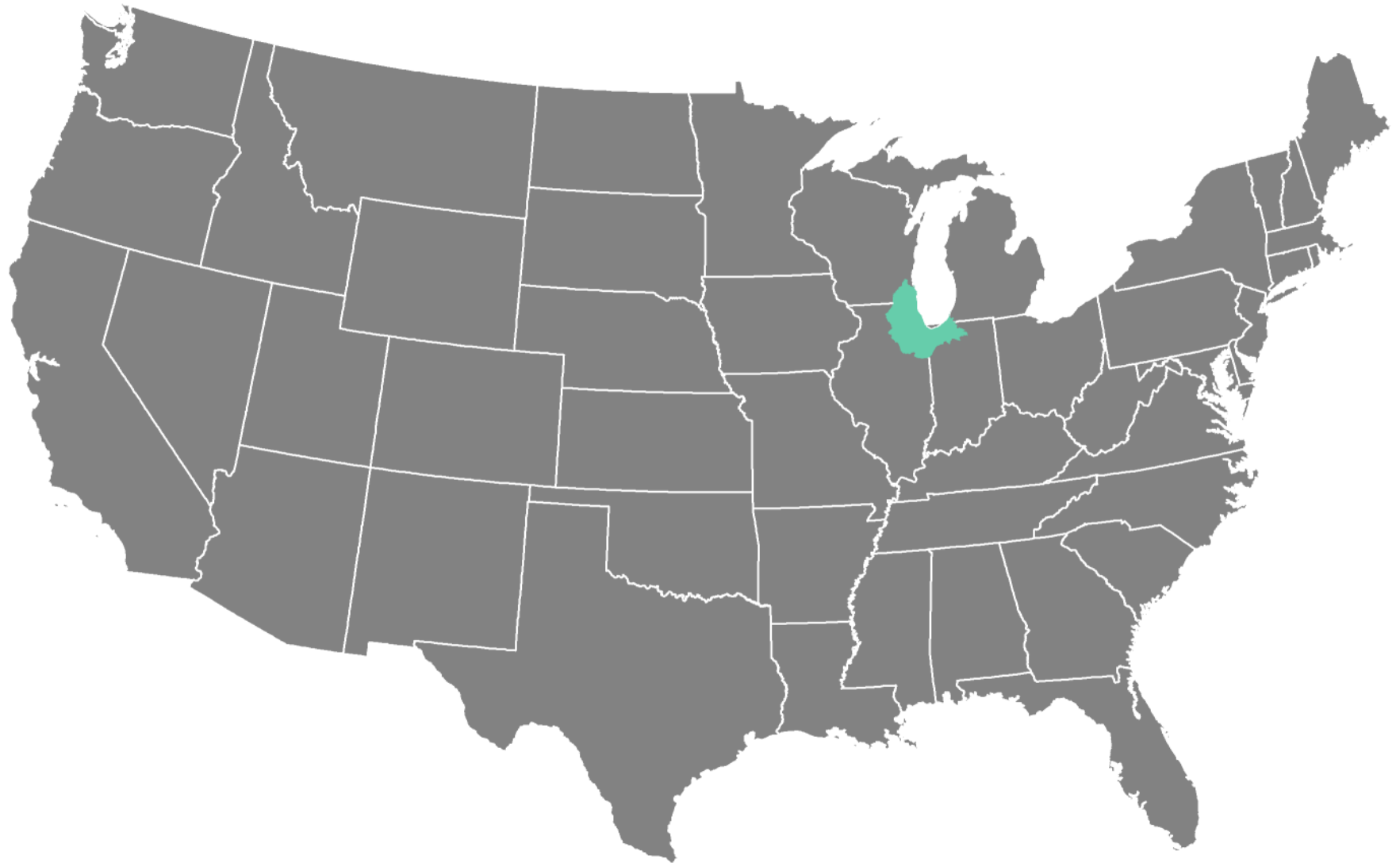
- Provides practical information, resources, and technical assistance related to forests and climate change
- Supports the integration of climate change information into natural resource management

CLIMATE CHANGE RESPONSE FRAMEWORK





PILOT URBAN AREA: CHICAGO WILDERNESS



KEY PARTNERS

- Chicago Region Trees Initiative
- Chicago Wilderness
 - Climate Change Task Force
 - Trees and Green Infrastructure Task Force
- US Forest Service
 - Northern Research Station
 - Eastern Region
 - Northeastern Area
- Northern Institute of Applied Climate Science
- The Morton Arboretum
- The Field Museum
- Chicago Botanic Garden

Chicago
Wilderness

A regional alliance dedicated to
protecting nature and enriching life



CHICAGO
REGION
TREES
INITIATIVE

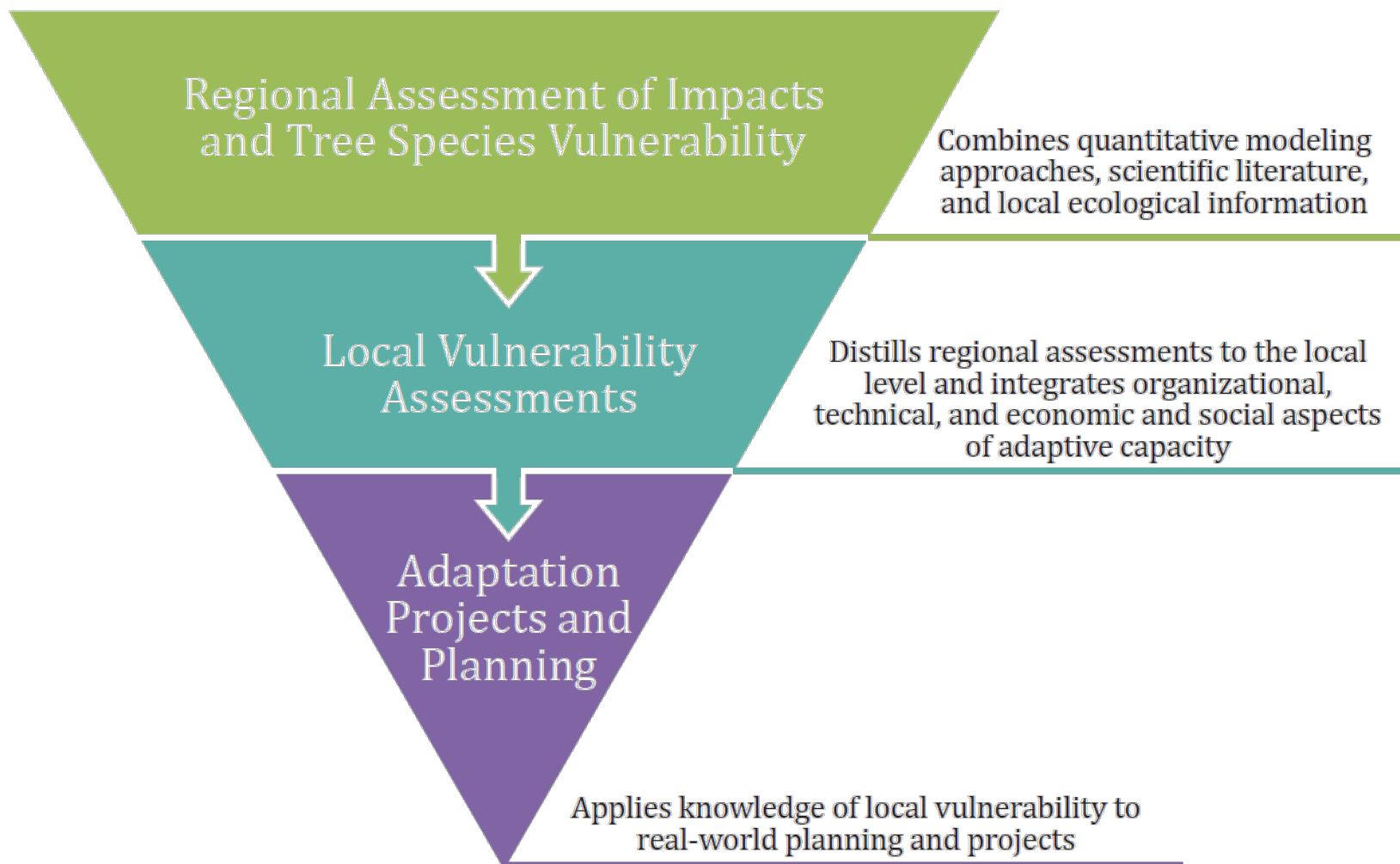
Our Trees.
Our Communities.
Our Future.



The Morton
Arboretum

The Field
Museum

URBAN FRAMEWORK APPROACH

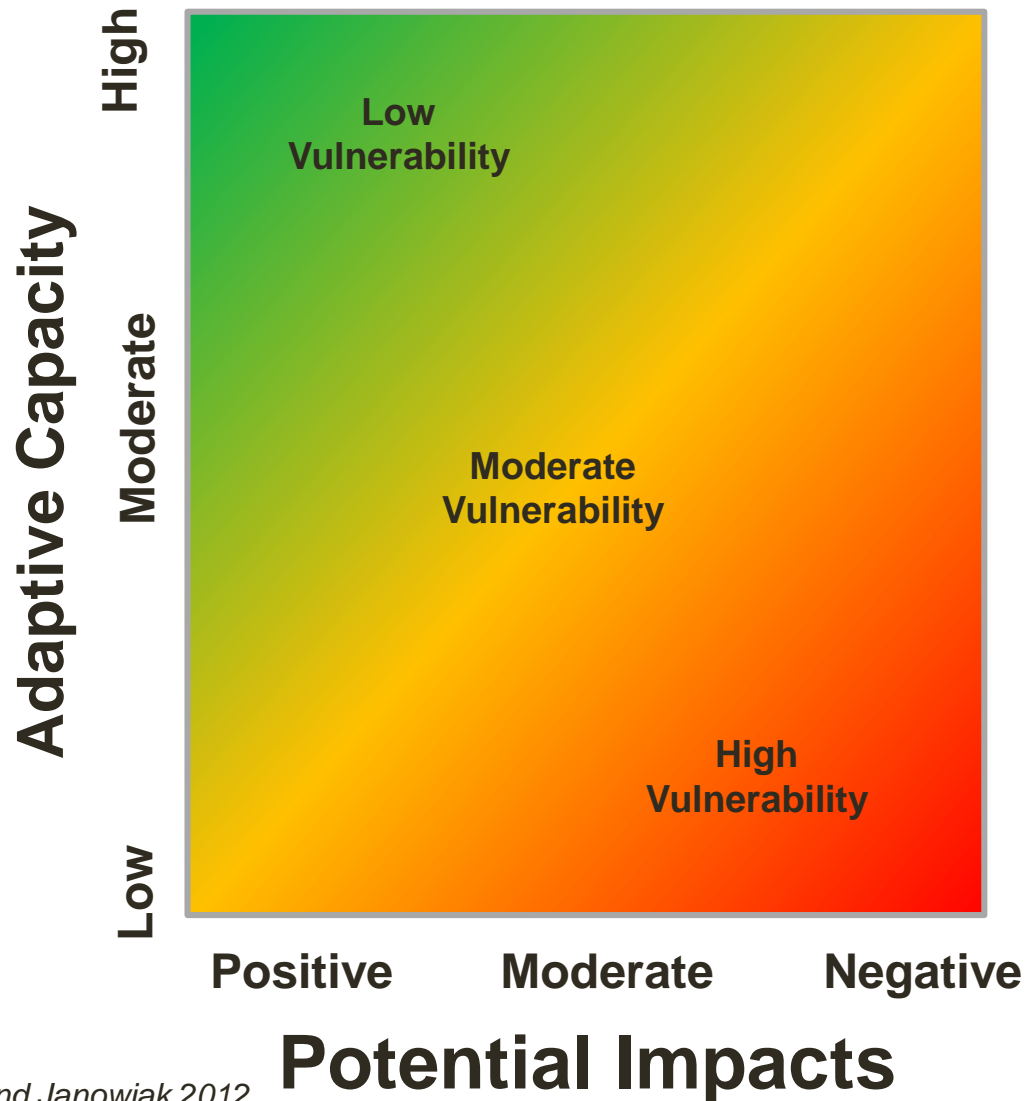


URBAN FRAMEWORK APPROACH

Regional Assessment of Impacts
and Tree Species Vulnerability

Combines quantitative modeling
approaches, scientific literature,
and local ecological information

VULNERABILITY



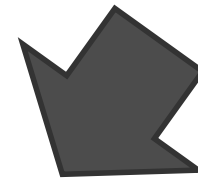
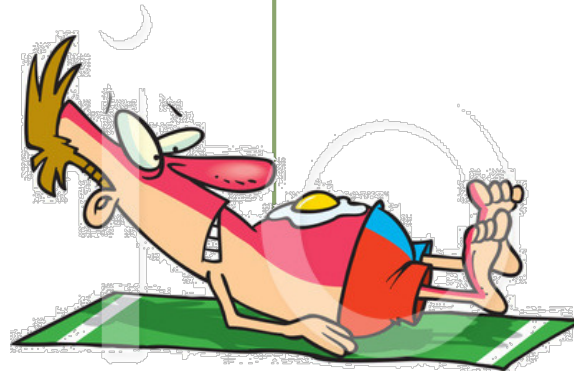
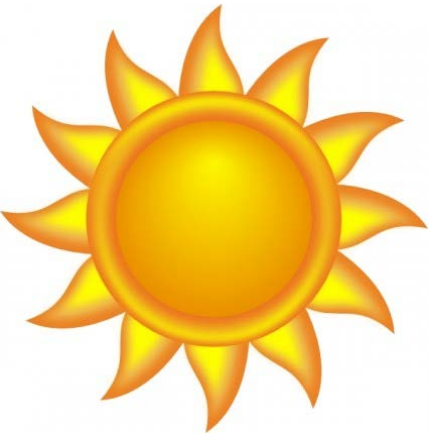
VULNERABILITY EXAMPLE: SUNBURN

Impacts

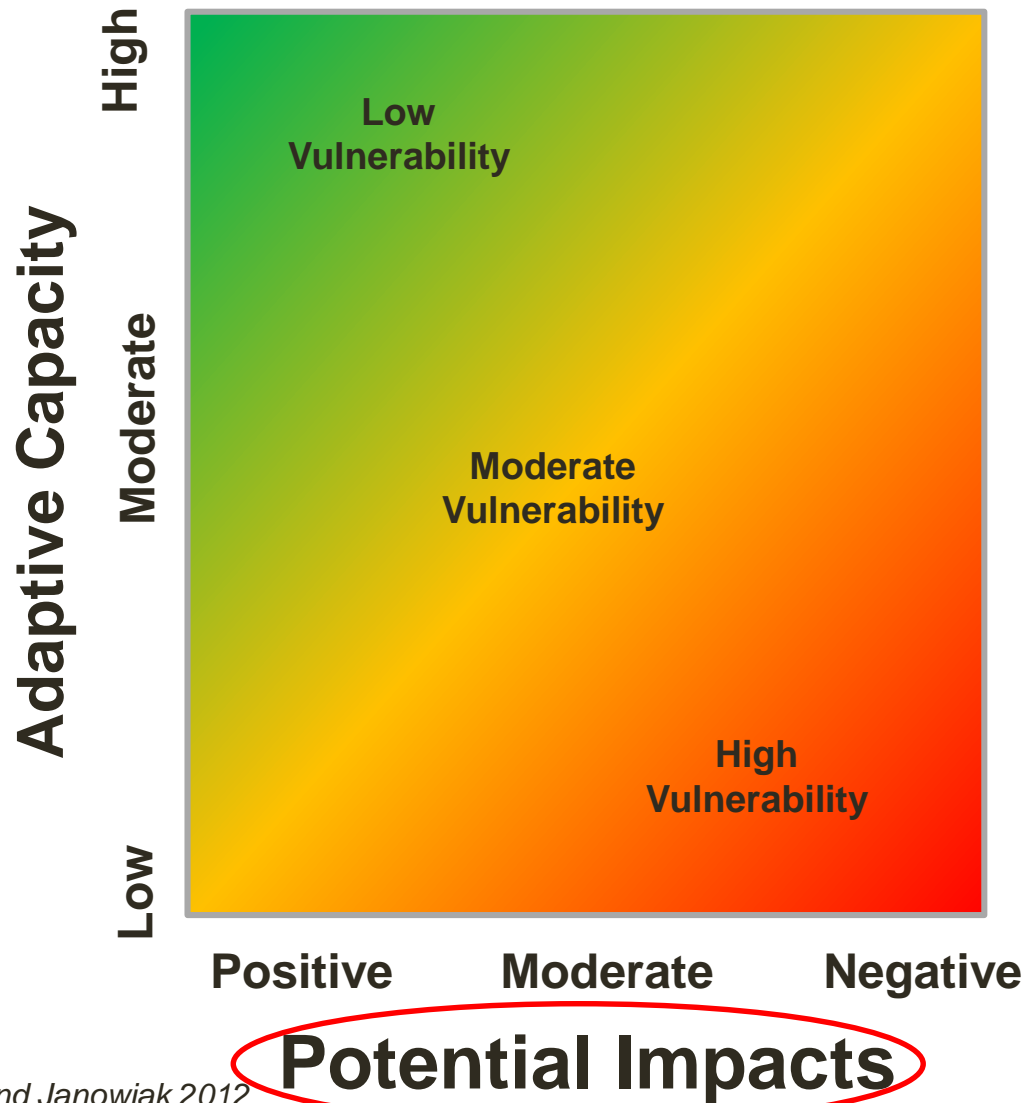
Adaptive Capacity

Exposure

Sensitivity



VULNERABILITY



IMPACTS

Tree Species Habitat Suitability Models

USDA United States Department of Agriculture Forest Service Northern Research Station

You are here: Northern Research Station Home / Tools & Applications / Climate Change Atlas

Climate Change Atlas

Explore the Climate Change Tree Atlas

Explore the potential habitat shifts for 134 tree species

Search for Trees & Birds:
Enter a common or scientific name
[List of Trees](#) | [List of Birds](#)

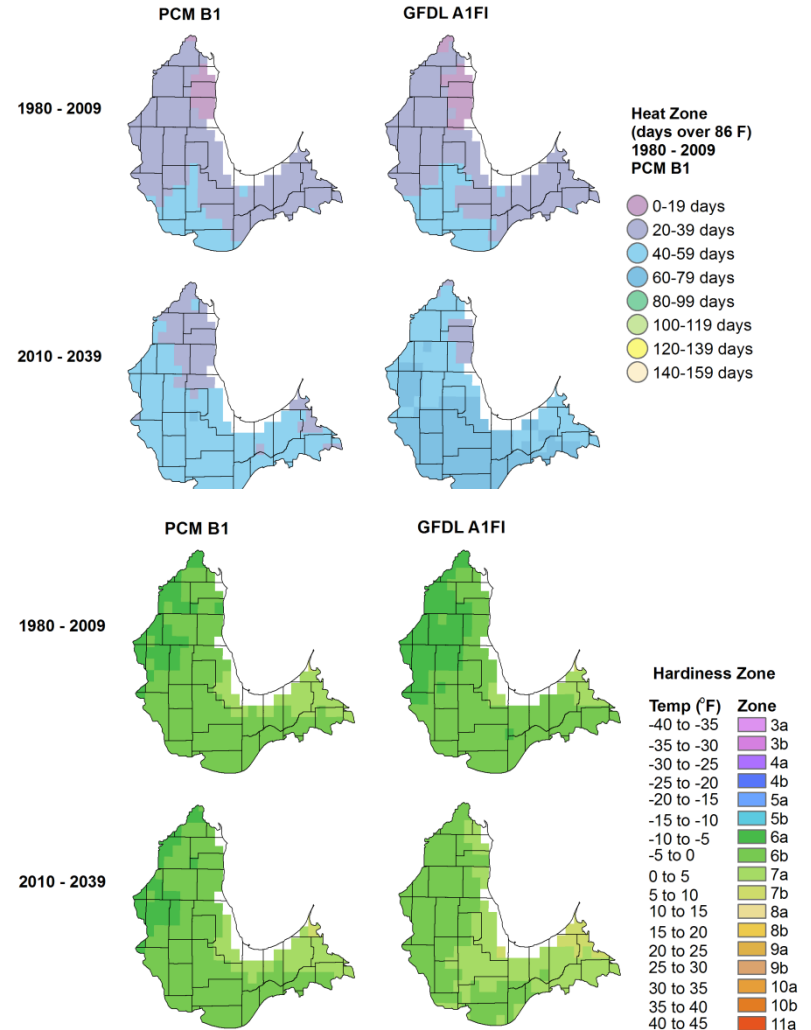
About the Climate Change Atlas
The Climate Change Atlas documents the current and possible future distribution of **134 tree species** and **147 bird species** in the Eastern United States and gives detailed information on environmental characteristics defining these distributions. Please be sure to read the **warnings, cautions and questions**. You can also **browse and view the previous version of the Tree Atlas**.

Climate Change Atlas Videos
Quick Start Guide
An Introduction to the Climate Change Atlas: How does it work?
An Overview of the Climate Change Atlas Components
Exploring Current Species Information
Modeled Future Habitats
Combined Species Outputs

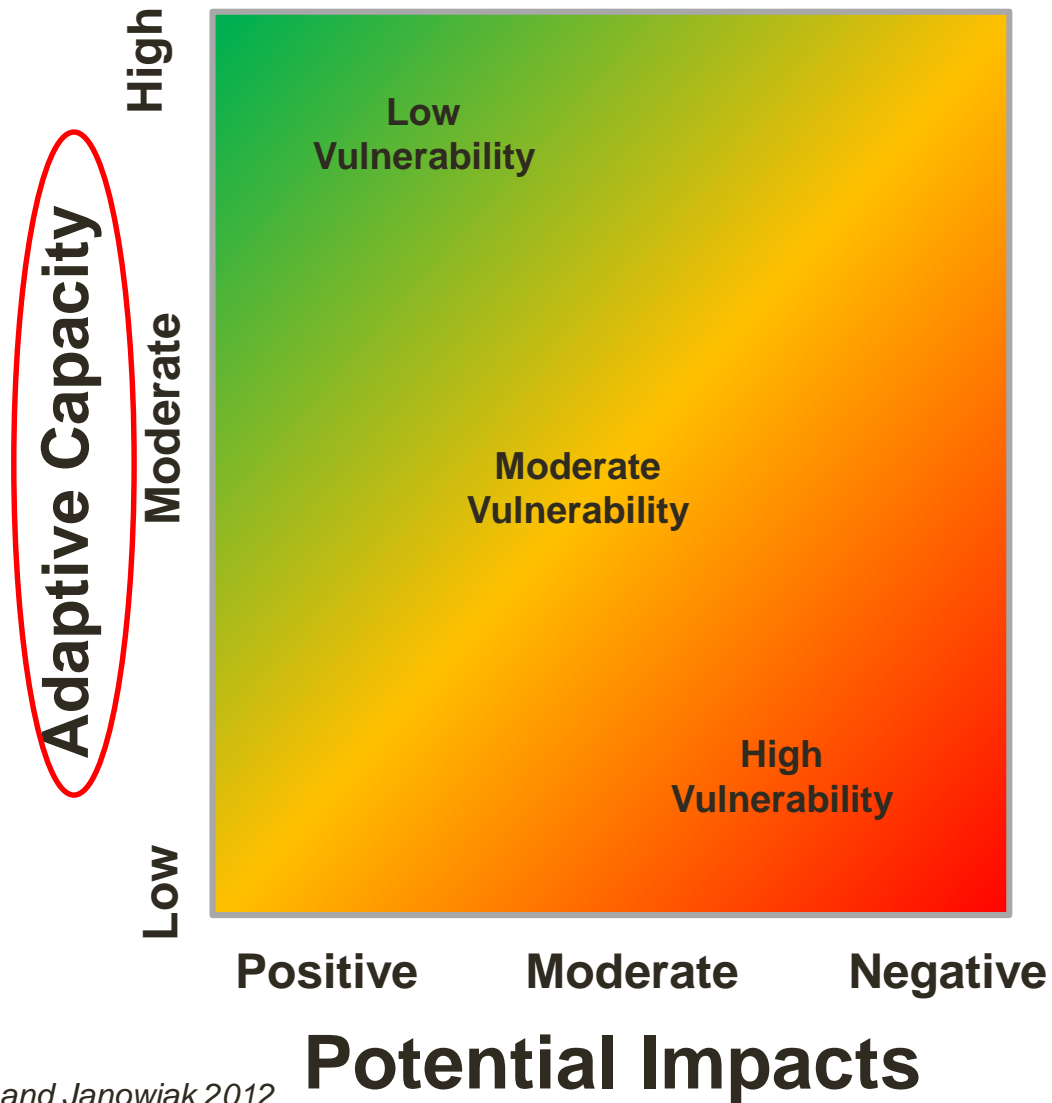
Featured Research
Ecosystem vulnerability assessment and synthesis: a report from the Climate Change Response Framework Project in northern Wisconsin

Combined Species Outputs
Potential Changes by Region, State, Forest Type or National Forest and Parks

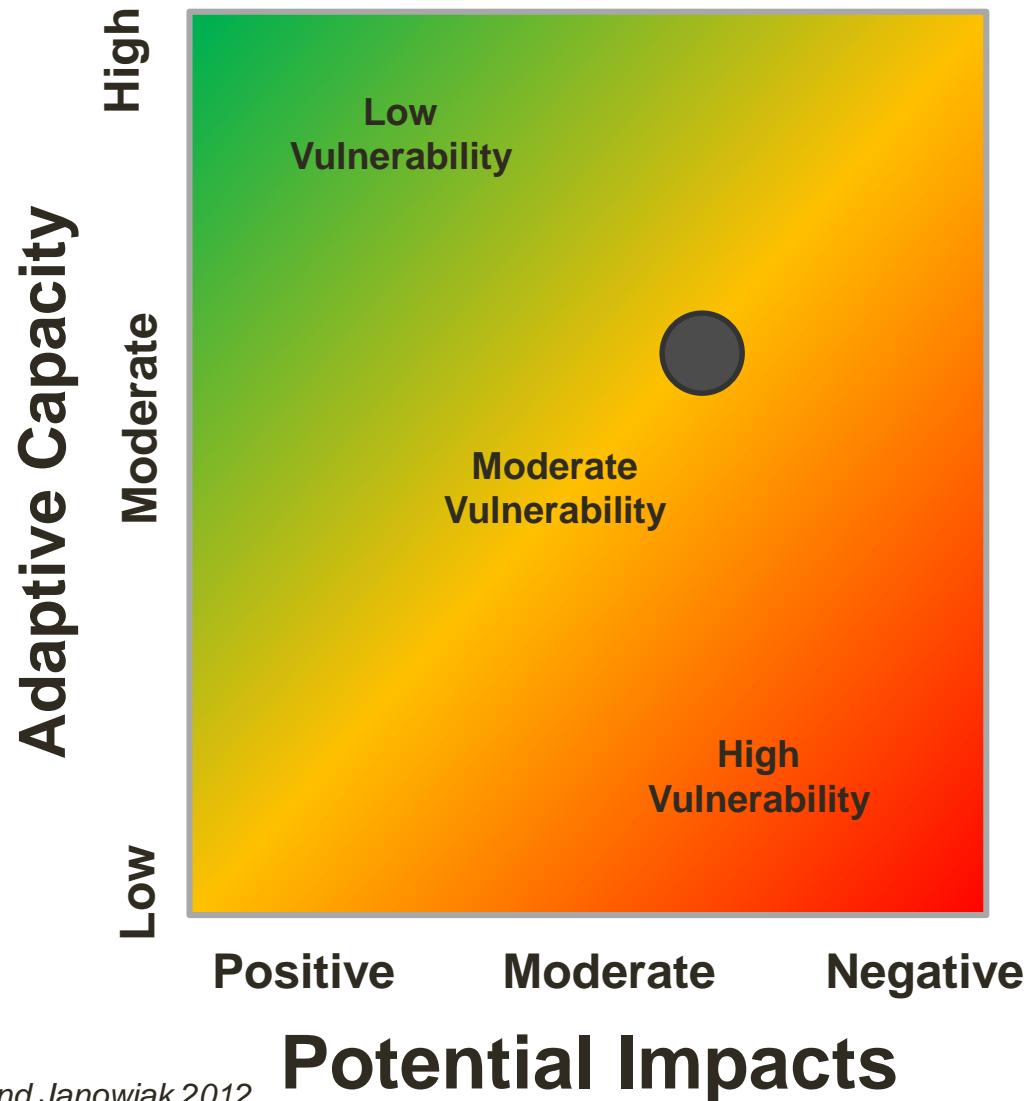
Heat and Hardiness Zones



VULNERABILITY

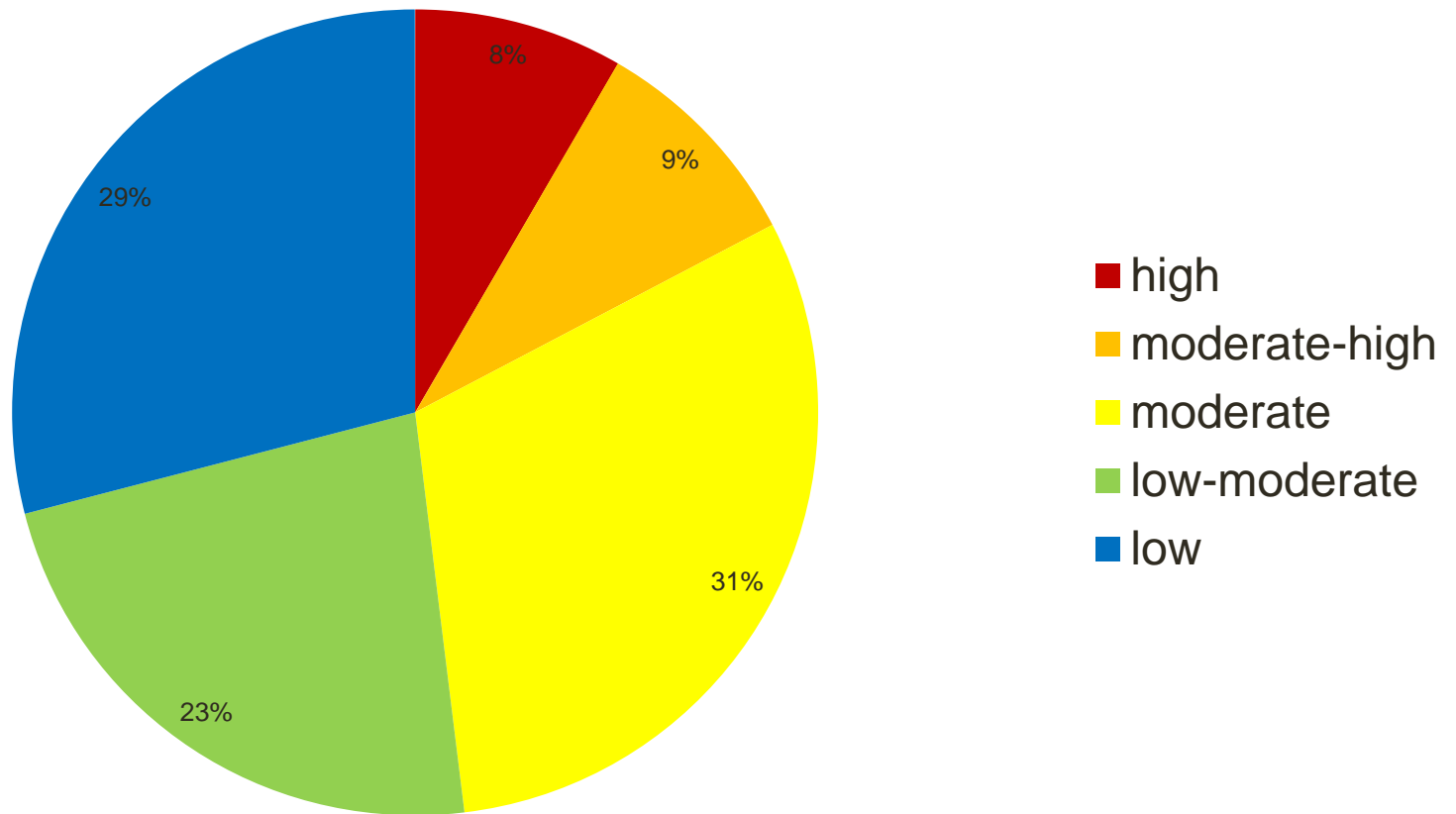


VULNERABILITY



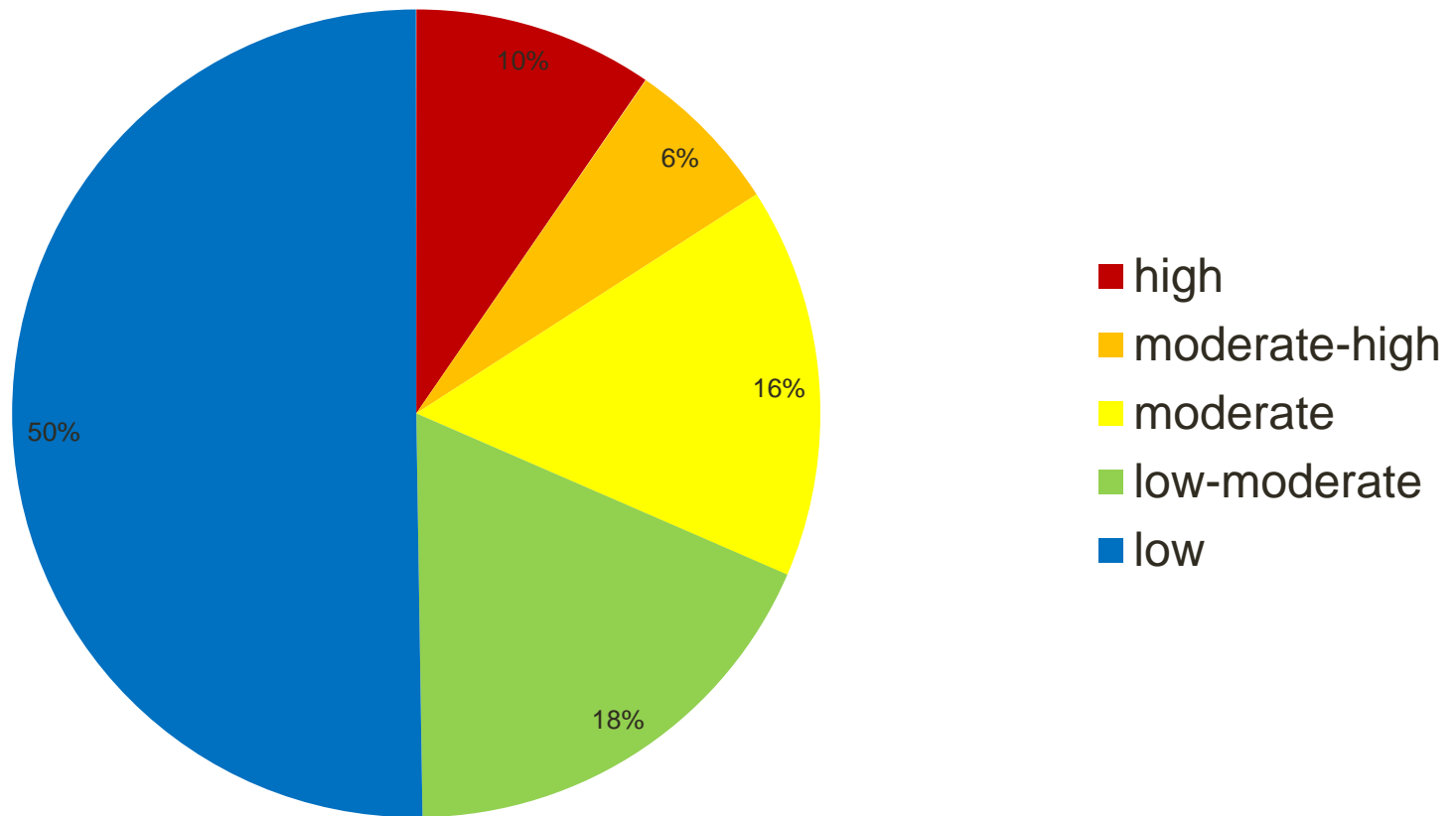
VULNERABILITY OF SPECIES IN CHICAGO REGION

% of Species



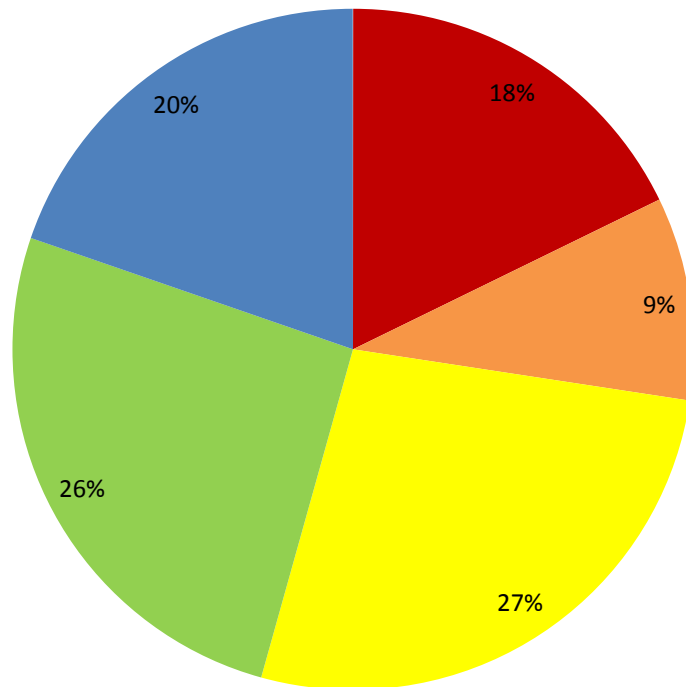
VULNERABILITY OF TREES IN CHICAGO REGION

% of Trees Inventoried

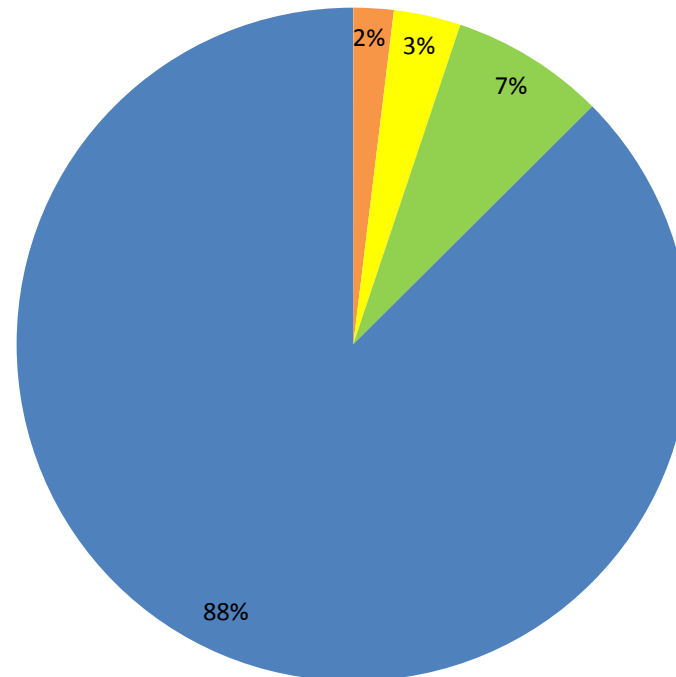


VULNERABILITY: NATIVE VS. INVASIVE SPECIES

% of Native Trees

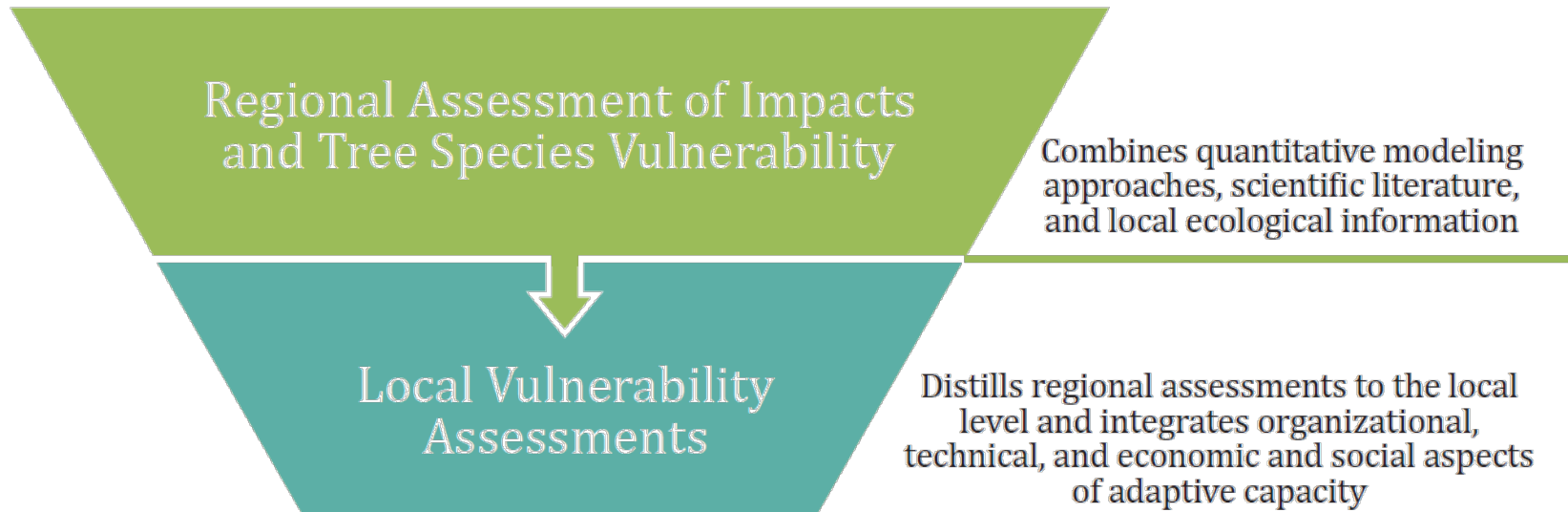


% of Invasive Species

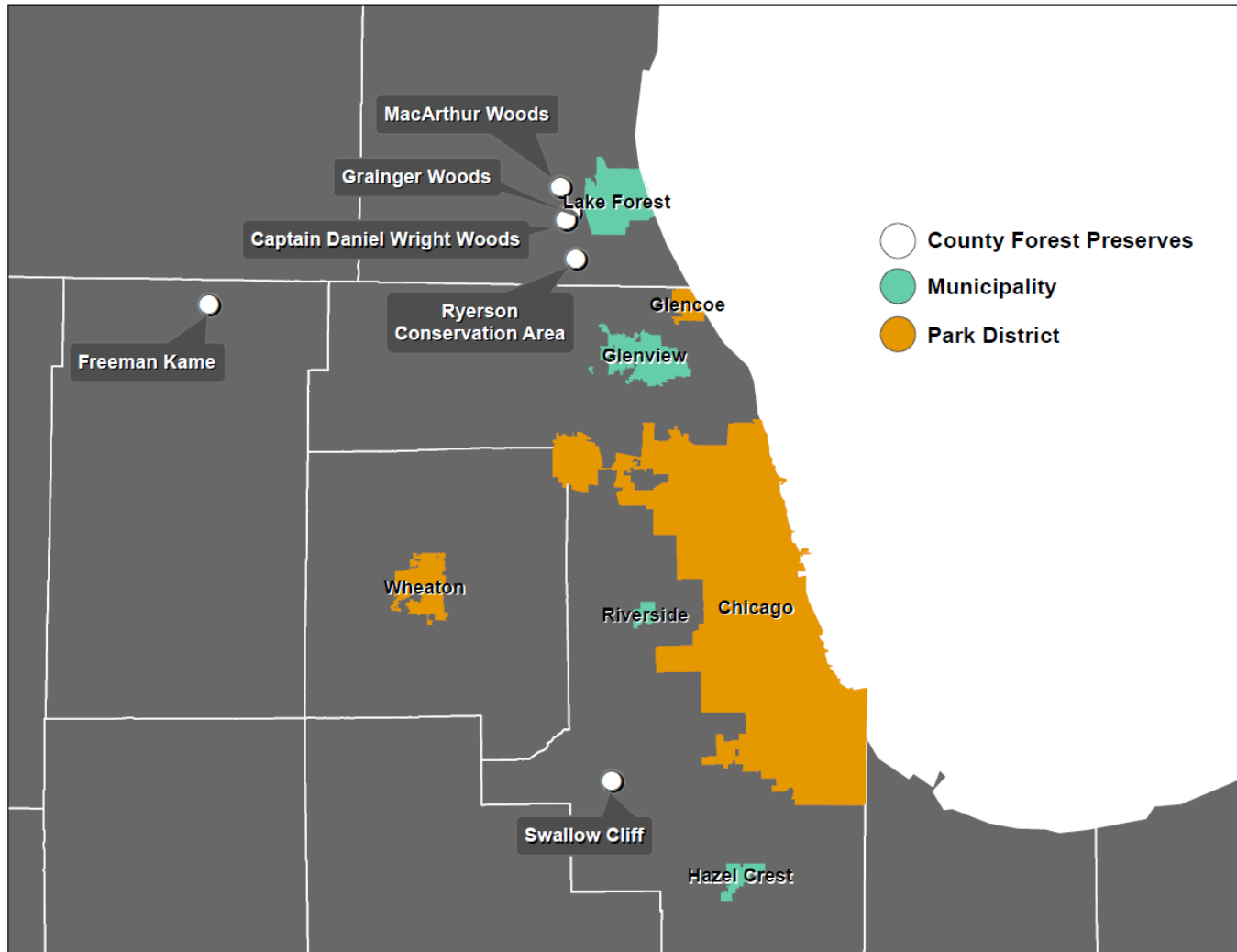


- high
- moderate-high
- moderate
- low-moderate
- low

URBAN FRAMEWORK APPROACH



PILOT COMMUNITIES





COMMUNITY VULNERABILITY ASSESSMENT COMPONENTS

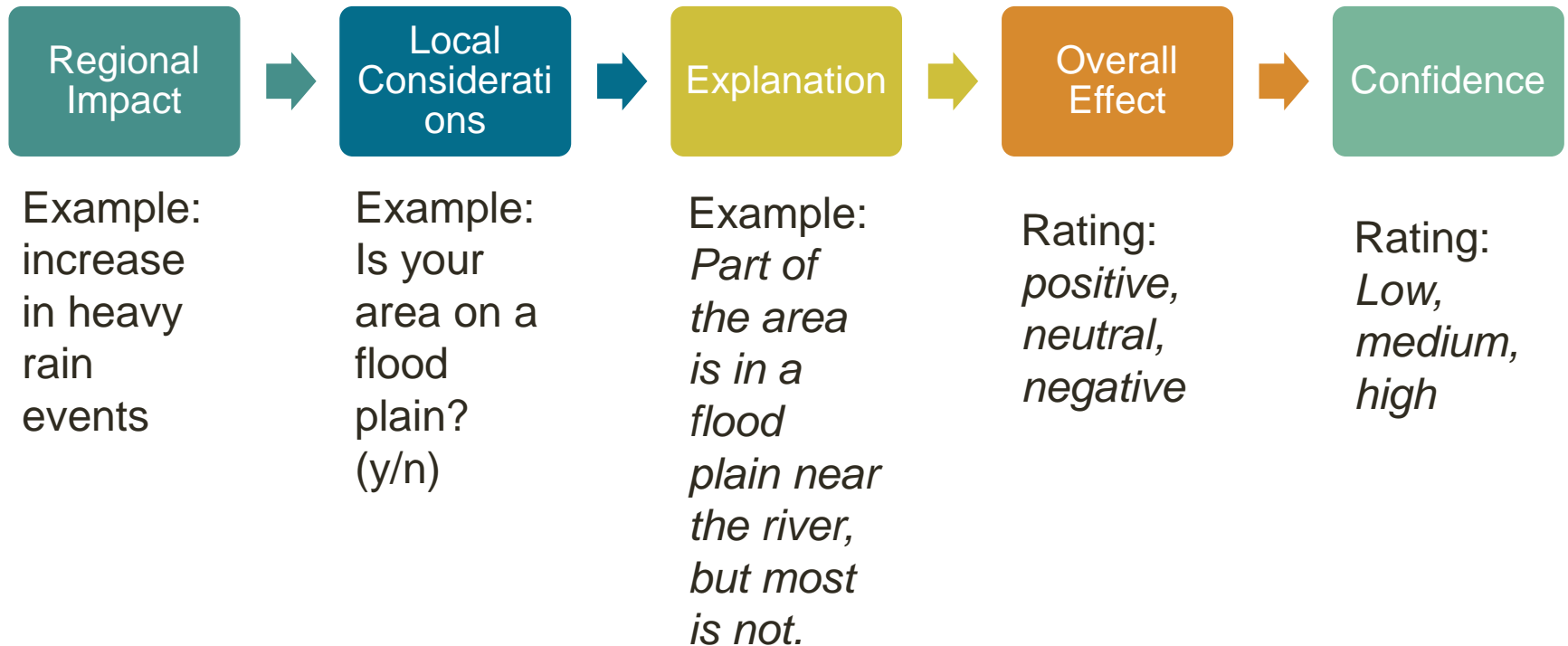
Impacts

- Physical Factors:
 - Position in floodplain
 - Soils
 - Proximity to large bodies of water
- Biological
 - Tree species
 - Pests, diseases
 - Invasive species
- Human
 - Pollution
 - Impervious surfaces

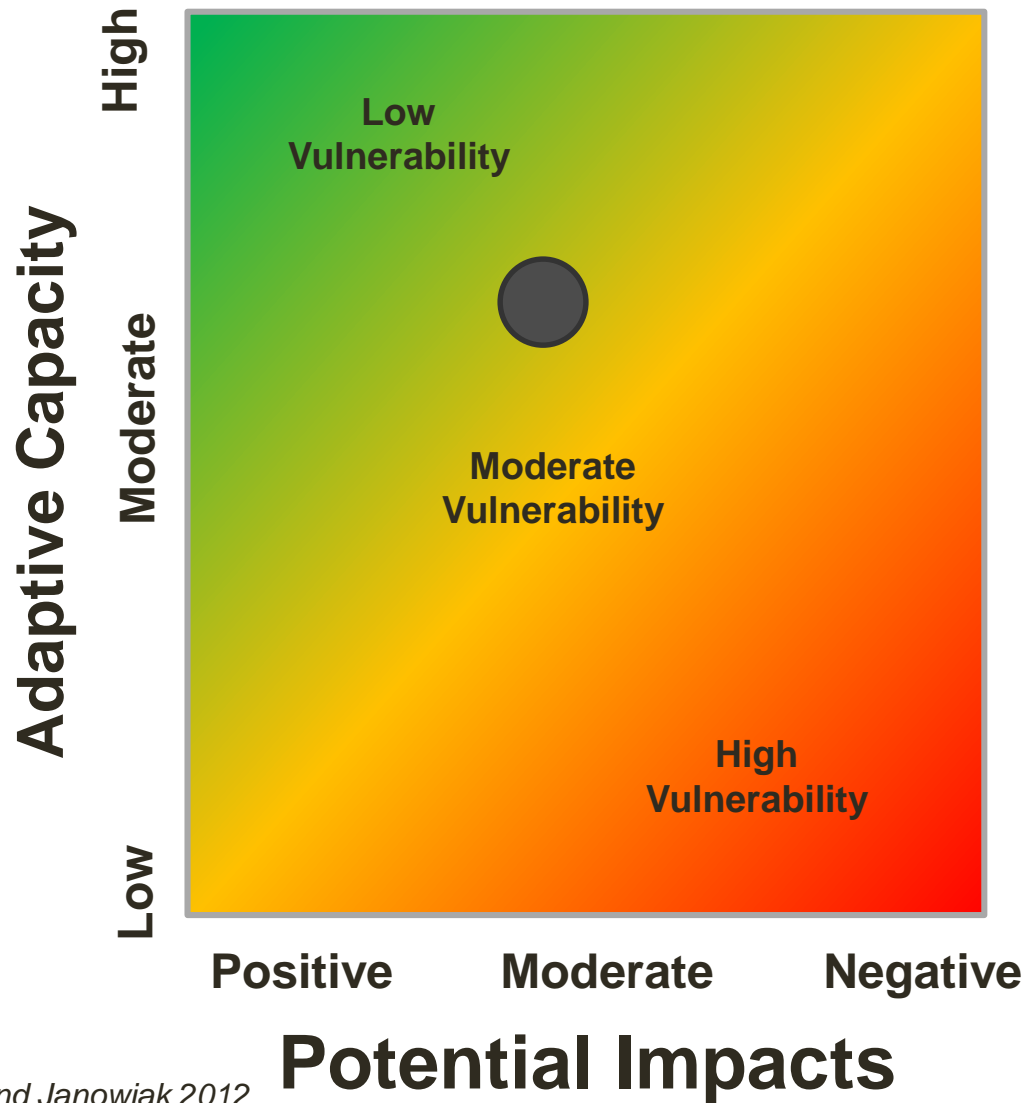
Adaptive Capacity

- Biological
 - Species, genetic, age class diversity
- Organizational/technical
 - Staffing
 - Planning
- Economic
 - Funding for care, planting
- Social
 - Volunteerism
 - Public support

WORKSHEET APPROACH

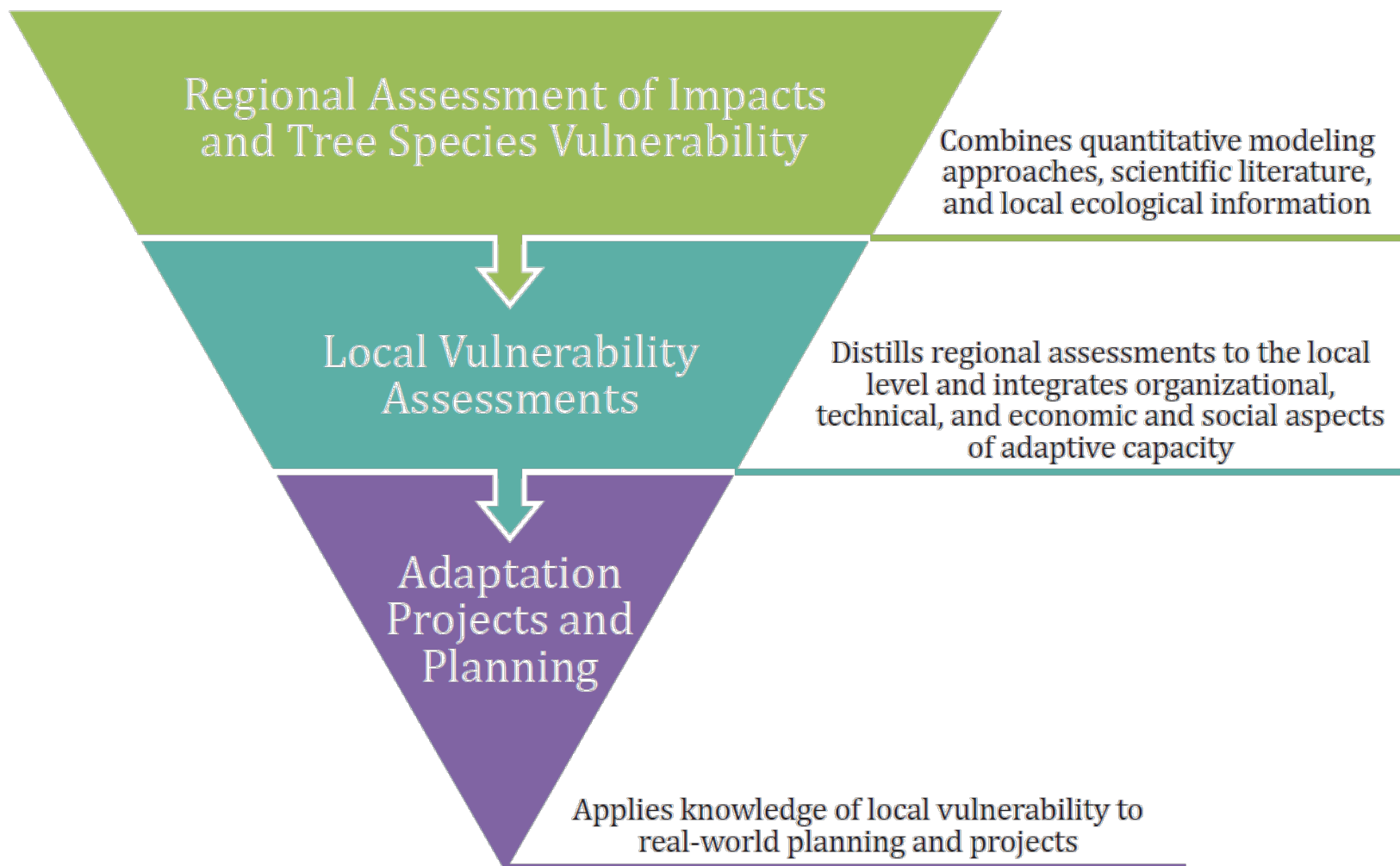


VULNERABILITY

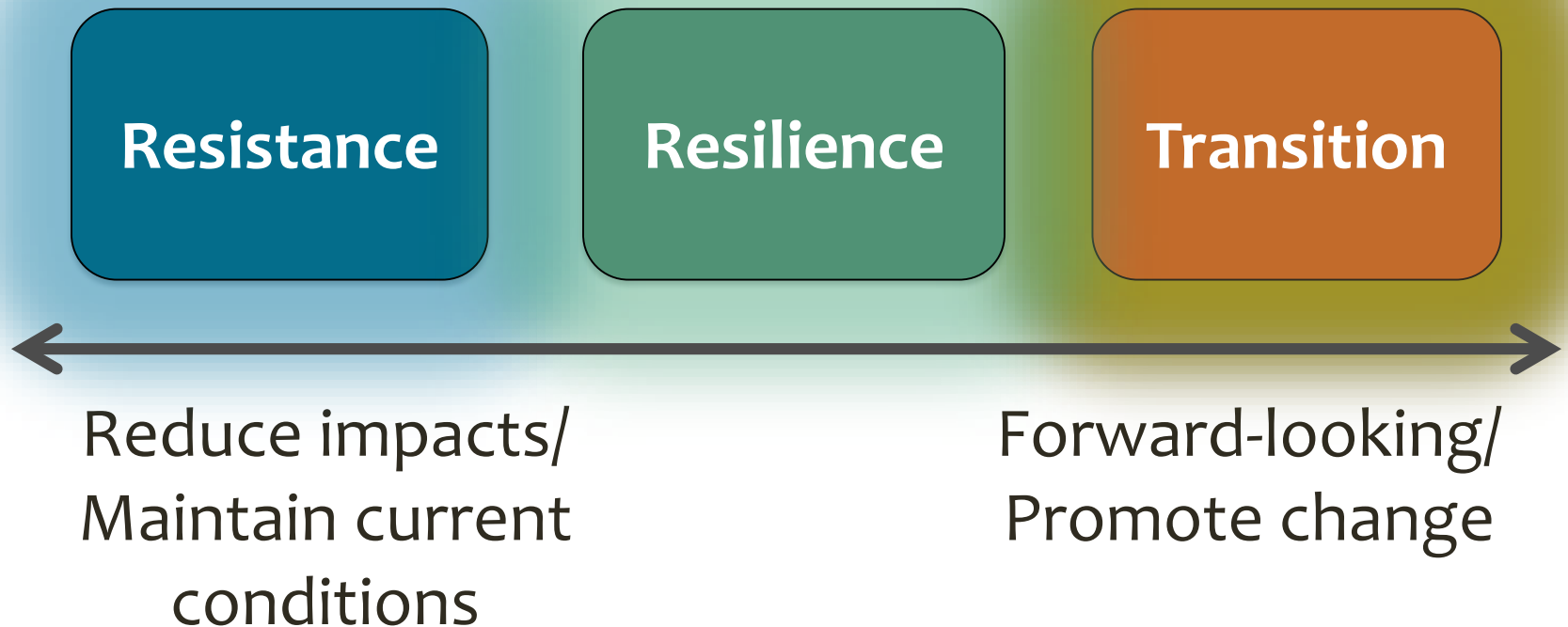


	Impacts				Adaptive Capacity					Vulnerability
Location	Physical	Biological	Human	Overall	Biological	Organizational/Technical	Economic	Social	Overall	
Riverside	moderate-negative	moderate	moderate	moderate	high	high	high	high	high	low-moderate
Lake Forest	moderate	negative	moderate	moderate-negative	high	moderate	high	high	moderate-high	moderate
Hazel Crest	moderate	moderate-negative	moderate-negative	moderate-negative	low	moderate-high	low	moderate	low-moderate	moderate-high
Glenview	moderate-negative	moderate-negative	moderate-negative	moderate-negative	moderate	high	high	high	high	moderate
Glencoe Parks	moderate	moderate-negative	negative	moderate-negative	moderate	low-moderate	low-moderate	low	low-moderate	moderate-high
Wheaton Parks	moderate	negative	negative	moderate-negative	high	high	high	moderate-high	high	moderate
Chicago Parks	moderate-negative	moderate-negative	moderate-positive	moderate-negative	moderate	moderate-high	moderate-high	moderate-high	moderate-high	low-moderate
Southern Des Plaines River Preserves	negative	moderate-negative	negative	moderate-negative	low-moderate	moderate	moderate-high	moderate-high	high	moderate
Freeman Kame Preserve	moderate-negative	moderate-negative	negative	moderate-negative	moderate	moderate	moderate	moderate-high	moderate-high	moderate
Swallow Cliff Preserve	moderate	moderate-negative	moderate	moderate-negative	low	moderate	low	low-moderate	low-moderate	moderate-high

URBAN FRAMEWORK APPROACH



ADAPTATION OPTIONS



Option 1: Resistance

Improve the defenses of the forest against effects of change.

- Short-term
- High-value





RESISTANCE EXAMPLES



Preventing herbivory



Preventing winterburn



Controlling flooding with french drains



Watering

Option 2: Resilience

Accommodate gradual change, usually returning to a prior condition after disturbance



Photo: USFS

Millar et al. 2007

RESILIENCE EXAMPLES



Enhancing biodiversity



Installing rain gardens



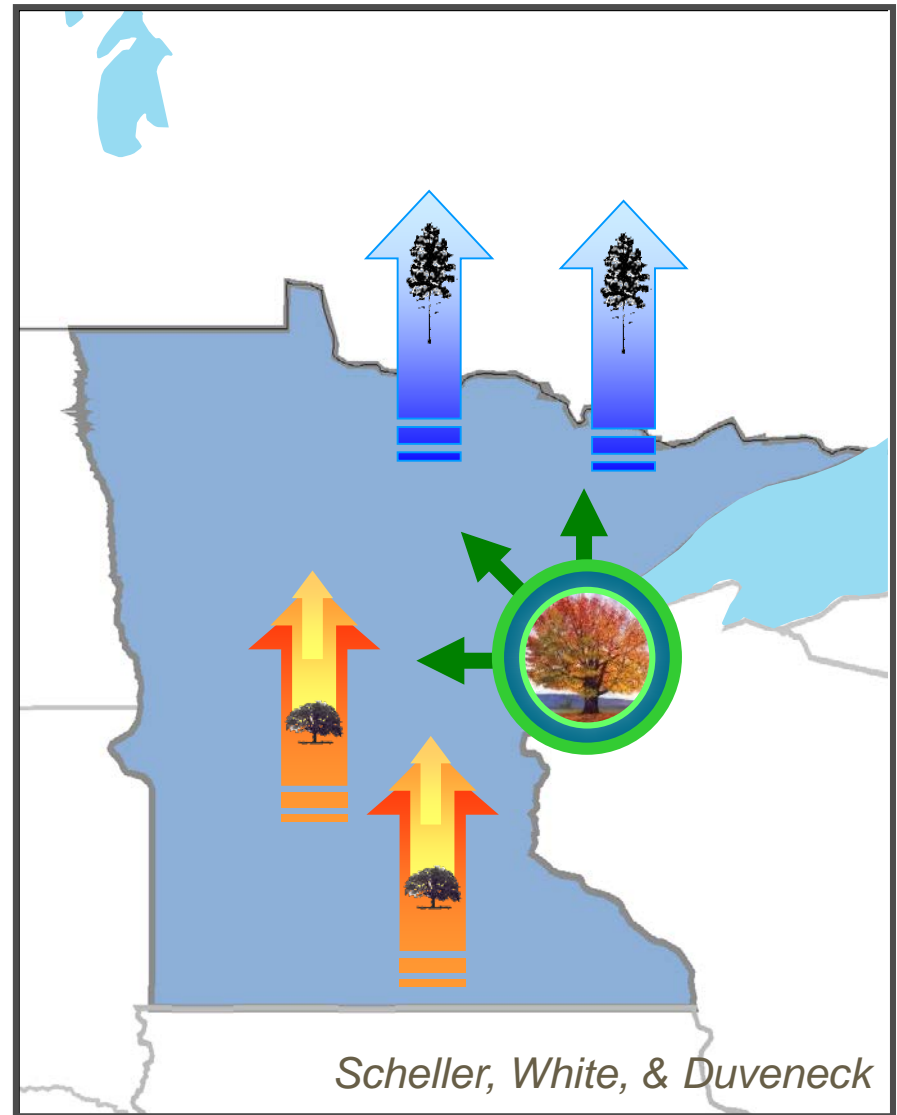
Prescribed fire



Pruning

Option 3: Transition

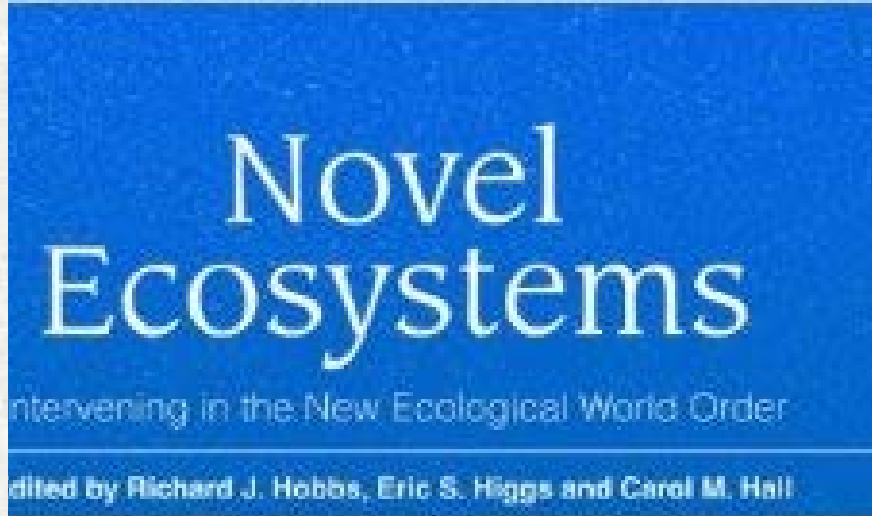
Intentionally accommodate change, enabling ecosystems to adaptively respond



TRANSITION EXAMPLES



Enhance connectivity for migration



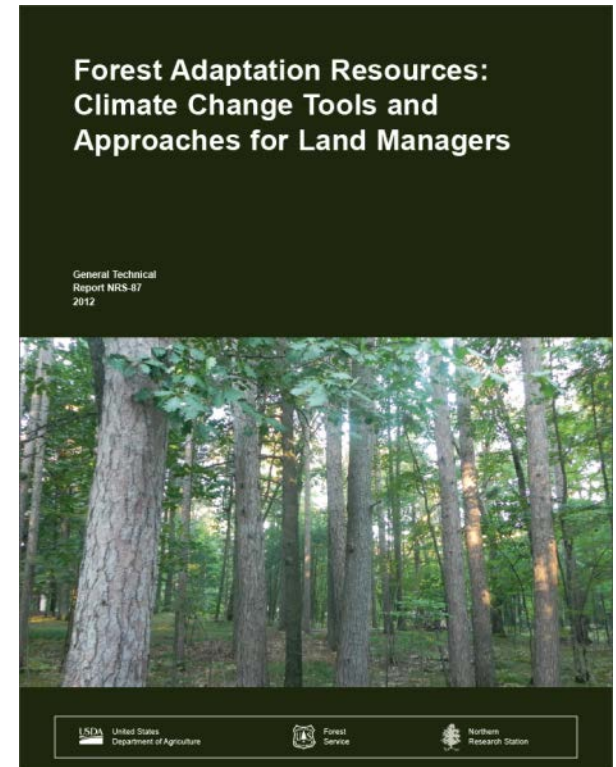
Promoting New species assemblages



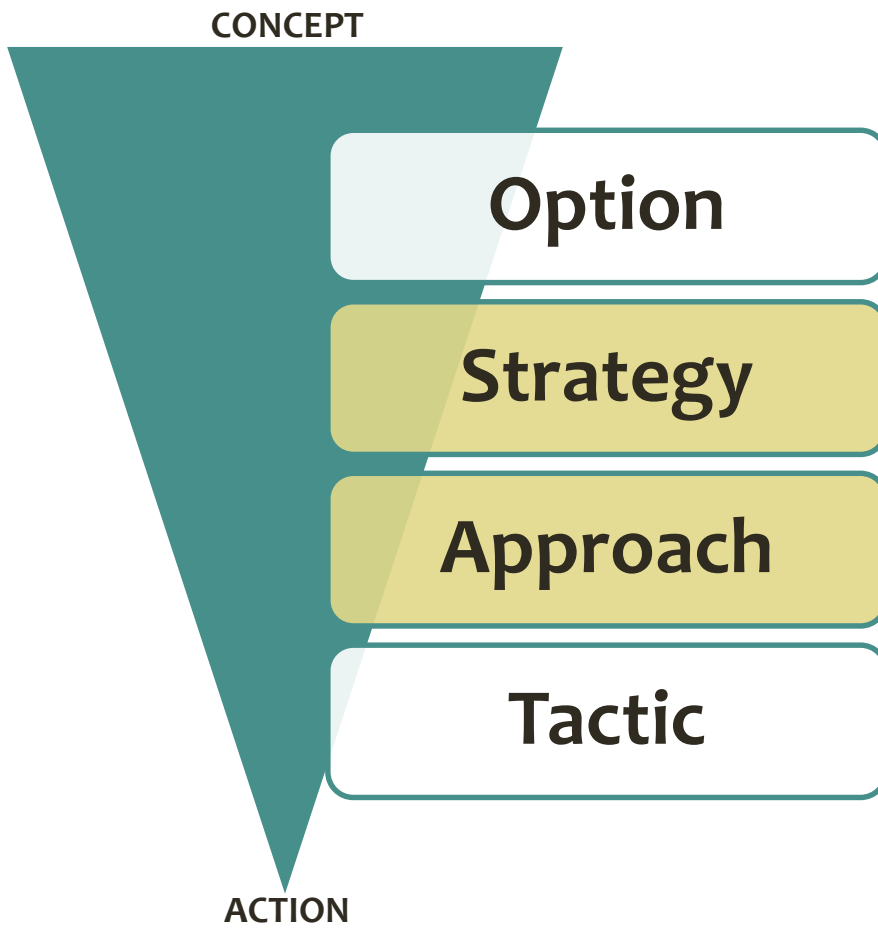
Planting future-adapted seedlings

FOREST ADAPTATION RESOURCES

- Designed for a variety of land managers with **various goals** and **objectives**
- Tailored to **eastern forest types**; the first version is now in revision
- **Does not make recommendations**
- Menu of adaptation **strategies & approaches** for forest ecosystems
- www.nrs.fs.fed.us/pubs/40543

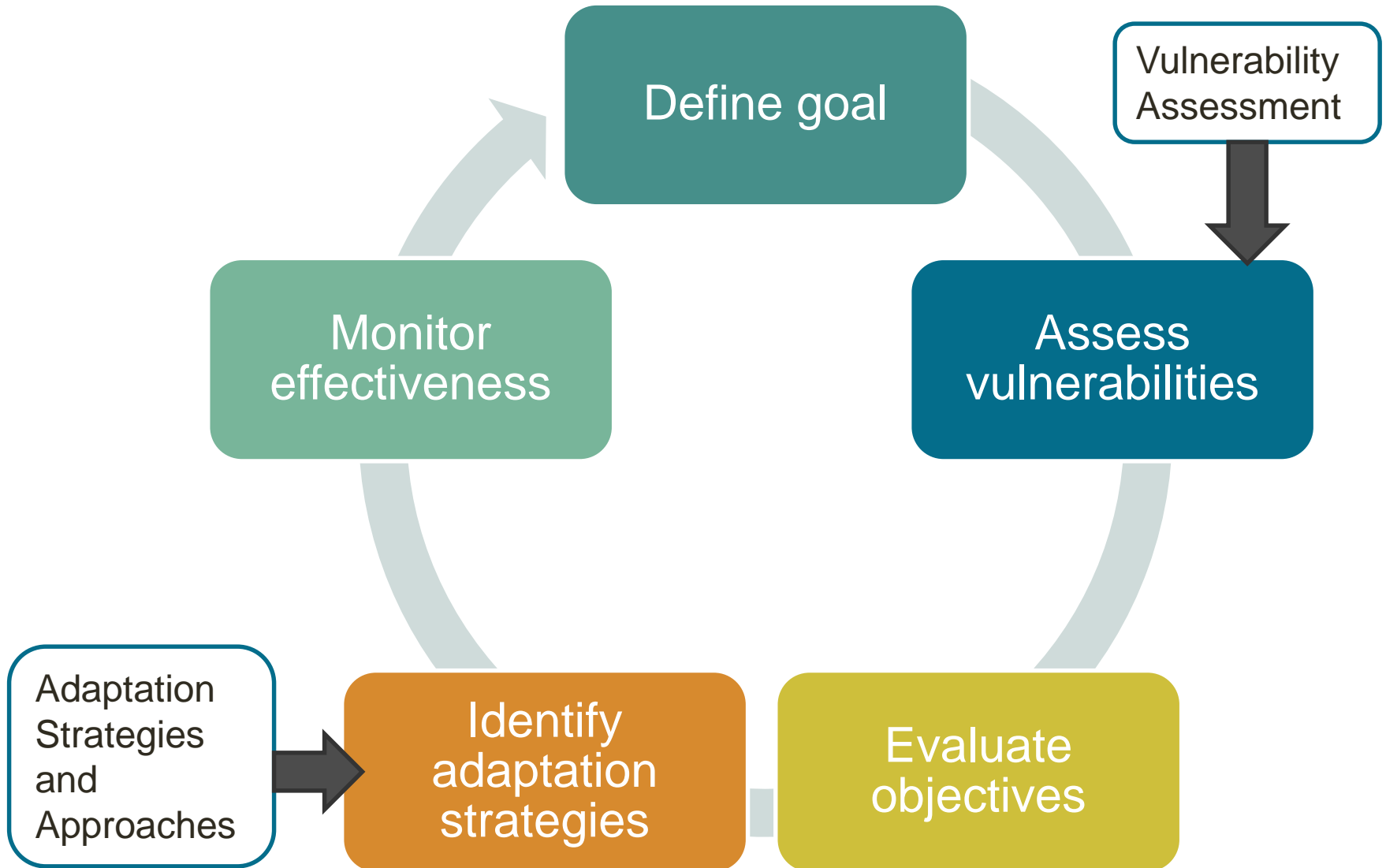


ADAPTATION STRATEGIES AND APPROACHES

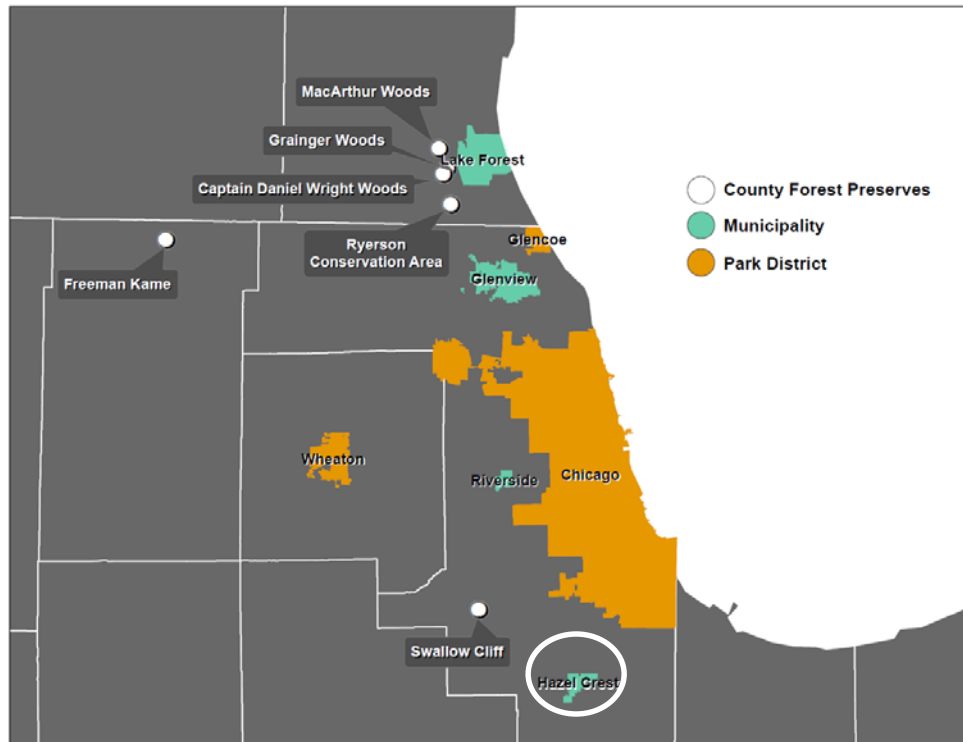


- Based on list developed for rural forests
- Adapted for urban forests by Chicago Wilderness Trees and Green Infrastructure Task Force

FOREST ADAPTATION RESOURCES: ADAPTATION WORKBOOK



HAZEL CREST





HAZEL CREST

Moderate-High Vulnerability

Impacts:

- Well-drained soils in most areas-drought susceptible.
- Silver maple-dominated (vulnerable to wind storms).
- Open lands in low-lying areas (flood prone).

Adaptive Capacity:

- ISA-certified arborist on staff.
- Low canopy diversity.
- Lower financial resources (relatively low-income area).
- Not a lot of community support for tree care, planting.

FLOOD-PRONE OPEN LANDS



ADAPTATION TACTICS

Minimize or
eliminate flooding

Increase
biodiversity

Select
future-adapted
tree species

Resistance

Resilience

Transition

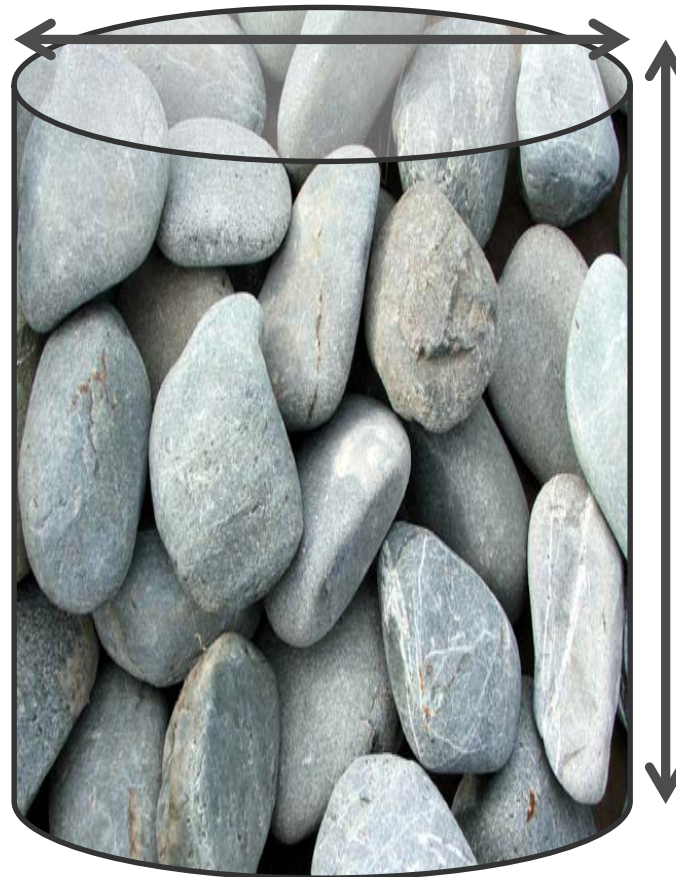


Reduce impacts/
Maintain current
conditions

Forward-looking/
Promote change

CONTROLLING FLOODING WITH DRY WELLS/FRENCH DRAINS

30 inch diameter



4 ft. deep

Explore
different rock
types
(limestone
vs. river
rock)



PLANTING FLOOD-TOLERANT TREES



Baldcypress

Copyright © Robert O'Brien



Swamp
White
Oak

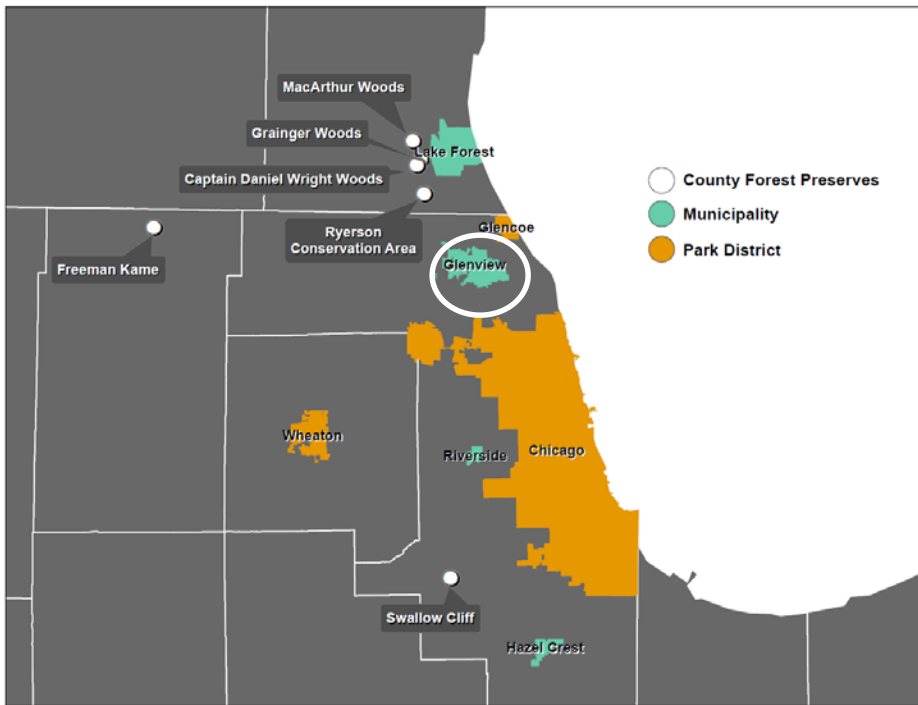
Copyright © Robert O'Brien



River Birch

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GLENVIEW





GLENVIEW

Moderate Vulnerability

Impacts:

- Poorly-drained soils in most areas-susceptible to water-logging.
- Honeylocust and maples are over-abundant
- Some areas near rivers flood-prone

Adaptive Capacity:

- Trained forestry staff with planting list and long-term plan.
- Relatively diverse canopy
- Higher-income area, sufficient financial resources.
- High community support for tree care, planting.

VOLUNTARY BUYOUT IN FLOOD-PRONE AREAS (FEMA GRANT)



ADAPTATION TACTICS

Remove buildings
in flood-prone areas

Restore a functioning
bottomland forest,
Increase biodiversity

Select
future-adapted
genotypes

Resistance

Resilience

Transition

Reduce impacts/
Maintain current
conditions

Forward-looking/
Promote change

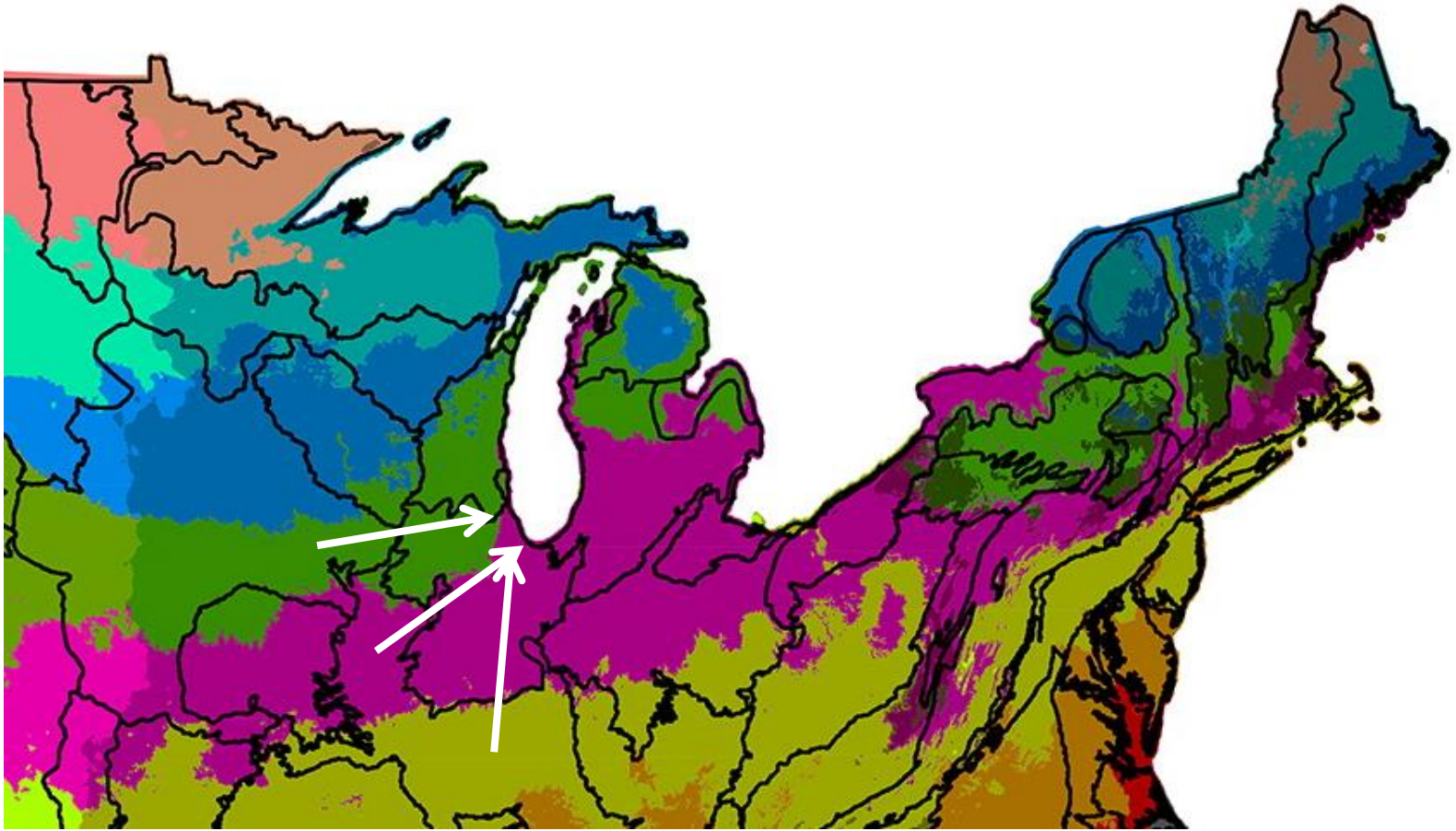




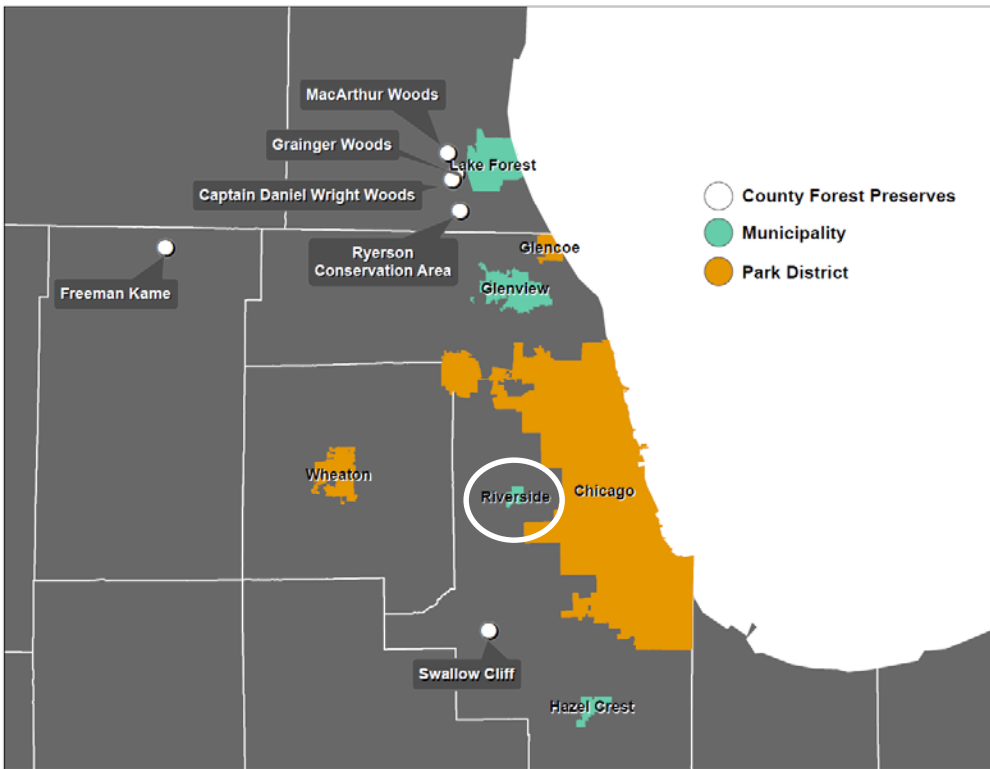
RESTORE FLOOD-TOLERANT ECOSYSTEMS



INCREASE DIVERSITY OF GENOTYPES/SEED SOURCE



RIVERSIDE





RIVERSIDE

Low-Moderate Vulnerability

Impacts:

- Divided into two distinct areas:
 - South side: well-drained soils, trees more vulnerable to wind storms
 - North side: compacted soils with high clay content
- Deer herbivory and invasive species are both problematic
- Many oak species that could be susceptible to increased pest and disease pressure

Adaptive Capacity:

- National Historic Landscape District, Frederick Law Olmsted Design.
- Trained forestry staff with planting list and long-term plan.
- Diverse species, genotypes, age classes.

ASH REPLACEMENT



ADAPTATION TACTICS

Remove
invasive
species

Restore fire to
fire-adapted
systems

Plant
tree species from
southern climates

Resistance

Resilience

Transition



Reduce impacts/
Maintain current
conditions

Forward-looking/
Promote change



REMOVE INVASIVE BUCKTHORN



INCORPORATE FIRE INTO SYSTEM TO REDUCE INVASIVE SPECIES AND PROMOTE NATIVE SEED BANK



PLANT FUTURE-ADAPTED SPECIES



Pecan

Copyright © Robert O'Brien



Sugarberry



Copyright © Robert O'Brien

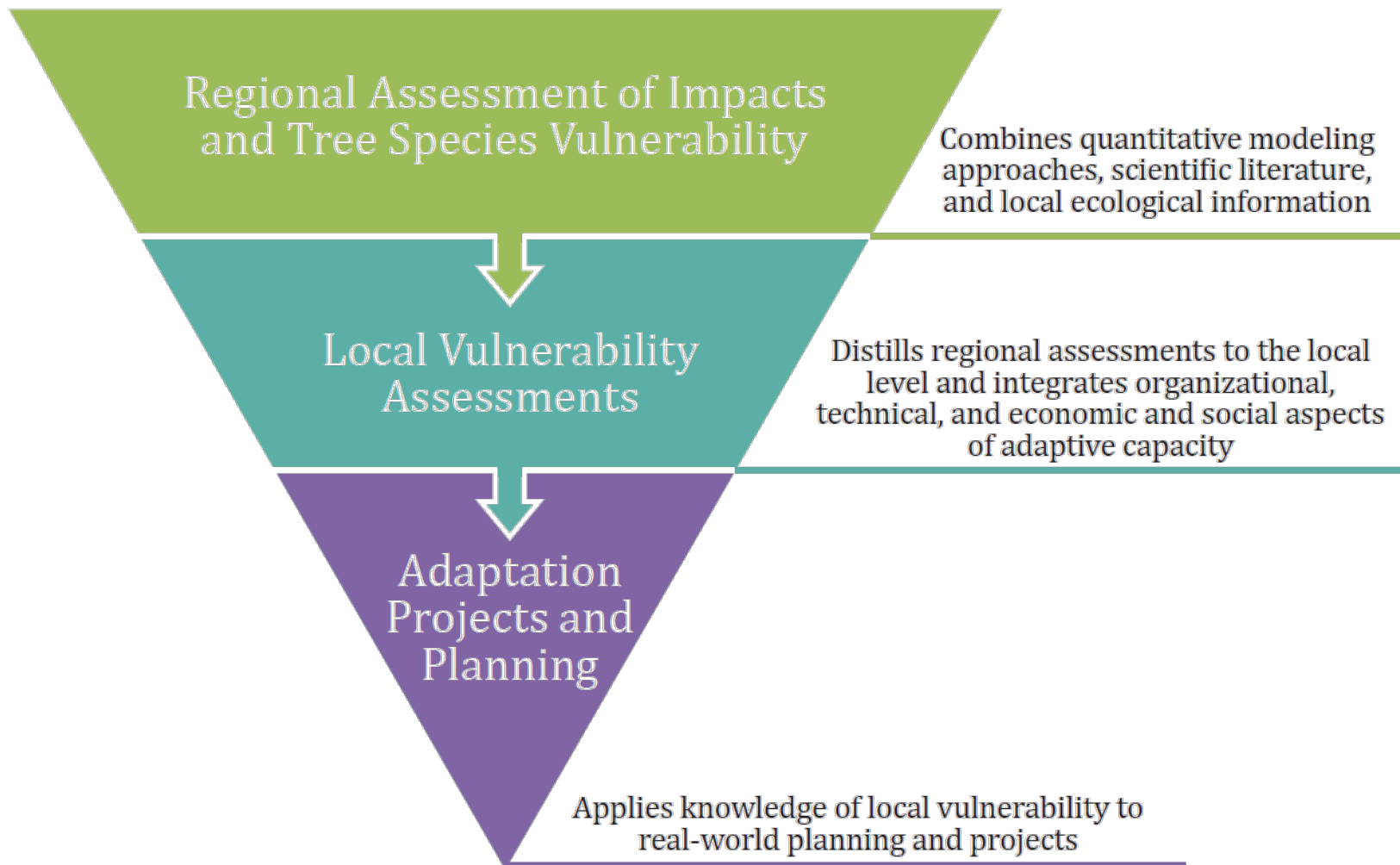
PILOT OUTCOMES

- ✓ Increased knowledge of local climate change impacts.
- ✓ Structured process to incorporate climate considerations.
- ✓ Greater familiarity with adaptation concepts.
- ✓ Empowerment: everyone can do something.

“This is a great process to go through. It breaks from the typical “Putting out fires” philosophy” –participant evaluation

“I think that the climate change topic can be intimidating and that many urban foresters will think there is nothing they can do. [We are] connecting how their current practices are actually a step in the right direction.” –participant evaluation

URBAN FRAMEWORK APPROACH



NEXT STEPS

- Publish Chicago assessment
- Write up lessons learned
- Expand to other areas
- Develop online urban forestry adaptation toolkit

LEARN MORE

www.forestadaptation.org/urban

Climate Change Response Framework

Home Our Approach Projects Demos Products Partners Resources Contact

Central Appalachians

Central Hardwoods

Mid-Atlantic

New England

Northwoods

Urban

Partnerships

Vulnerability Assessment

Forest Adaptation Resources

Demonstration Projects

Urban

Urban forests will experience local climate change impacts in the coming decades. To reduce these impacts, urban forest managers will need to adapt their management, but often lack the specialized knowledge and tools to do so.

The overall goal of this effort is to ensure that urban forests will continue to provide benefits to the people that live in urban communities as the climate changes. The Urban Forestry Framework project is in the beginning stages of planning and development. We are seeking urban forestry professionals from variety of organizations, both public and private, to work toward this goal by accomplishing the following objectives:

- Engage with communities across the Northeast, Mid-Atlantic, and Midwest that are interested in adapting their urban forest management to climate change.
- Work with these communities to assess the vulnerability of their urban forests to climate change.

Chicago

lbrandt@fs.fed.us