Assessing priority amphibian and reptile conservation areas (PARCAs) in the North Atlantic LCC

Allison Moody, Department of Wildlife Ecology, Univ. Maine
Cynthia Loftin, USGS Maine Cooperative Fish and Wildlife Research Unit
Phillip deMaynadier, Maine Department of Inland Fisheries and Wildlife
Bill Sutton, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Kyle Barrett, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Priya Nanjappa, Association of Fish &Wildlife Agencies

USGS science for a changing world

Wildlife Management Institute, Washington, D.C.

State of Maine Department of Inland Fisheries and Wildlife

U.S. Fish & Wildlife Service, Department of the Interior

1865 The University of Maine

PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

and PARCAs

Priya Nanjappa, AFWA

Phillip deMaynadier, Maine DIFW

WHAT IS PARC?

PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

- Diverse network of like-minded citizens, professionals, and organizations
- Dedicated to herpetofaunal conservation

- Serves to **connect and complement** local, regional, and national efforts to conserve amphibians, reptiles, and related wildlife or habitat
- Most comprehensive herpetofaunal conservation effort ever undertaken

WHO are our Partners?

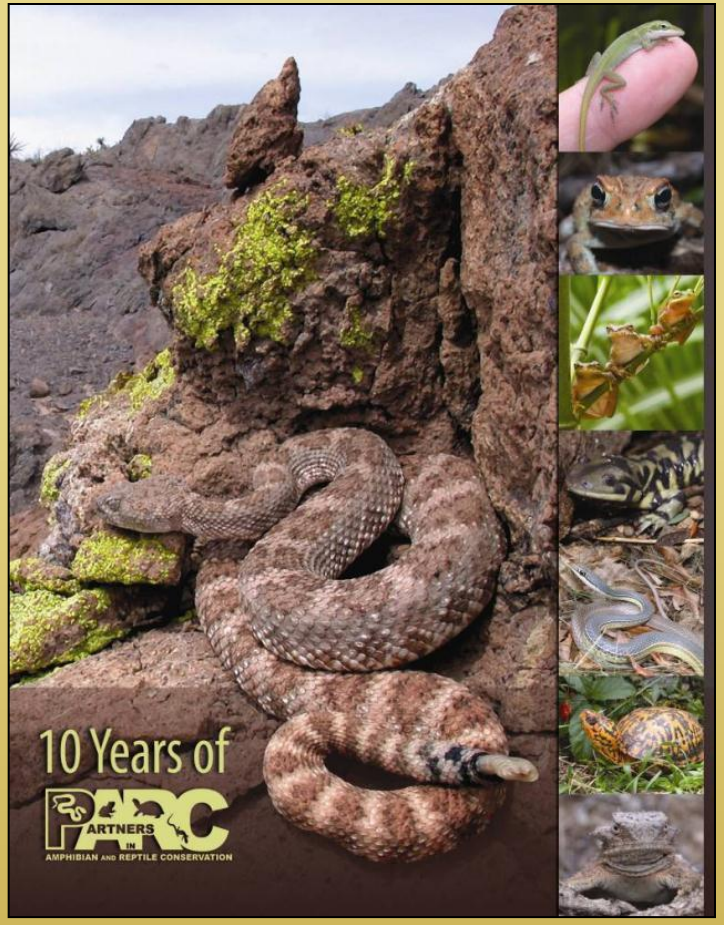
- Federal Agencies
- State Agencies
- Non-Governmental Organizations (NGOs)
- Researchers/Academics
- Industry
- other herpetofaunal enthusiasts

The PARC Mission…

PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

"To conserve amphibians, reptiles, and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public/private partnerships."

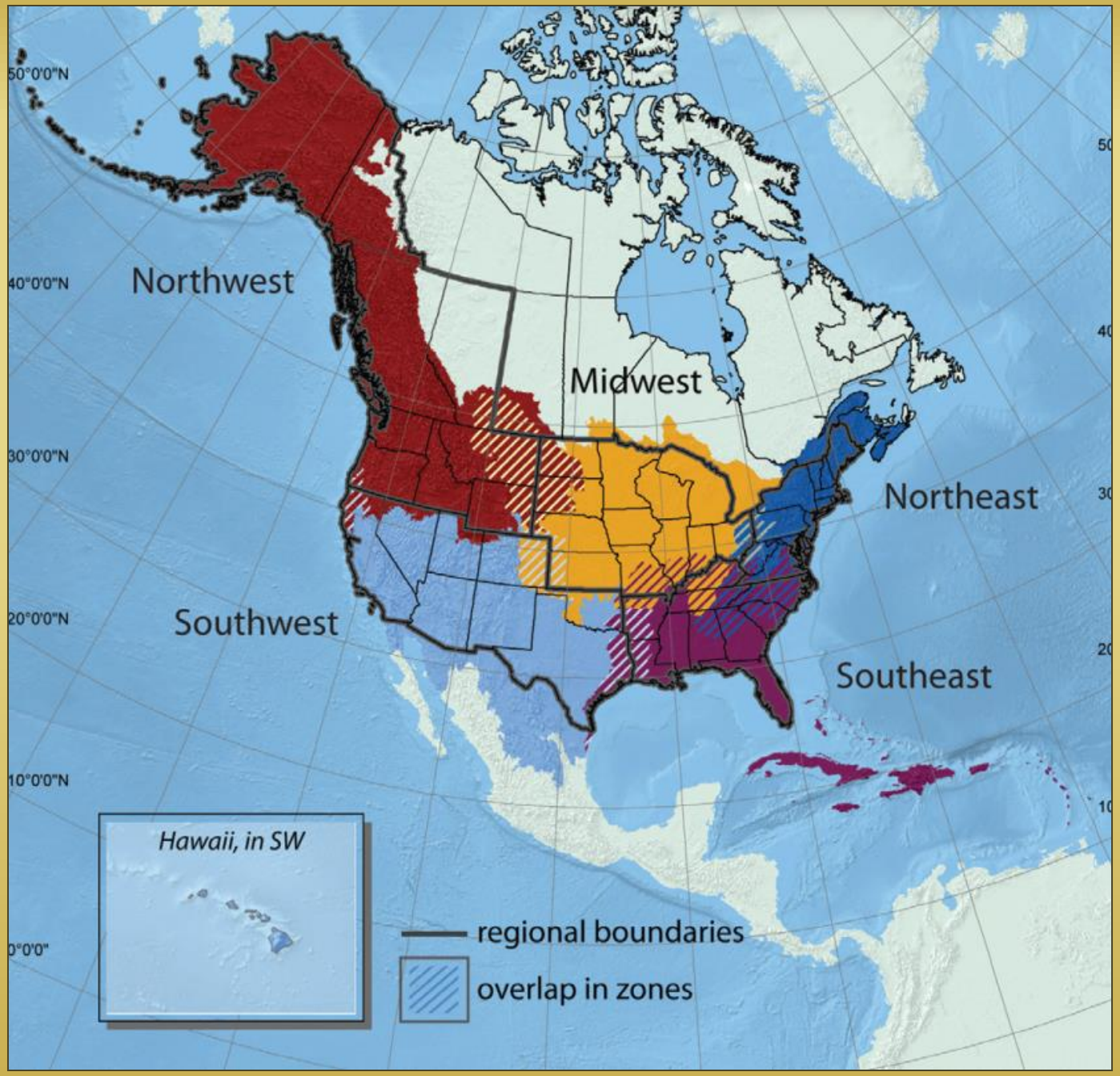
2009 marked 10 Years!



www.parcplace.org

2010 - 2012 Annual Reports

www.parcplace.org

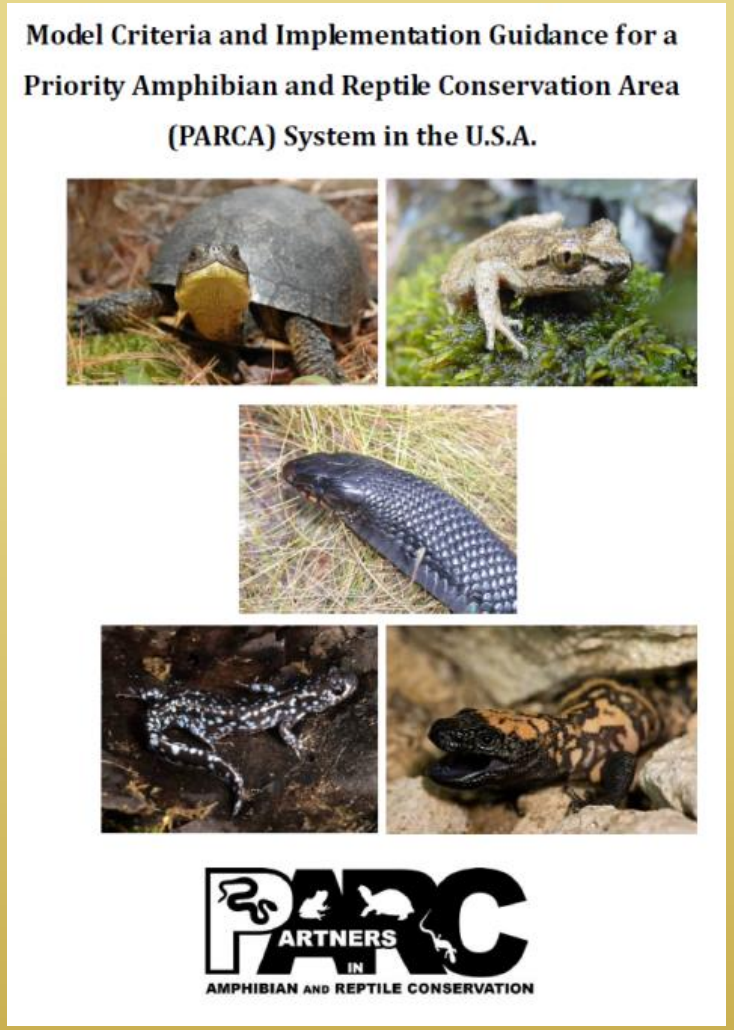

50°0'0"N
40°0'0"N
30°0'0"N
20°0'0"N
10°0'0"N
0°0'0"
Northwest
Midwest
Northeast
Southwest
Southeast
Hawaii, in SW
regional boundaries
overlap in zones

PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

ORGANIZATIONAL STRUCTURE SUMMARY

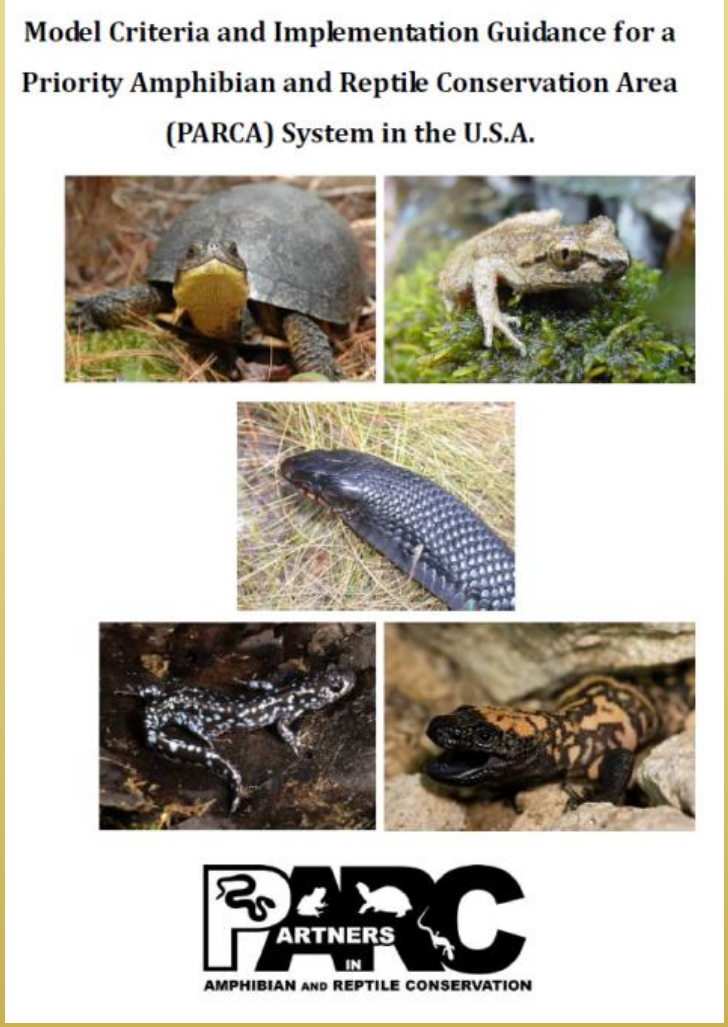
Internal Leadership

Priority A&R Conservation Areas (PARCAS)



- **PARC National Task Team**
  - Identifying/ Nominating priority habitat
    - Criteria & Implementation Plan
      - **Regional (or State) Implementation**
      - **Expert Review**

Priority A&R Conservation Areas (PARCAS)



- Non-regulatory designation
- Goals:
  - Raise awareness
  - Spark voluntary conservation action
  - **Connect & complement** existing habitat prioritization and conservation initiatives

Priority A&R Conservation Areas (PARCAS)

Progress Timeline

2007-2009

National Team Established

2009-2010

Developed Science-based criteria:

- species rarity, richness
- regional responsibility (PARC)
- landscape integrity

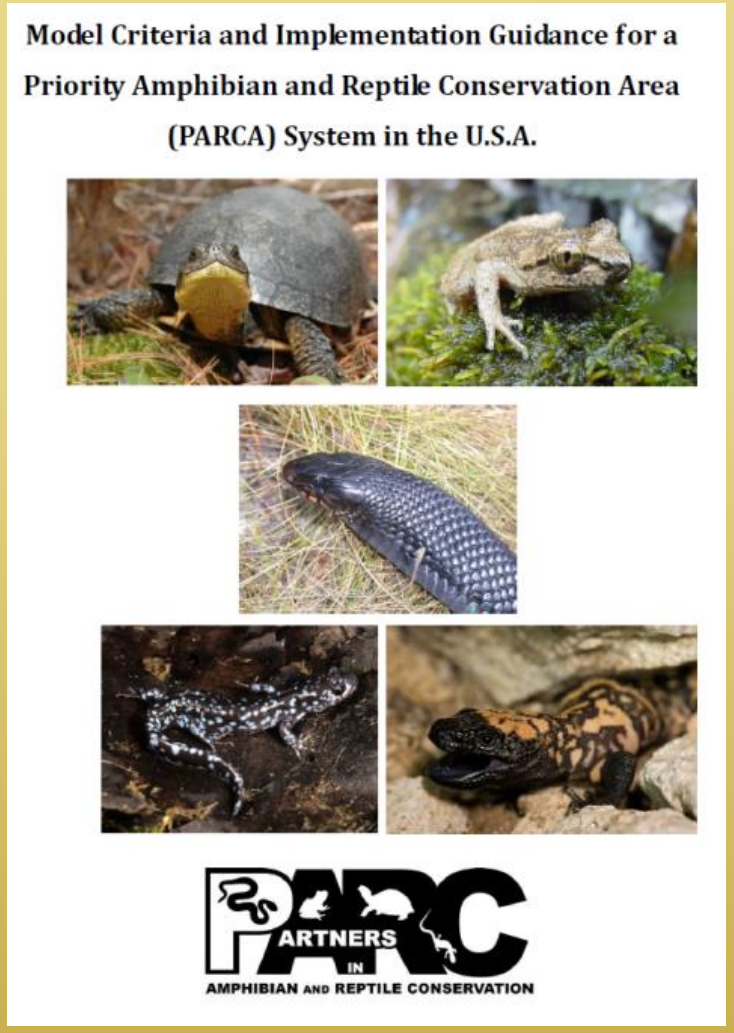
2011

Peer-review

2011-2012

Secured SA- and NA-LCC grants to begin implementation, assess resiliency to climate change/other threats

Priority A&R Conservation Areas (PARCAS)



ACKNOWLEDGEMENTS

Ron Sutherland, SEPARC
(Duke University), Chair
Phillip deMaynadier, NEPARC
(Maine Dept of Fish & Wildlife)
Margaret Griep, SEPARC (USFS)
Randy Jennings, SWPARC
(Western New Mexico University)
Karen Kinkead, MWPARC
(Iowa DNR)
Audrey Hatch, NWPARC
(Oregon Dept of Fish & Wildlife)

North Atlantic LCC & WMI

Questions?

Priya Nanjappa

Association of Fish & Wildlife Agencies

pnanjappa@fishwildlife.org

Phillip deMaynadier

Maine Dept of Inland Fisheries and Wildlife

phillip.demaynadier@maine.gov

Assessing priority amphibian and reptile conservation areas (PARCAs) in the North Atlantic LCC

Allison Moody, Department of Wildlife Ecology, Univ. Maine
Cynthia Loftin, USGS Maine Cooperative Fish and Wildlife Research Unit
Phillip deMaynadier, Maine Department of Inland Fisheries and Wildlife
Bill Sutton, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Kyle Barrett, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Priya Nanjappa, Association of Fish &Wildlife Agencies

USGS science for a changing world

Wildlife Management Institute, Washington, D.C.

State of Maine Department of Inland Fisheries and Wildlife

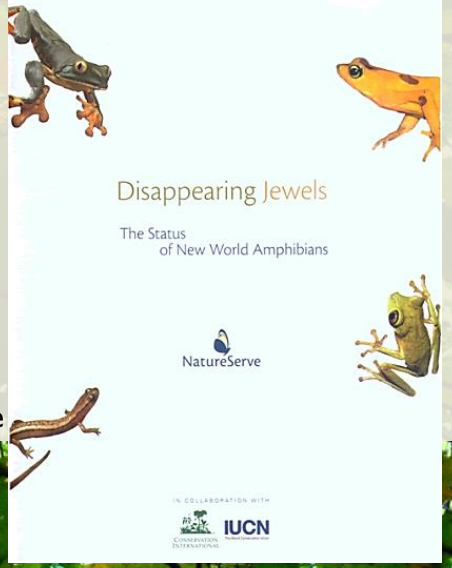
U.S. Fish & Wildlife Service, Department of the Interior

1865 The University of Maine

WHY?

Threats to populations

- **habitat loss and fragmentation**
- introduced species
- environmental pollution
- disease
- pet trade and overexploitation
- global climate change



Gibbons et al. 2000 BioScience; Young et al. 2004 NatureServe

Conserving herpetofauna in the U.S.

unique responsibility

- 19% salamander diversity
- 19% turtle diversity
- wealthy with high number conservation biologists
- advanced environmental legislation

unique natural history

- biphasic species requiring aquatic & upland components
- habitat specialization not captured by generalist taxa
- low mobility and/or complex movement dynamics

Objectives

- determine best areas for herp conservation
  - Priority Amphibian and Reptile Conservation Areas (PARCAs)
- develop spatially-explicit models of these areas as decision support tools for conservation planners
  - what species?
  - where are they?
- resiliency

WHAT SPECIES?

Draft criteria

Draft criteria

landscape integrity

gut instinct!

research history/value

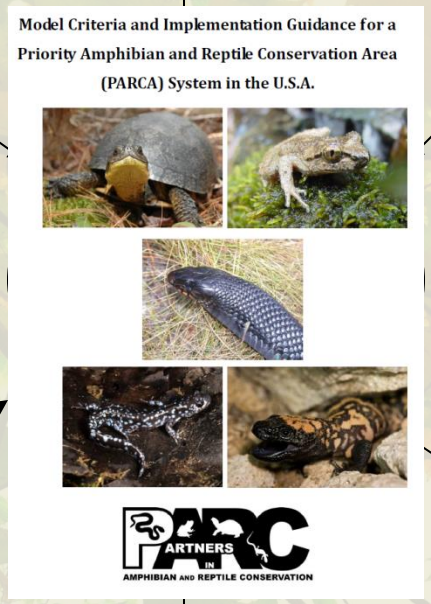
exceptional diversity

global/national rarity

natural community diversity

other biodiversity values

state rarity



Draft criteria

landscape integrity
(criteria 1)

gut instinct!
expert opinion

research history/value

and

exceptional diversity
(criteria 5)

or

Candidate
PARCA

or

global/national rarity
(criteria 2)

or

other biodiversity values

natural community diversity

state rarity
(criteria 3-4)

NA-LCC species list

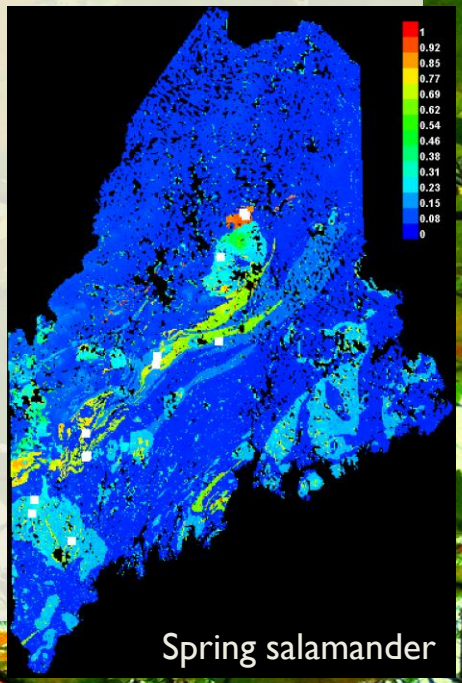
- 120 species/subspecies fit criteria 2-4
- >200 species for species richness (criteria 5)

- 6 species ME pilot area
  - Spring Salamander
  - Blanding's Turtle
  - Spotted Turtle
  - Wood Turtle
  - Northern Black Racer
  - Ribbon Snake

WHERE?

Presence-only modeling

- Maxent
- compares random areas to areas species occur
- probability conditions are suitable
- only on priority species



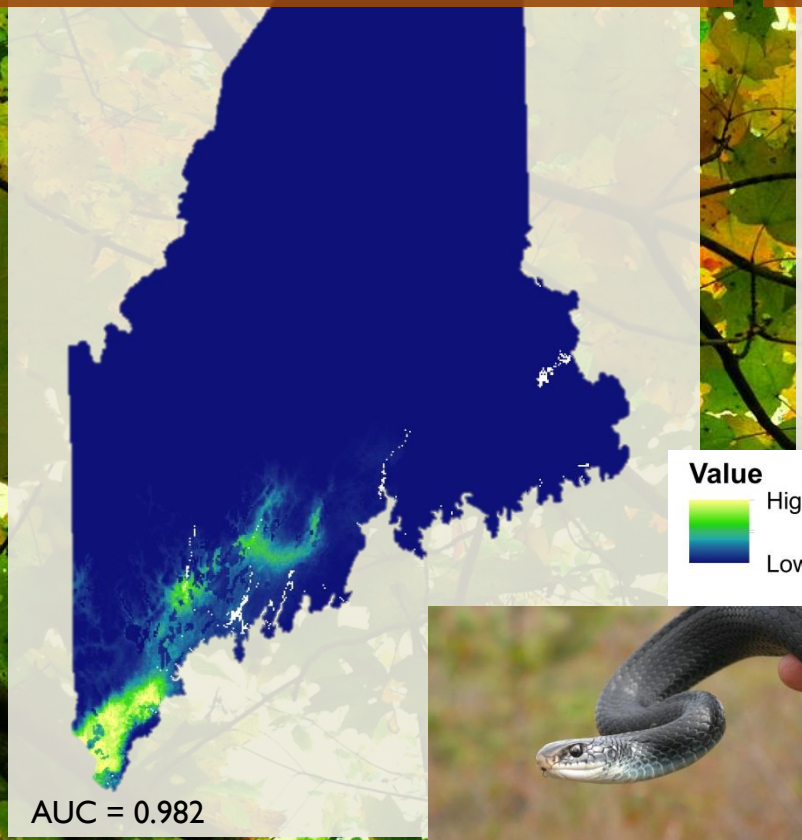
Spring salamander

Variables – YES models

	Spring Salamander	Spotted Turtle	Blanding's Turtle	Wood Turtle	Northern Black Racer	Ribbon Snake
	Gyrinophilus porphyriticus	*Clemmys guttata*	*Emydoidea blandingii*	*Glyptemys insculpta*	*Coluber constrictor constrictor*	*Thamnophis sauritus*
elevation	✓	✓	✓	✓		✓
growing degree days		✓	✓	✓	✓	✓
geology	✓					
landcover	✓	✓	✓	✓		✓
slope	✓	✓	✓			✓
soils	✓				✓	✓
streams & rivers		✓		✓		
wetlands						✓
max temperature			✓	✓		
min temperature	✓	✓	✓	✓	✓	✓
summer temperature				✓	✓	✓
spring/summer precipitation		✓	✓			

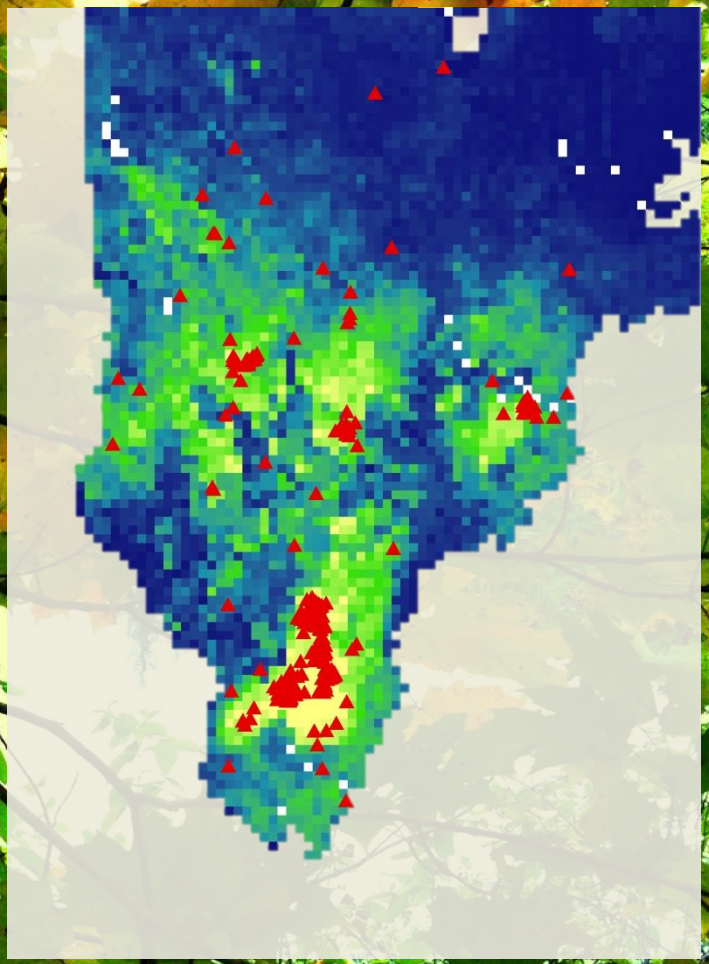
YES vs. YES+MAYBE

gdd + soils + mintemp + summertemp

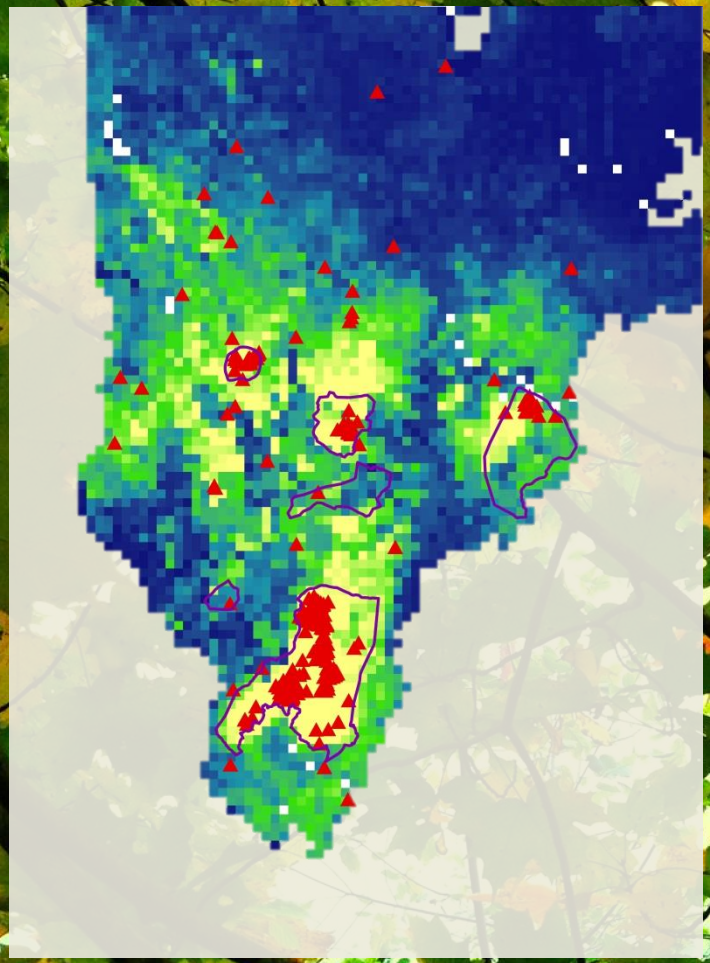


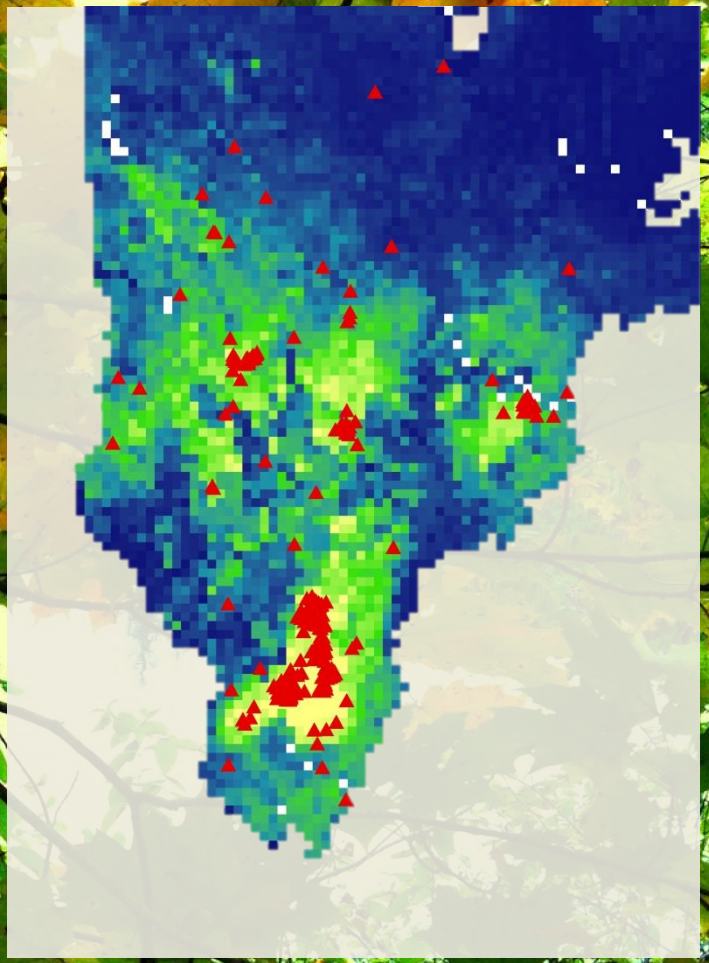
+ geology + landcover + slope + elevation + meantemp + annprecip + tempwinter

Emydoidea blandingii

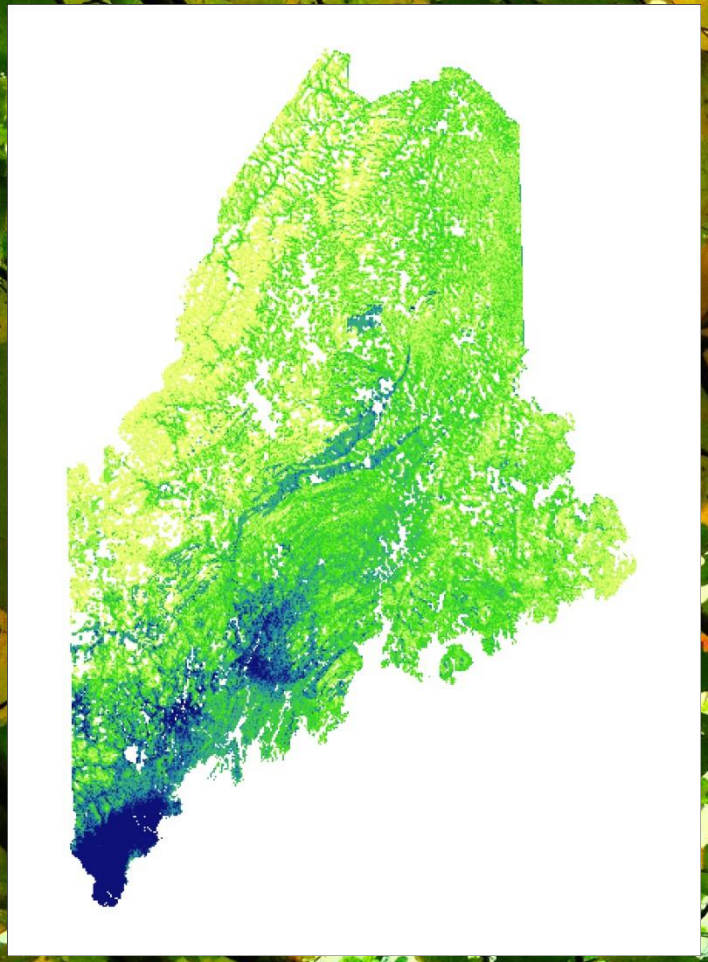


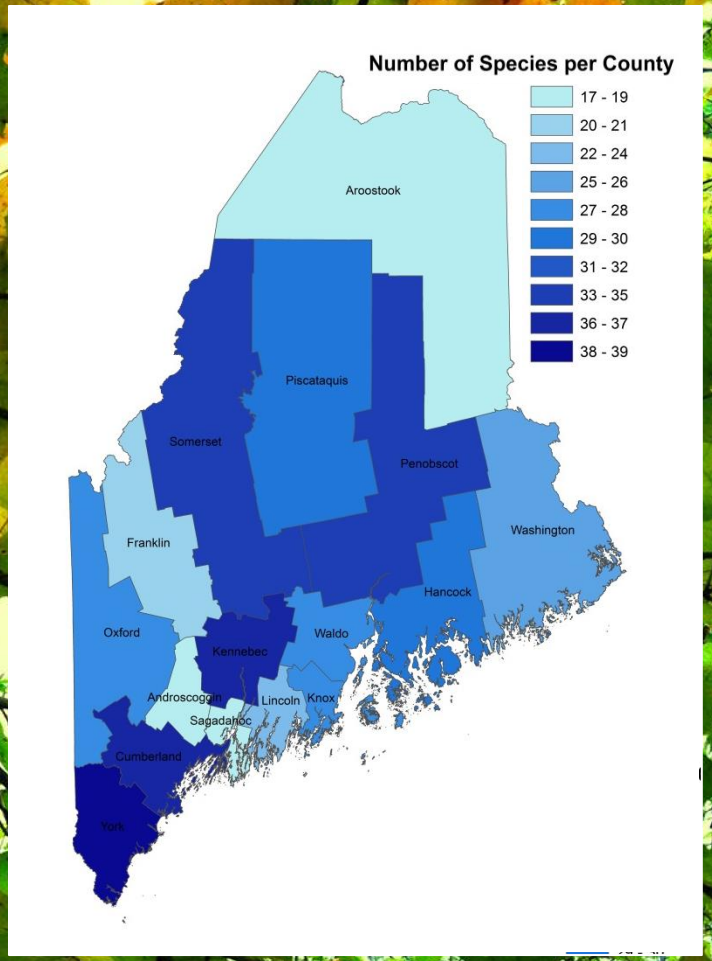
Emydoidea blandingii

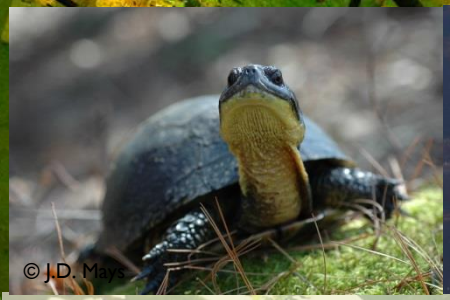




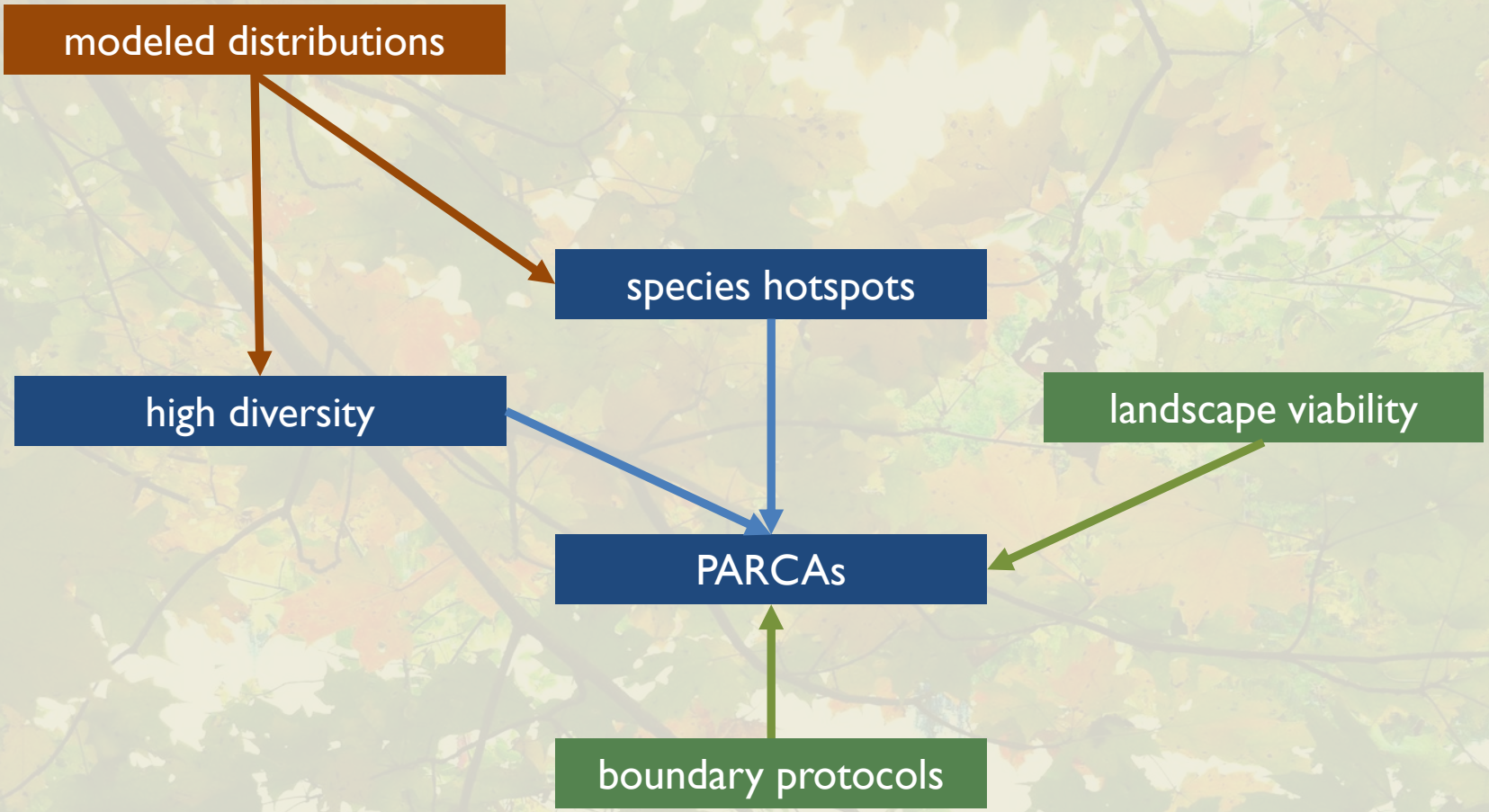
Herp diversity





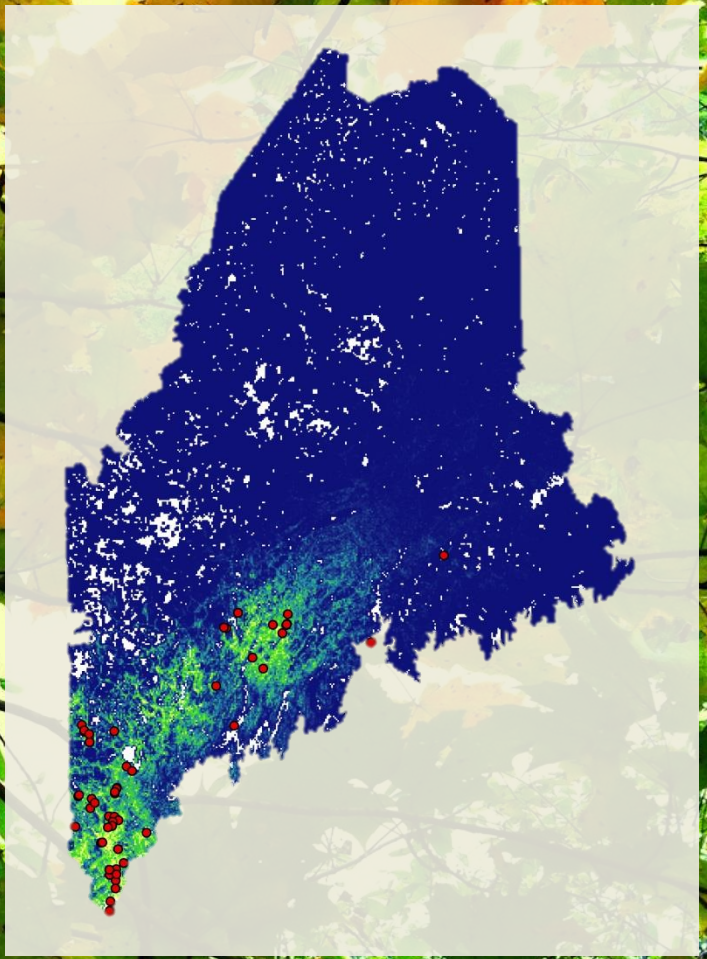


PUTTING IT TOGETHER


modeled distributions
species hotspots
high diversity
landscape viability
PARCAs
boundary protocols

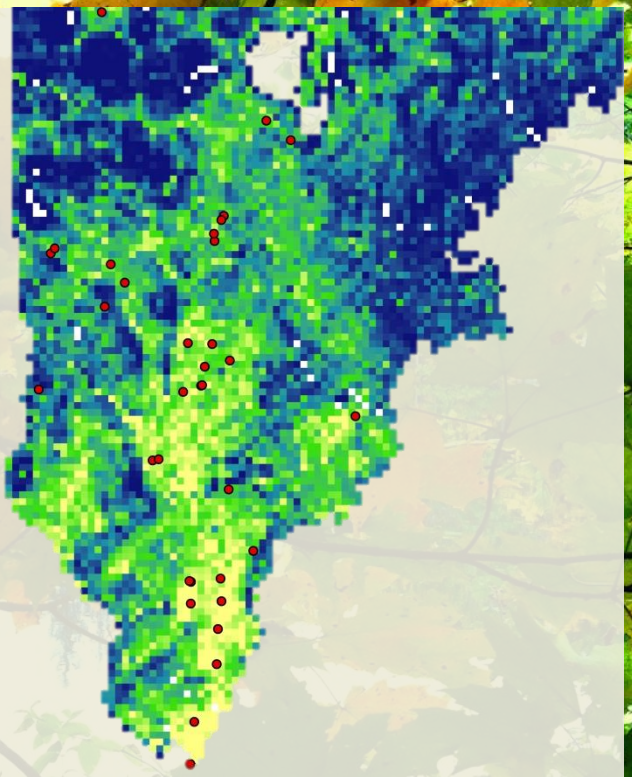
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



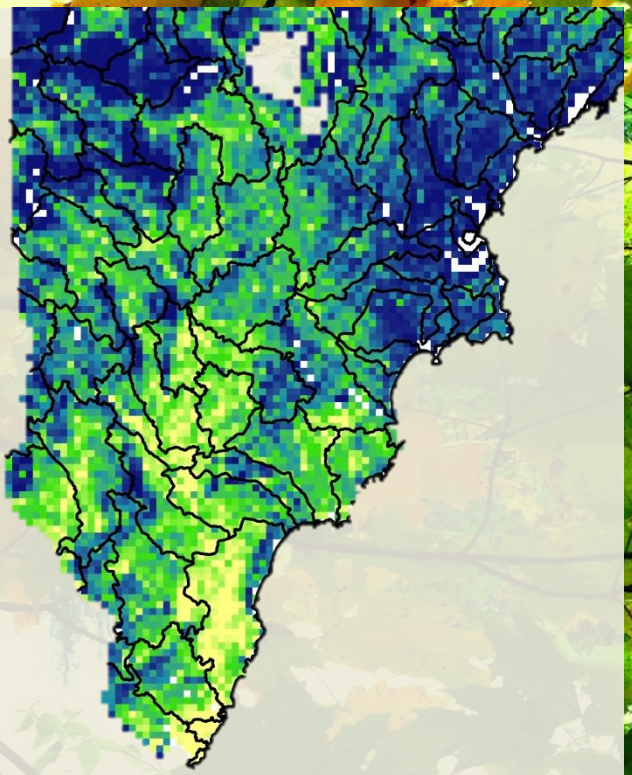
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



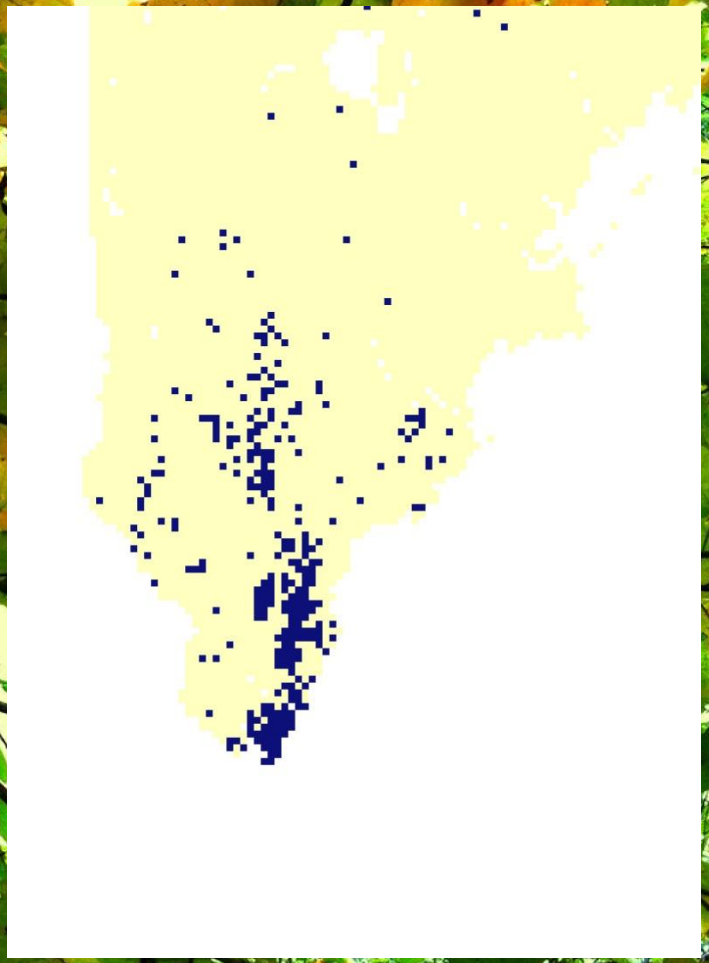
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



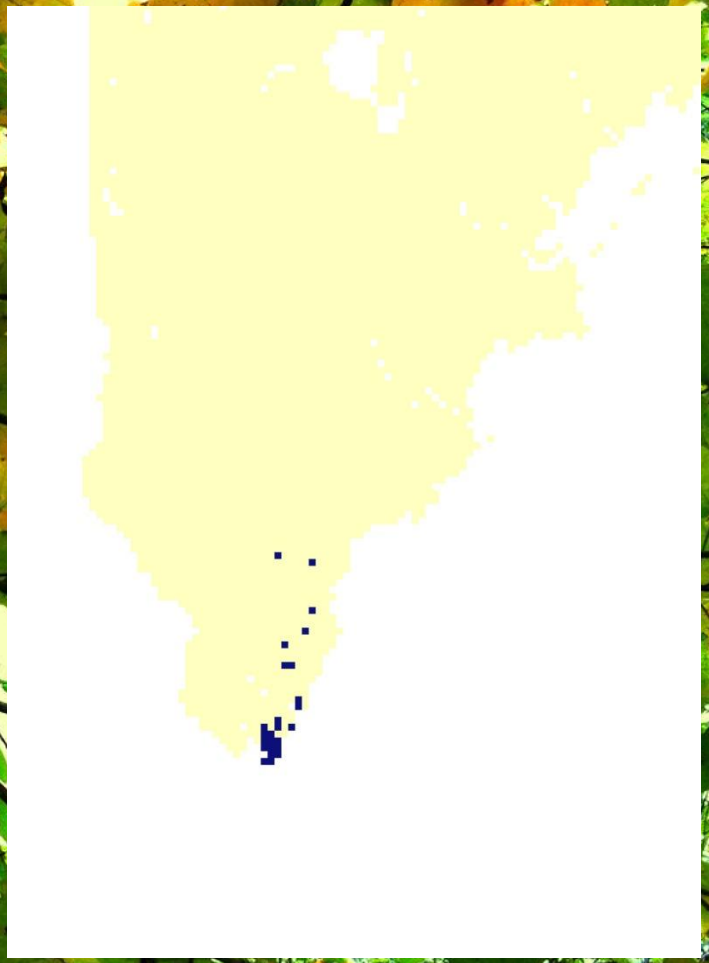
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



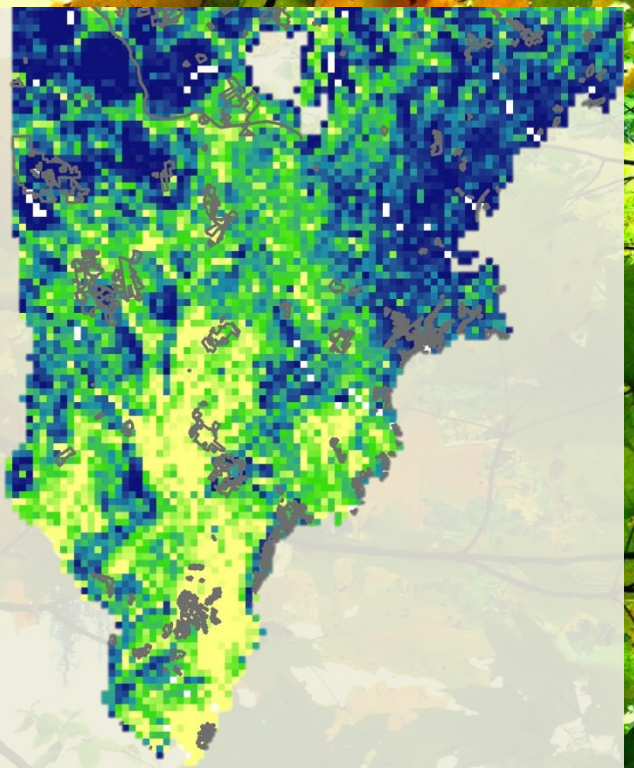
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



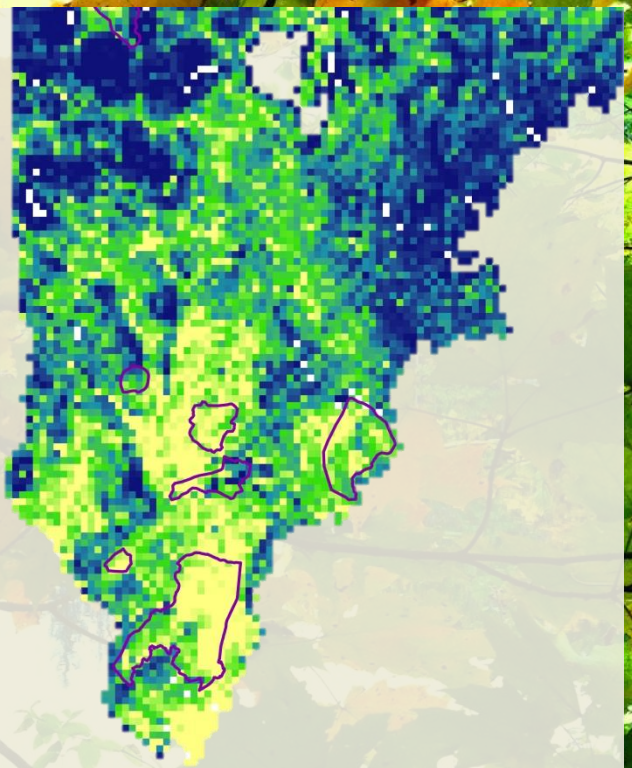
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



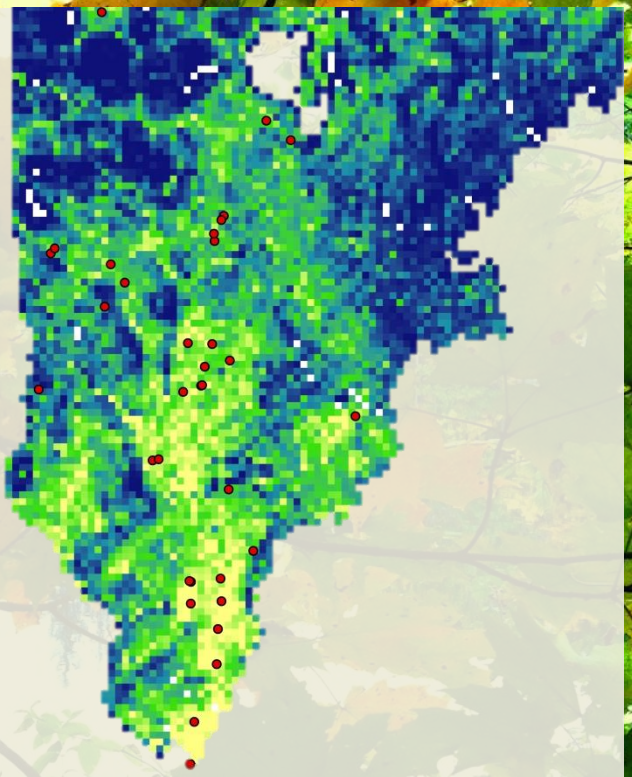
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



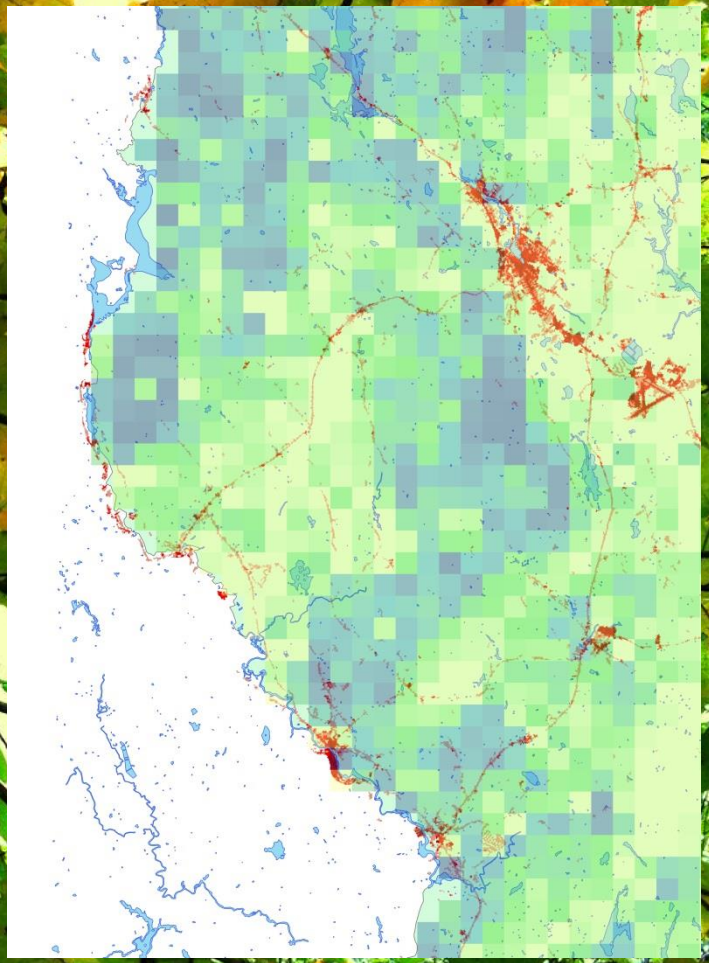
PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



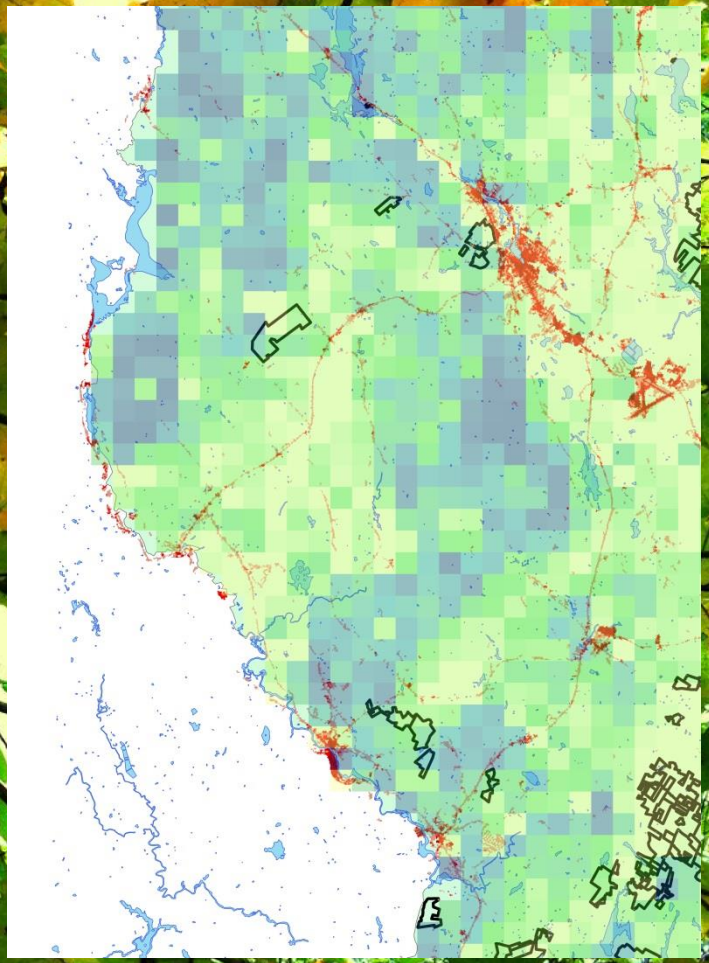
PARCAs

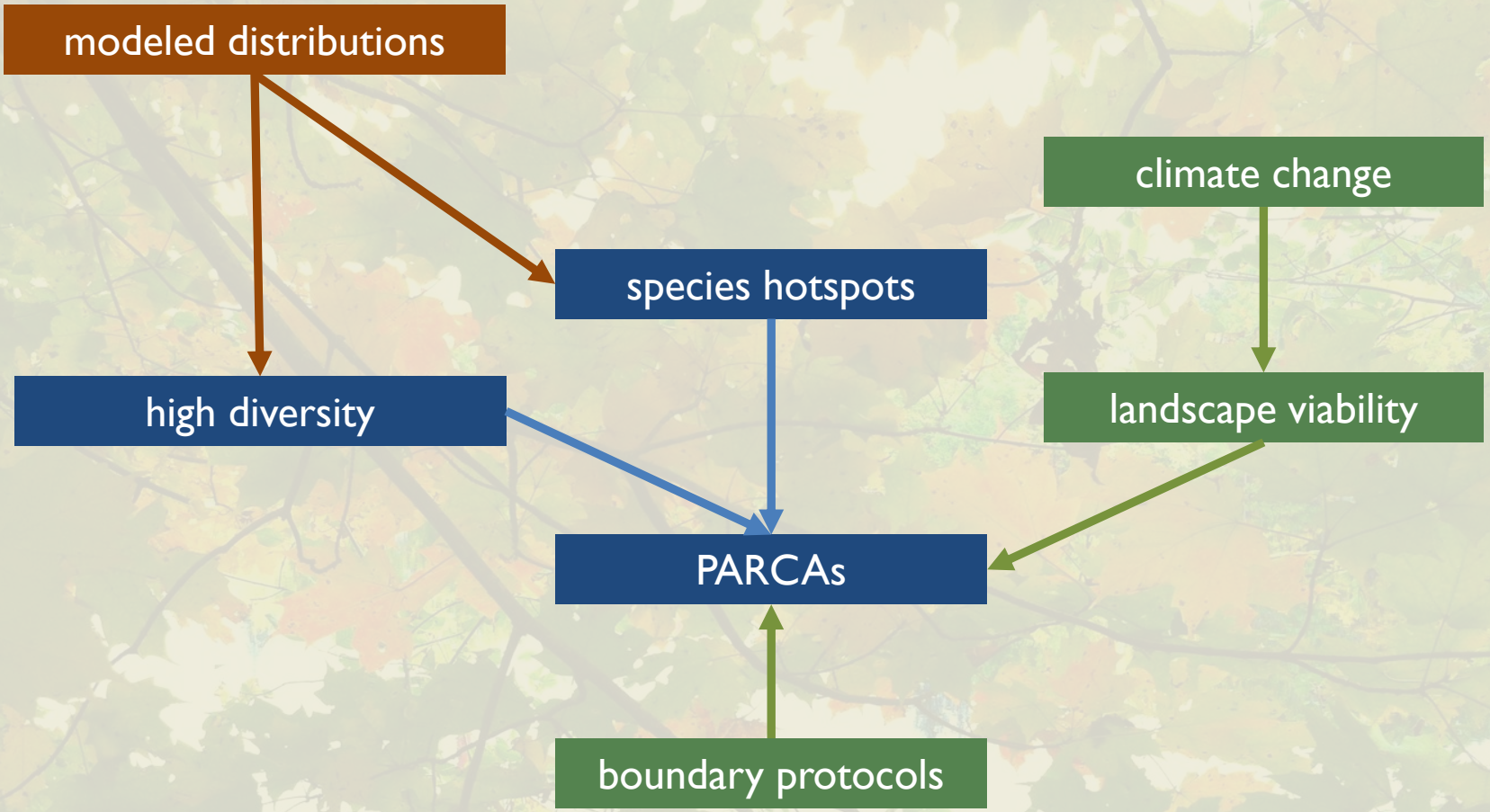
- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?



PARCAs

- watersheds?
- prob. suitable habitat?
- protected areas?
- landcover?




modeled distributions
climate change
species hotspots
high diversity
landscape viability
PARCAs
boundary protocols

Wildlife Management Institute
Washington, D.C.
U.S. Fish & Wildlife Service
Department of the Interior
State of Maine
Department of Inland Fisheries and Wildlife
1865 The University of Maine
USGS
science for a changing world
Thank you
www.coopunits.org/Maine
©Luke Groff

Determining Vulnerability of PARCAs in the North Atlantic LCC to Climate Change

Bill Sutton, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Kyle Barrett, School of Agriculture, Forest & Environmental Sciences, Clemson Univ.
Allison Moody, Department of Wildlife Ecology, Univ. Maine
Cynthia Loftin, USGS Maine Cooperative Fish and Wildlife Research Unit
Phillip deMaynadier, Maine Department of Inland Fisheries and Wildlife
Priya Nanjappa, Association of Fish &Wildlife Agencies

Talk Objectives

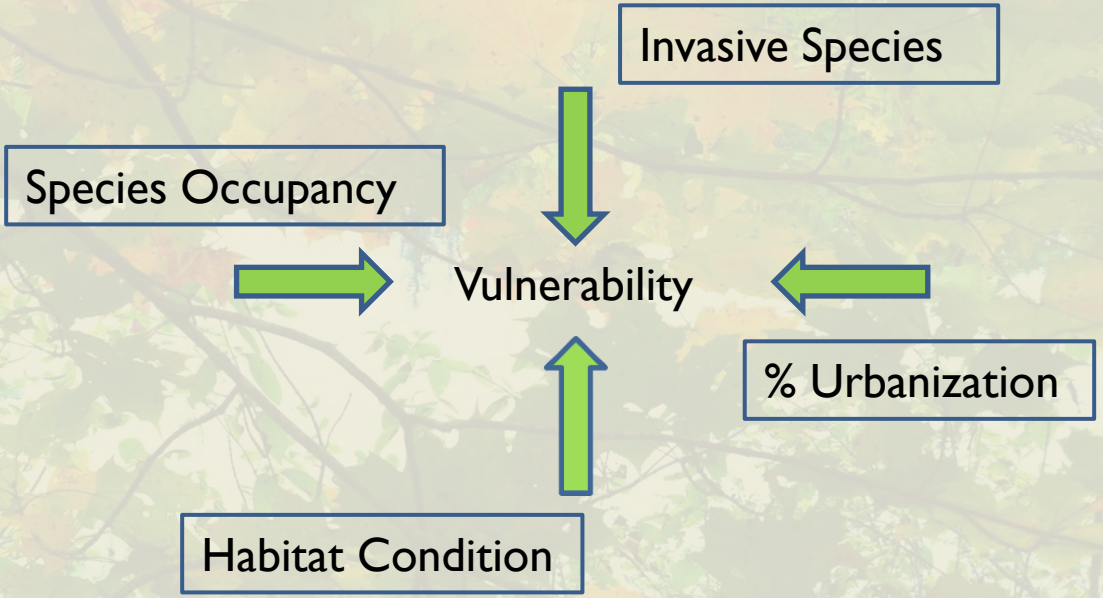
- Ecosystem vulnerability
- Vulnerability assessment
- Need for identifying PARCA vulnerability
- Demonstrate proof of concept

Ecosystem Vulnerability

- Exposure to contingencies and stressors
  -Difficulties coping with them
- Usually issue of multiple stressors
- Long-term issue requiring pro-active thinking and management

Vulnerability Assessment

- Requires monitoring of multiple aspects of the environment
- Evaluation of environmental health from multiple perspectives



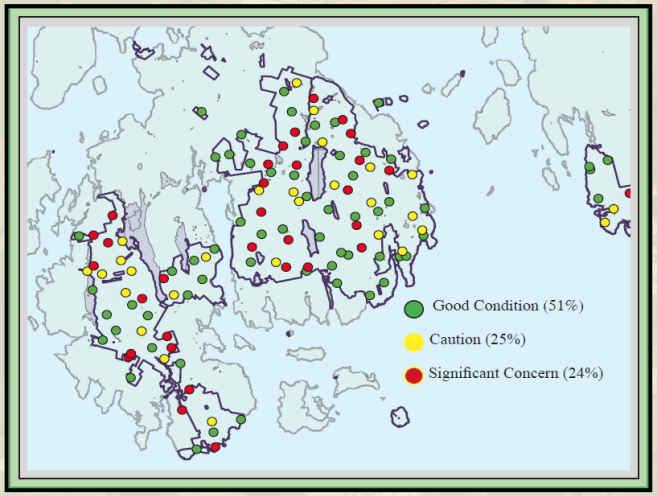
Vulnerability Assessment

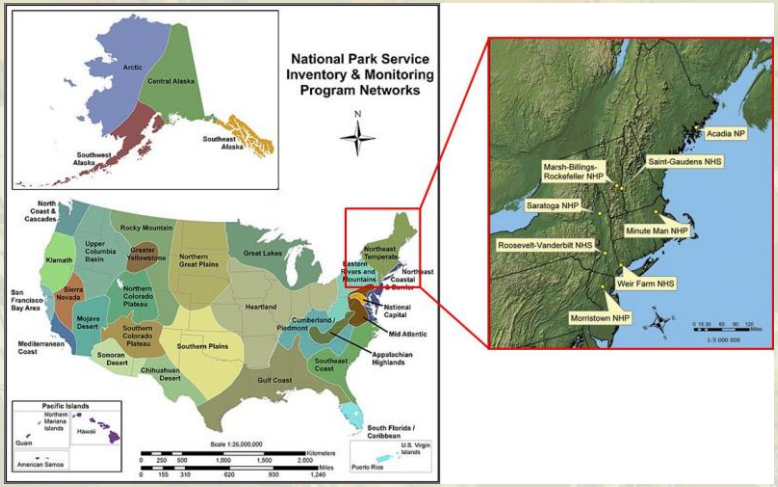
Photos by: E. Stein, D. Osborne, and B. Sutton

Vulnerability Assessment

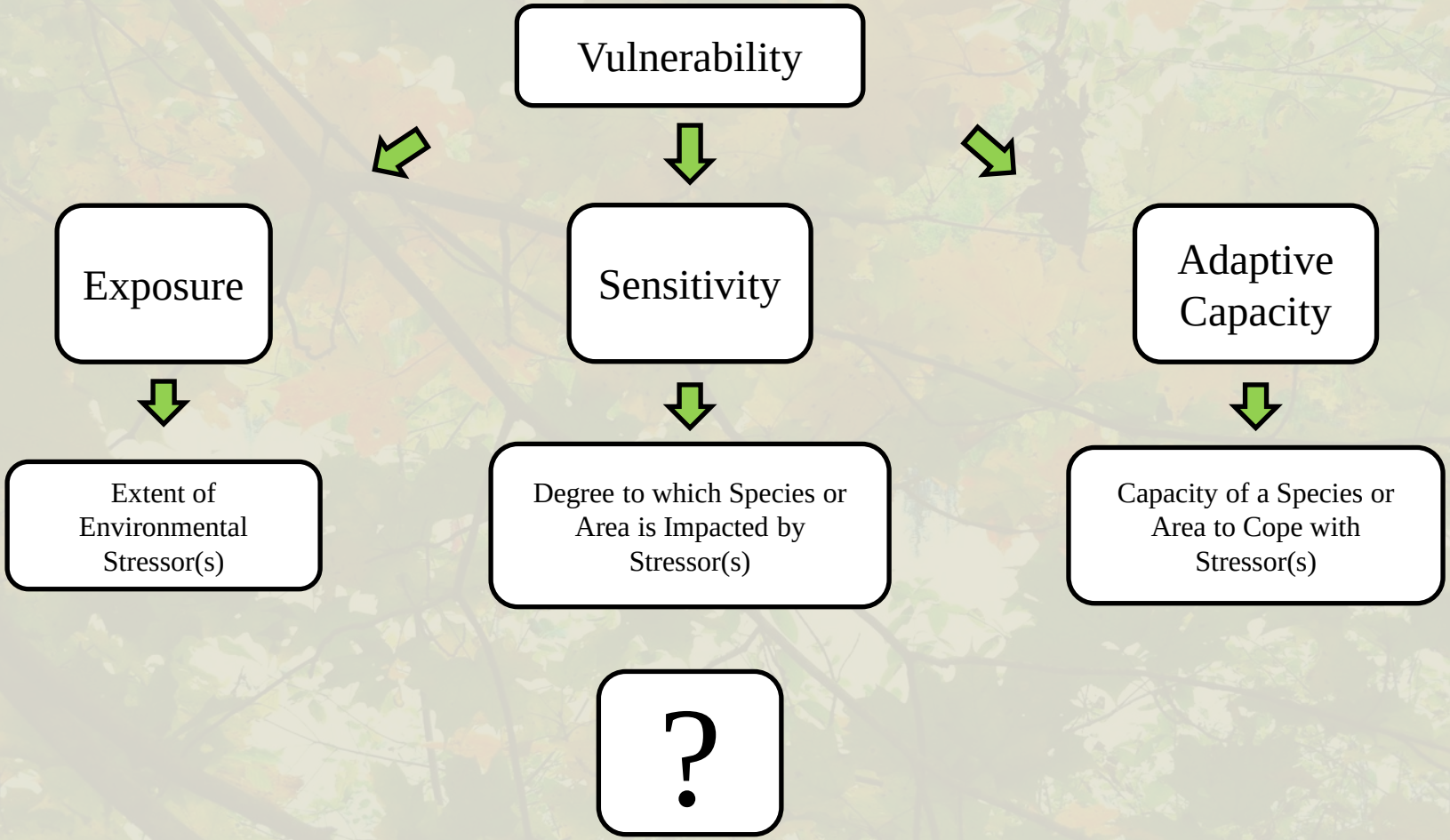
- Clear identification of monitoring objectives

- Similar to NPS vital signs monitoring program: permits transparency at multiple levels



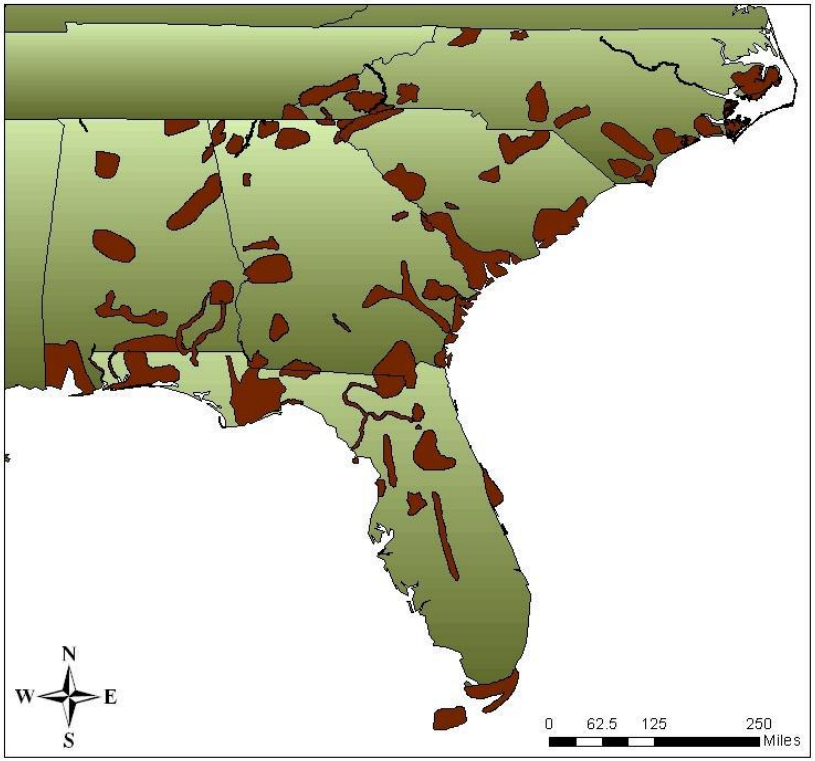


Vulnerability – What Does It All Mean?



(Kelly and Edgar 2000; Magness et al. 2011)

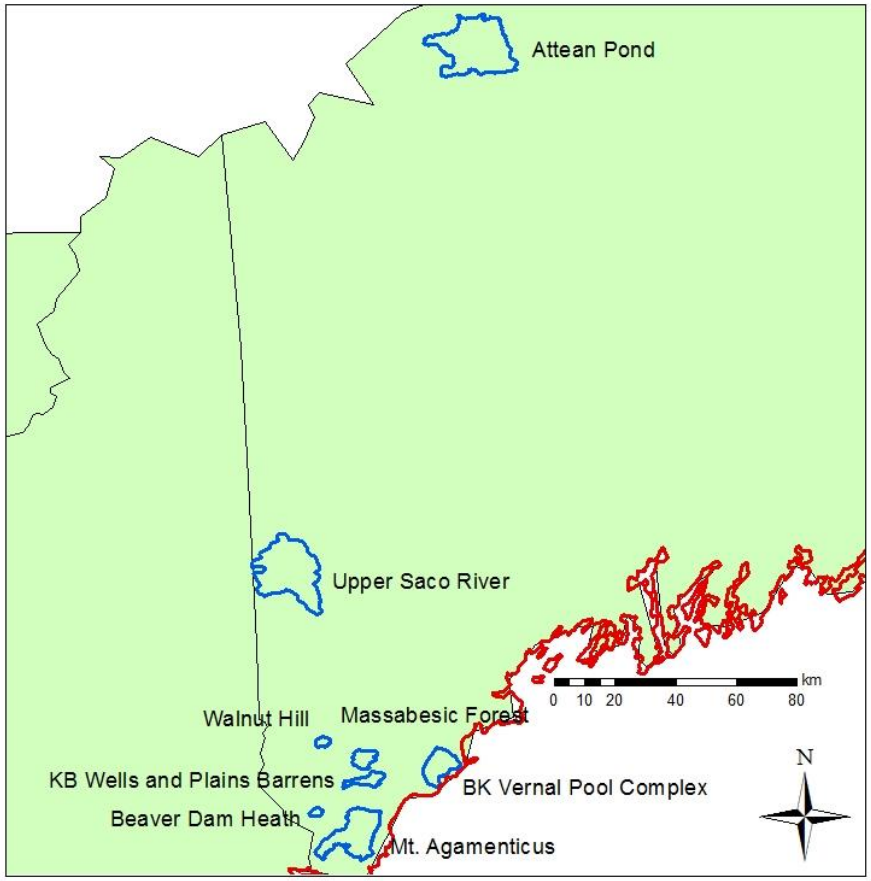
From PARCA Designation to Vulnerability



(Speare, Apodaca, and Jenkins, 2013)

- Landscape-scale conservation
- Focused on amphibians and reptiles
- "Bang for your conservation buck"
- Idea of current conservation status
- Future vulnerability unknown
- Incorporate current and projected metrics

Maine Pseudo – PARCAs



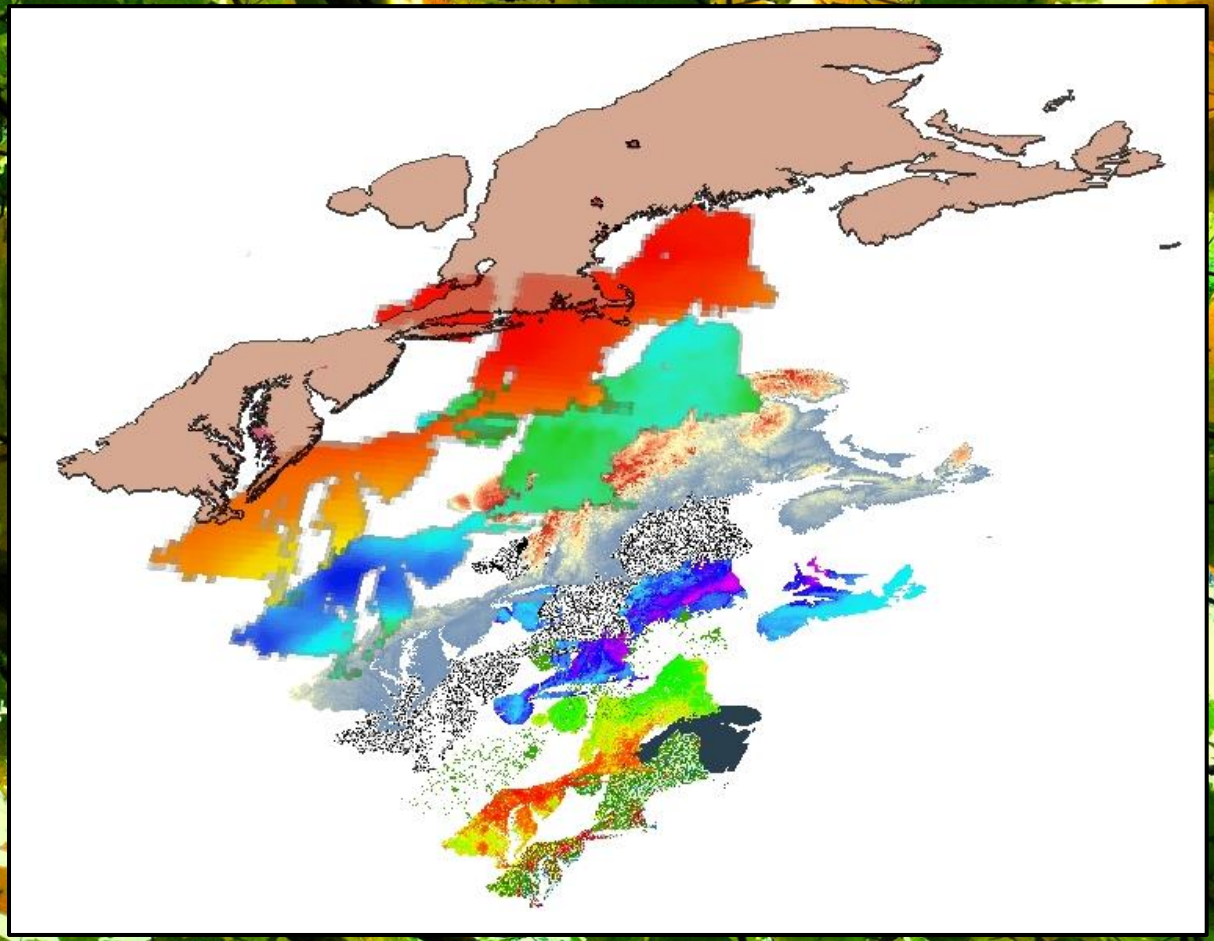
1. Attean Pond
2. Upper Saco River
3. Walnut Hill
4. Massabesic Forest
5. Kennebunk Plains and Wells Barrens
6. Biddeford Kennebunk Vernal Pool Complex
7. Beaver Dam Heath
8. Mt. Agamenticus

- Areas likely to comprise PARCAs in the future

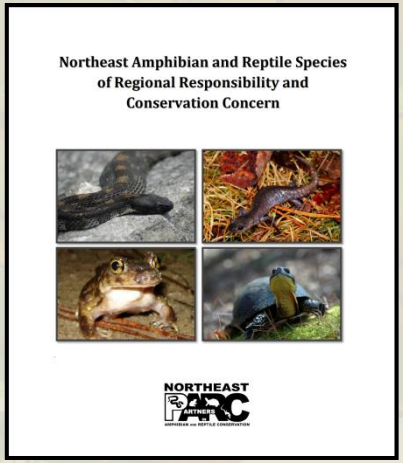
- Provide practice sites to evaluate data layers

Beginning *with* HABITAT

Vulnerability Assessment Data Layers

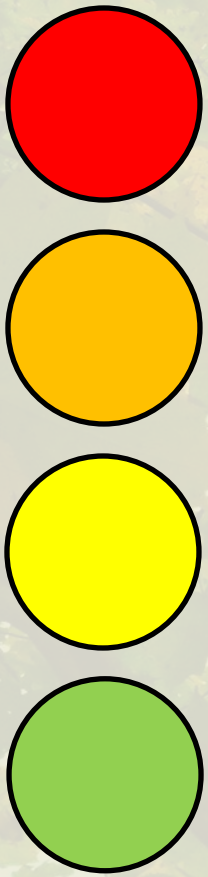


11. NALCC Boundary
10. Level III Ecoregions
9. Proj. 1m Sea-Level Rise
8. 2050 Temp. Change A2A Proj.
7. 2050 % Precip. Change A2A Proj.
6. Elevation
5. Hillshade
4. Species Distribution Models
3. Protected Areas
2. 2030 Natural Landscapes
1. 2006 LULC Data


Northeast Amphibian and Reptile Species of Regional Responsibility and Conservation Concern

NORTHEAST PARC PARTNERS

Vulnerability and Attribute Scoring



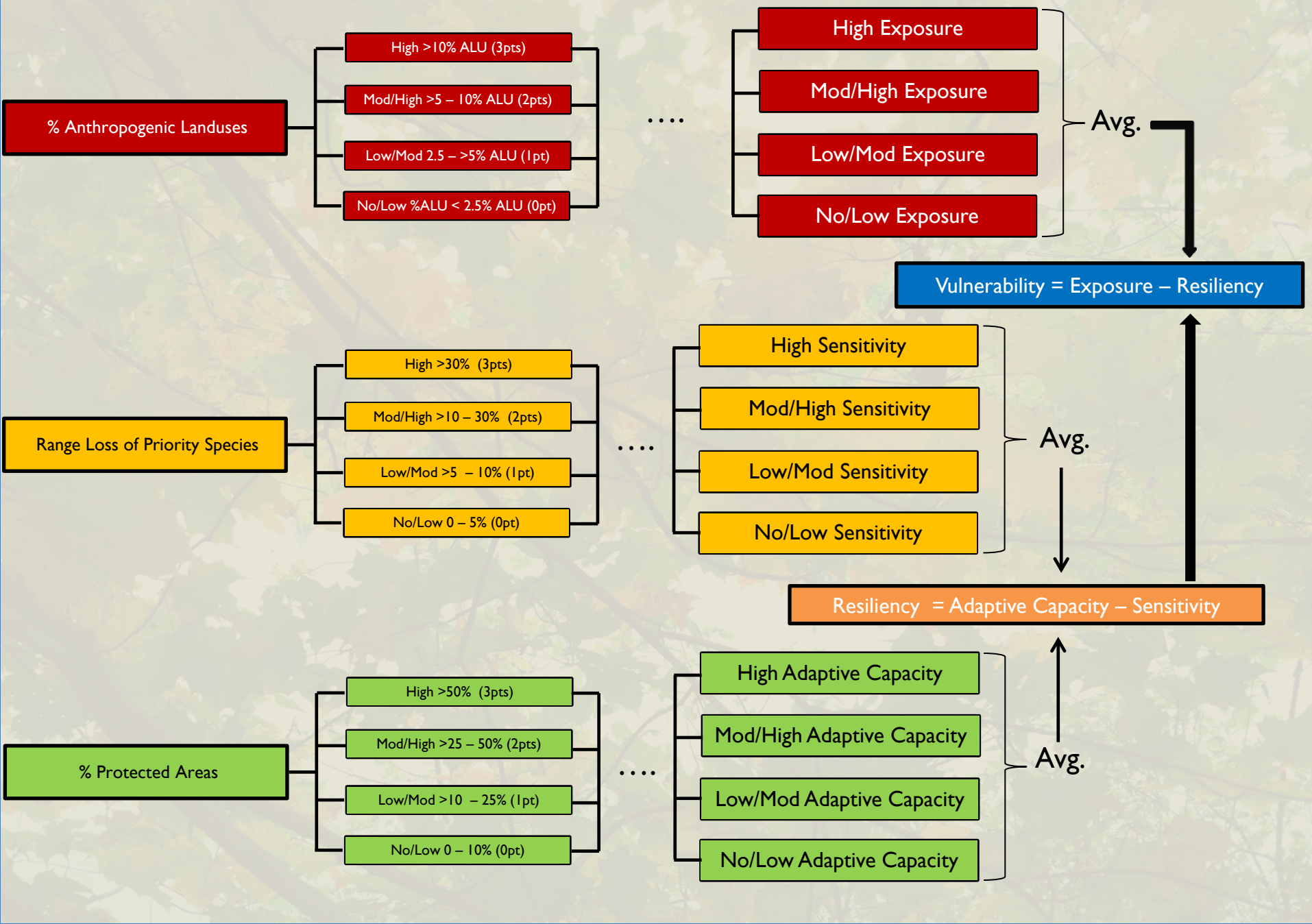
High Vulnerability

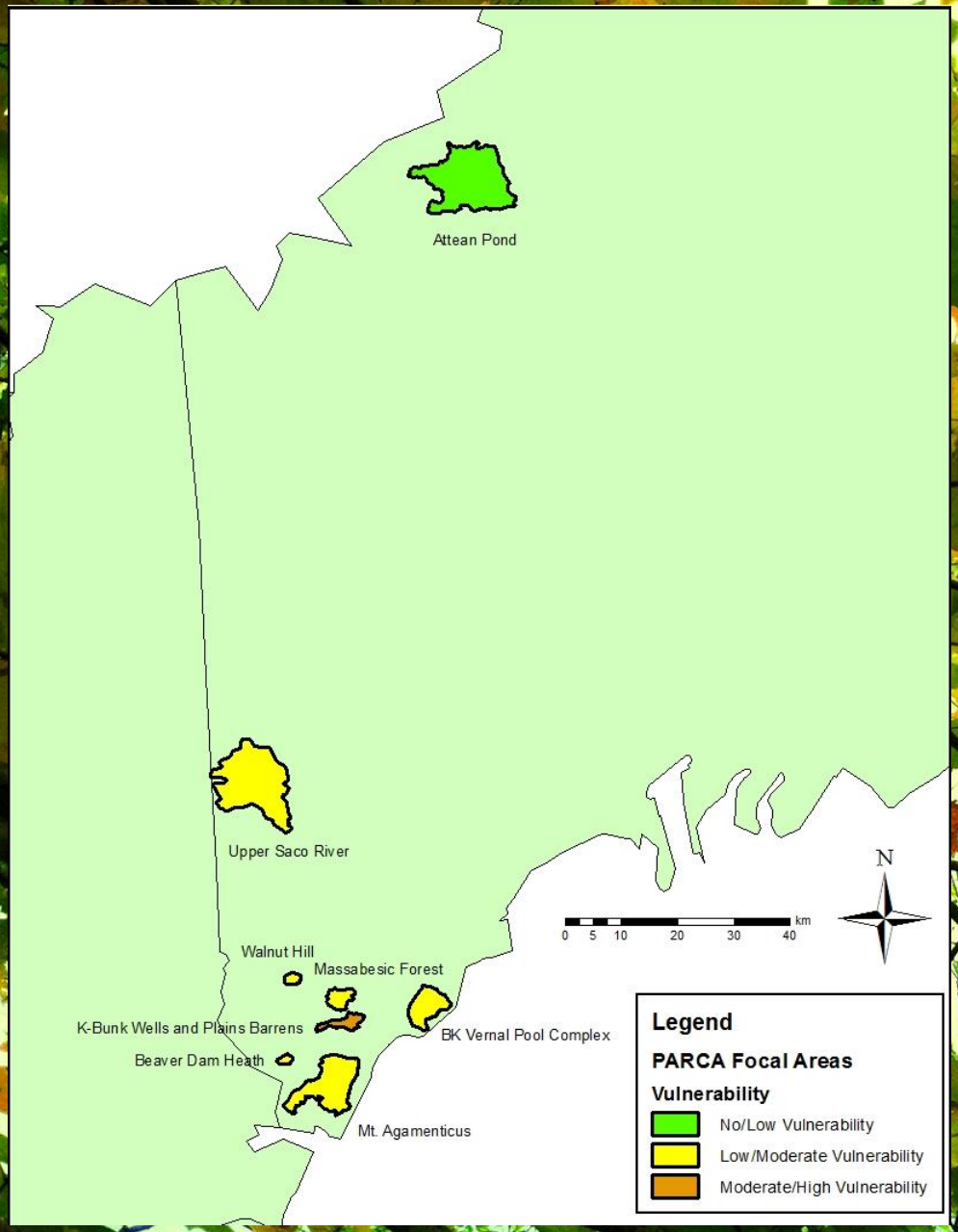
Moderate/High Vulnerability

Low/Moderate Vulnerability

No/Low Vulnerability

- Modified "stop-light" scoring analogy
- Scores for each metric standardized on a scale of 0 – 3
- Thresholds for each metric developed based on expert opinion
- Metrics averaged to determine exposure, adaptive capacity, and sensitivity


% Anthropogenic Landuses
High >10% ALU (3pts)
Mod/High >5 – 10% ALU (2pts)
Low/Mod 2.5 – >5% ALU (1pt)
No/Low %ALU < 2.5% ALU (0pt)
....
High Exposure
Mod/High Exposure
Low/Mod Exposure
No/Low Exposure
Avg.
Vulnerability = Exposure – Resiliency
Range Loss of Priority Species
High >30% (3pts)
Mod/High >10 – 30% (2pts)
Low/Mod >5 – 10% (1pt)
No/Low 0 – 5% (0pt)
....
High Sensitivity
Mod/High Sensitivity
Low/Mod Sensitivity
No/Low Sensitivity
Avg.
Resiliency = Adaptive Capacity – Sensitivity
% Protected Areas
High >50% (3pts)
Mod/High >25 – 50% (2pts)
Low/Mod >10 – 25% (1pt)
No/Low 0 – 10% (0pt)
....
High Adaptive Capacity
Mod/High Adaptive Capacity
Low/Mod Adaptive Capacity
No/Low Adaptive Capacity
Avg.



Vulnerability of the Landscape

- Eight total PARCAs assessed
- Attean Pond (Low Vulnerability)
- Six out of eight PARCAs (Low/ Moderate Vulnerability)
- One out of eight PARCAs (Moderate/ High Vulnerability)
- No High Vulnerability PARCAs

	Attean Pond	K-B Wells Plains B
VULNERABILITY		
Exposure		
• Projected Temperature Change		
• Projected Precipitation Change		
• Projected 1m Sea-Level Rise	NA	NA
• *% Urban Landuse		
Adaptive Capacity		
• Elevation Variation		
• PARCA Size		
• Hillshade		
• % Protected Areas		
• Projected Natural Landscape		
• Landscape Connectivity (%PA in Buffer)		
• Landscape Connectivity (%NL in Buffer)		
• Habitat Heterogeneity (Diversity)		
Sensitivity		
• Distance to Ecoregion Boundary		
• Loss of Climate Envelope (Priority Amphs.)		
• Loss of Climate Envelope (Priority Reps.)		
• Priority Species Endemicity		
• Management Effort (Sensitive Habitats)	NA	NA

What this Framework Does

- Provides stakeholders with a tool to evaluate PARCA vulnerability across the landscape
- Provides a method to incorporate multiple monitoring objectives as necessary
- Provides a flexible framework to alter thresholds based on biological knowledge
- Provides multiple levels of information
  - Metric level
  - Exposure, sensitivity, adaptive capacity, and resiliency
  - Vulnerability

What this Framework Does Not Do

- May not be best proxy to determine biological importance of habitats
- In current state does not say anything about climate buffering aspects of microhabitats
- Does not predict species loss, just loss of climate envelope
- Does not consider weight of variable – all aspects are equal

Future Goals

- Finalize thresholds for individual metrics
- Explore additional means to assess connectivity
- Determine the role of expert opinion – mgmt. effort
- Evaluate vulnerability of finalized PARCAs throughout the NALCC; range-wide maps
- Examine trends by state and ecoregion

Acknowledgements

- USFWS North Atlantic LCC for financial support
- NEPARC for financial and intellectual support
- S. Speare and J. Apodaca for ideas on assessing vulnerability

NORTHEAST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

LANDSCAPE CONSERVATION COOPERATIVES

North Atlantic Landscape Conservation Cooperative