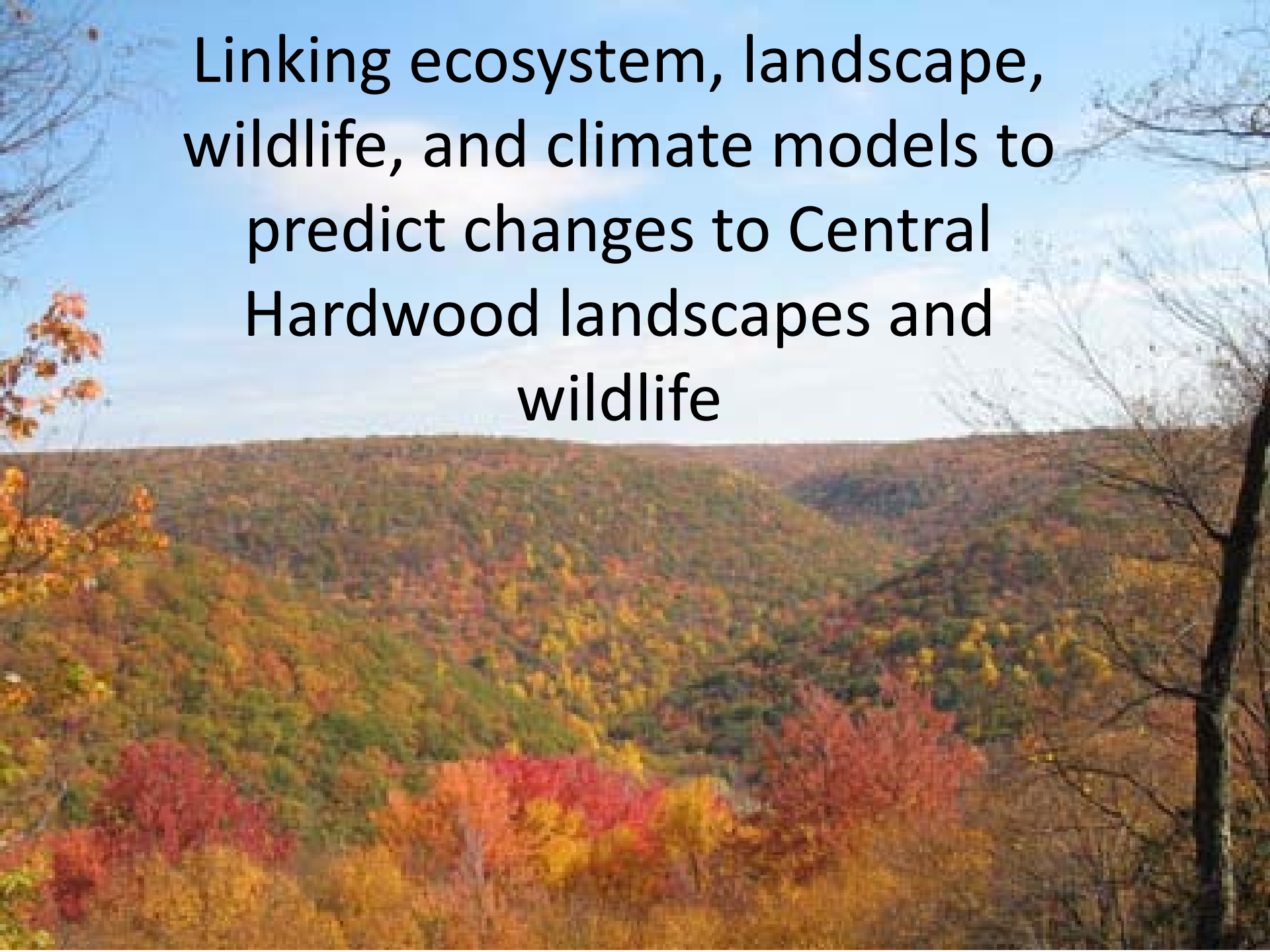

Linking ecosystem, landscape, wildlife, and climate models to predict changes to Central Hardwood landscapes and wildlife

Linking ecosystem, landscape, wildlife, and climate models to predict changes to central hardwood landscapes and wildlife

Frank Thompson, Bill Dijak, Steve Shifley	USFS Northern Research Station, Columbia MO
Hong He, Josh Millspaugh, Jeffery Schniedermann, Jaymi LeBrun	School of Natural Resources, University of Missouri
Chris Swanston, Leslie Brandt, Patricia Butler	Northern Institute of Applied Climate Science, NRS, R9
John Tirpak	USGS Gulf Coastal Plains and Ozarks LCC
Todd Jones-Farrand	USFWS Region 4, CHJV

Goal

- **Deliver the knowledge and tools needed to incorporate climate change into conservation planning for central hardwoods forest and wildlife.**

Modeling Approach

- Use an integrated modeling approach to consider
  - Alternative climate scenarios
  - Alternative forest management scenarios
  - Alternative disturbance regimes
- Impacts on
  - Tree species composition
  - Landscape pattern
  - Wildlife habitat/abundance/viability

General Approach

Down-scaled climate predictions

Ecosystem model: LINKAGES

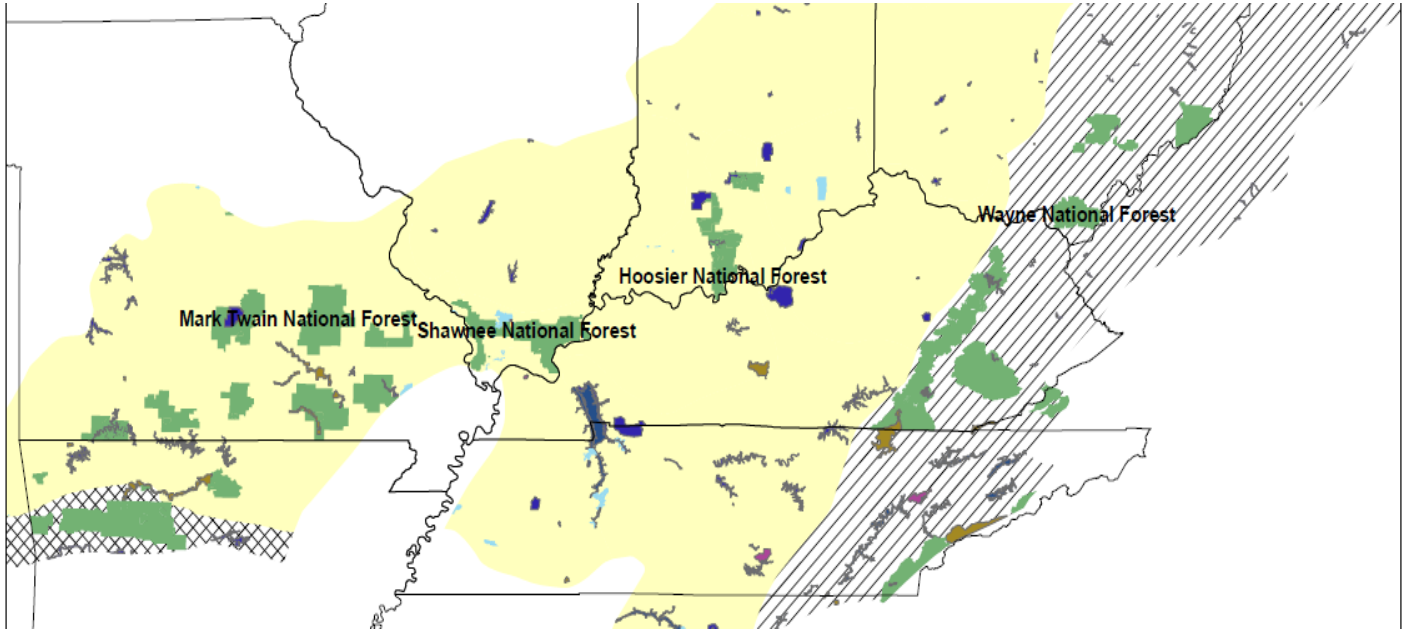
Dynamic landscape model: LANDIS

Wildlife habitat/abundance/viability models

The Central Hardwoods Climate Change Response Framework

NIACS
Northern Institute of Applied Climate Science

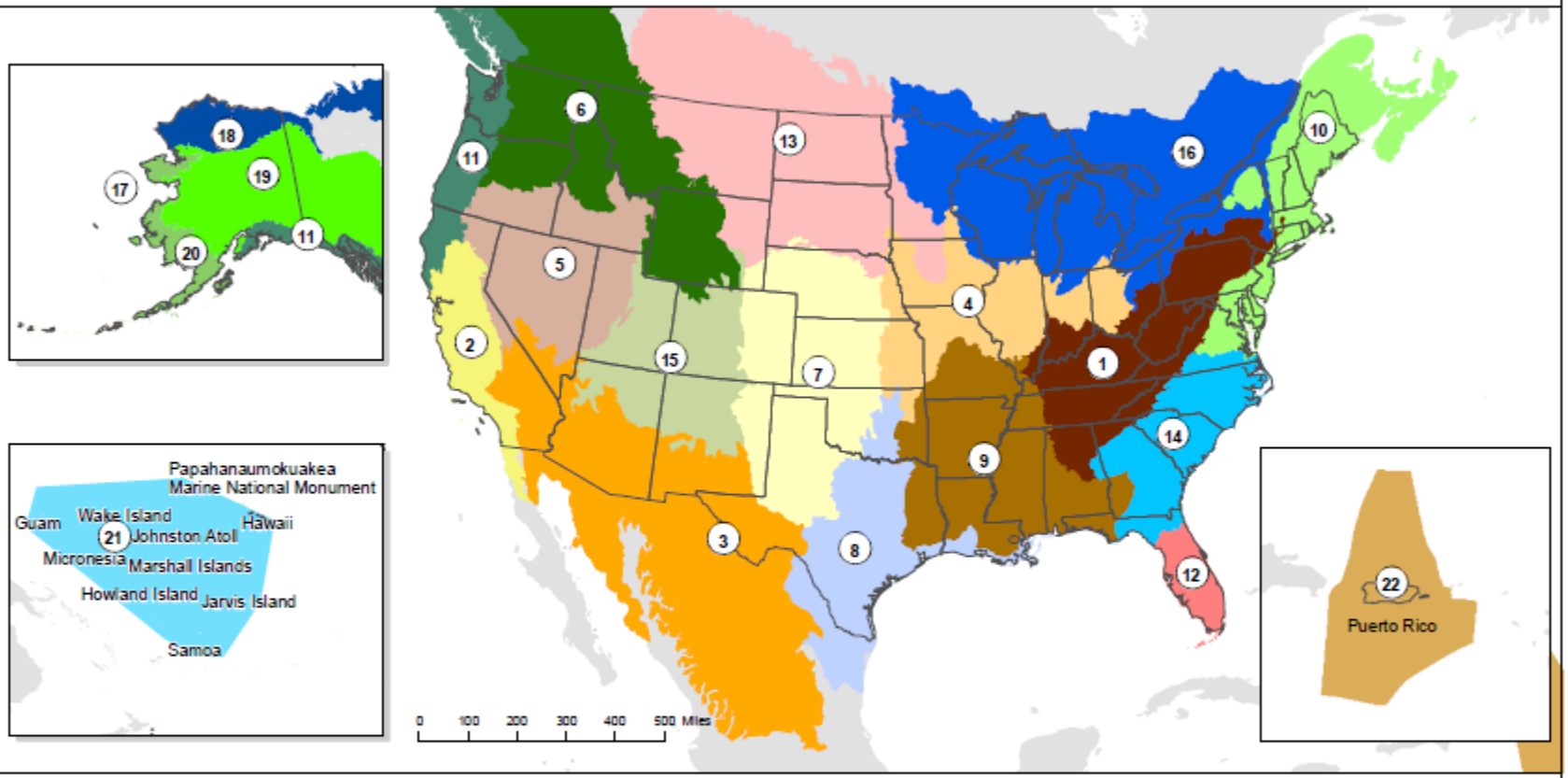
Goal: Provide an integrated set of tools, partnerships, and actions to support "climate smart" conservation and management



Partners include NIACS; Region 9, Mark Twain, Shawnee, Hoosier NF; NRS; NA; TNC, CHJV and GPO LCC; State agencies; University of Missouri

Landscape Conservation Cooperatives

USGS science for a changing world



Landscape Conservation Cooperatives

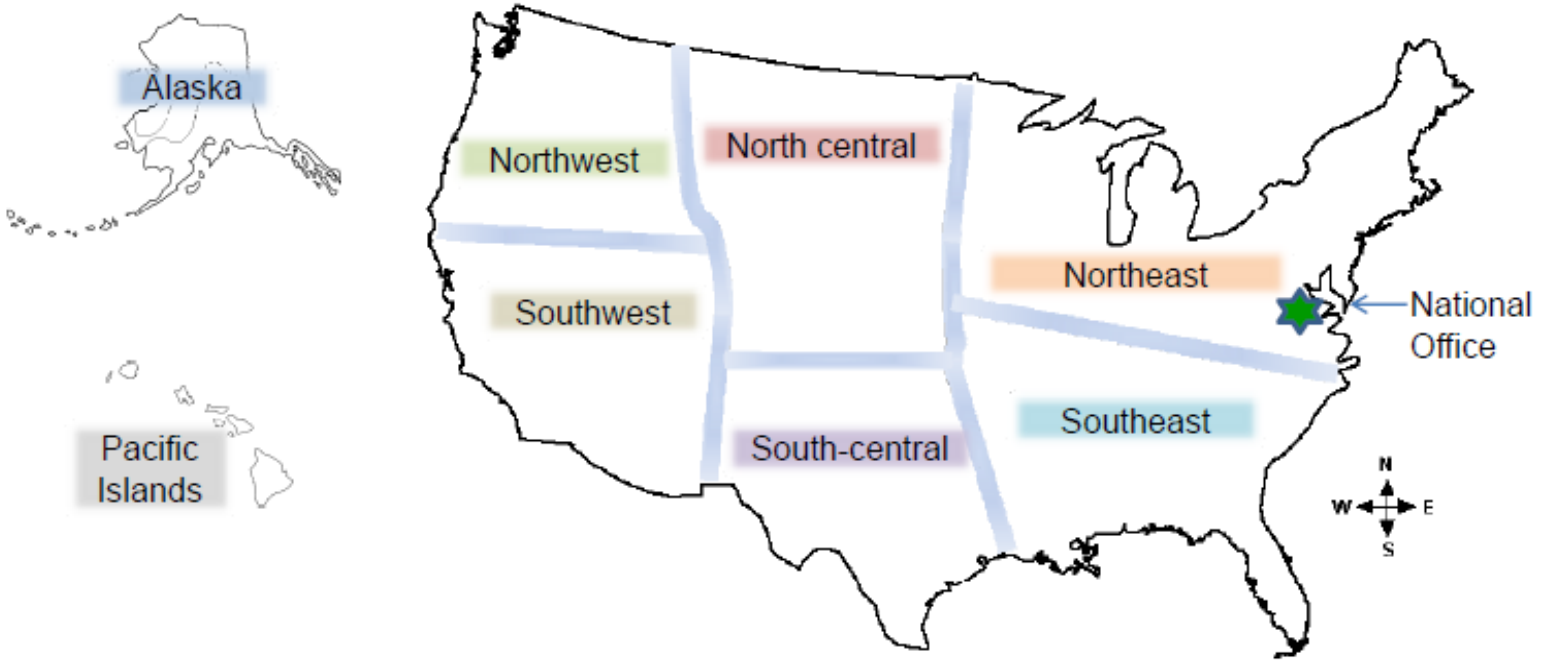
1. Appalachian
2. California
3. Desert
4. Eastern Tallgrass Prairie and Big Rivers
5. Great Basin
6. Great Northern
7. Great Plains
8. Gulf Coast Prairie
9. Gulf Coastal Plains and Ozarks
10. North Atlantic
11. North Pacific
12. Peninsular Florida
13. Plains and Prairie Potholes
14. South Atlantic
15. Southern Rockies
16. Upper Midwest and Great Lakes
17. Aleutian and Bering Sea Islands
18. Arctic
19. Northwestern Interior Forest
20. Western Alaska
21. Pacific Islands
22. Caribbean
Unclassified

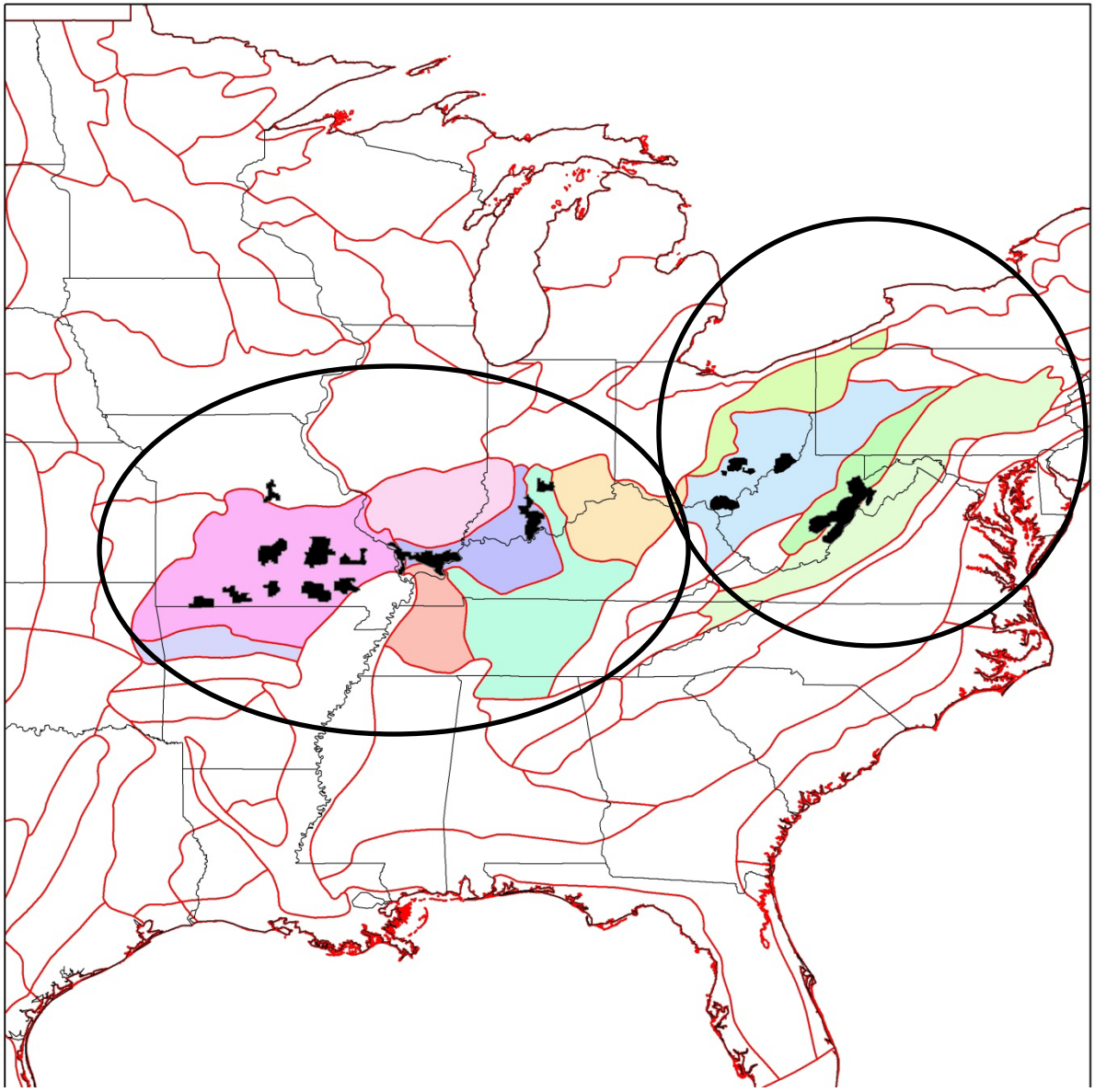
Albers Equal Area Conic NAD83
Produced by FWS, IRTM, Denver, CO
Map Date: 12142011

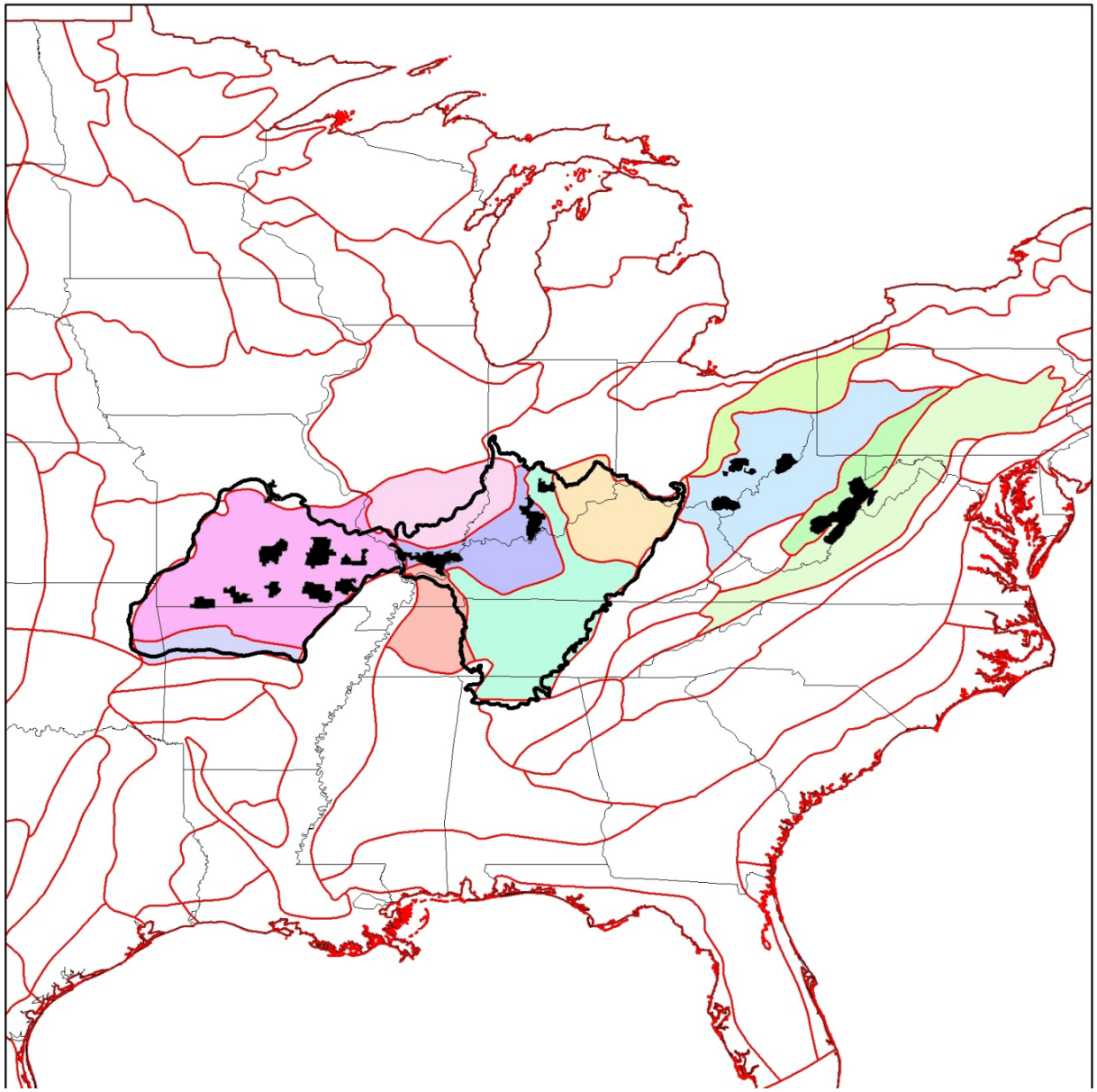
USGS
science for a changing world

National Climate Change and Wildlife Science Center

NCCWSC National & Regional Organization







Climate and Management Effects

Climate scenario	Forest management scenario			
	Current management	No harvest	Even-aged 10%	Uneven-aged 10%
Current Climate (1980-2003)	☑	☑	☑	☑
Low-range: PCM-B1	☑	☑	☑	☑
Mid-range: GFDL-A1fi	☑	☑	☑	☑
High-range: Hadley-A1Fi	☑	☑	☑	☑

- These scenarios “bracket” the range of management applied within the study area and range of climate projections.

Modeling Approach

Climate Models

Predictions:

- Temperature
- Precipitation
- Solar radiation

Ecosystem Simulation

Linkages Model

Inputs:

- Location
- Tree sps vital attributes
- **Climate**
- Soil characteristics

Tree biomass at yr 10

Landscape Simulation

LANDIS Model

Inputs:

- Species establishment
- Seed dispersal
- Vegetative reproduction
- Longevity
- Shade tolerance
- Fire tolerance
- Disturbance regime
- Management regime

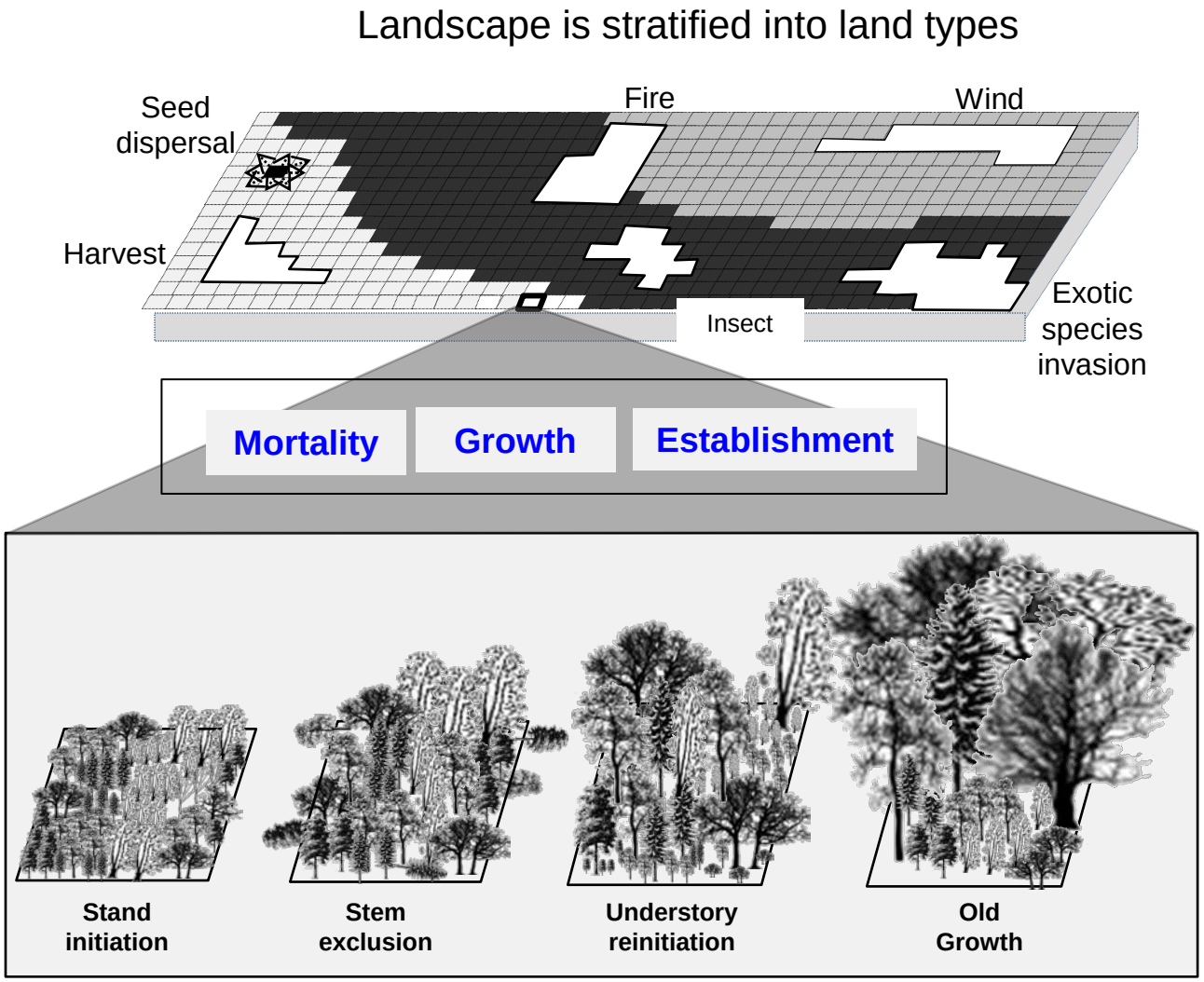
LINKAGES

- Simulates ecosystem processes by integrating soil, climate, and species data.
- Uses data on:
  - Climate: Daily temp, precip, solar radiation, wind, growing season degree days
  - Soils: Rock, clay, sand, organic matter, nitrogen, field capacity, wilting point
  - Tree species: maximum height, longevity, maximum dbh, ……

Early results from LINKAGES

- As climate warming predictions become more extreme (i.e. Current to GFDL to Hadley):
  - Oaks (red, white, black) and other deciduous species decrease in biomass at year 30
  - Eastern redcedar, loblolly pine, and shortleaf pine increase in biomass at year 30

LANDIS PRO Design



Landscape-level

- Fire/fire suppression
- Wind/hurricane/ice storm
- Insects
- Diseases
- Exotic species invasion
- Harvest/silverculture
- Fuel treatment

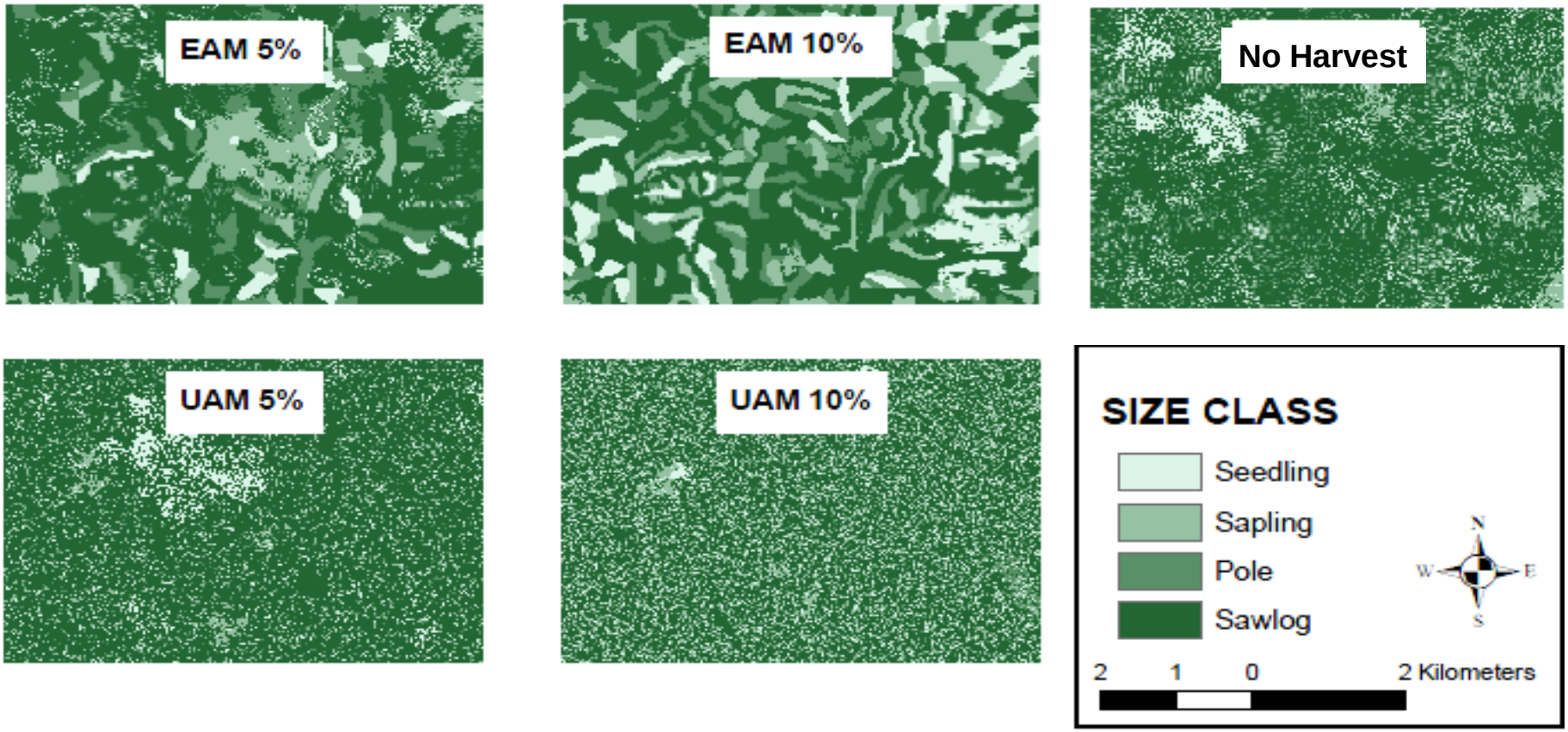
Tree species-level

- Longevity/Maturity
- Shade tolerance
- Maximum DBH
- Average seed numbers
- Dispersal distance
- Fire tolerance
- Disturbance susceptibility

Stand/pixel-level

- Development stages
- Competition for growing space
- Regulate species level processes

Management and disturbance effects on tree size class distribution at year 100



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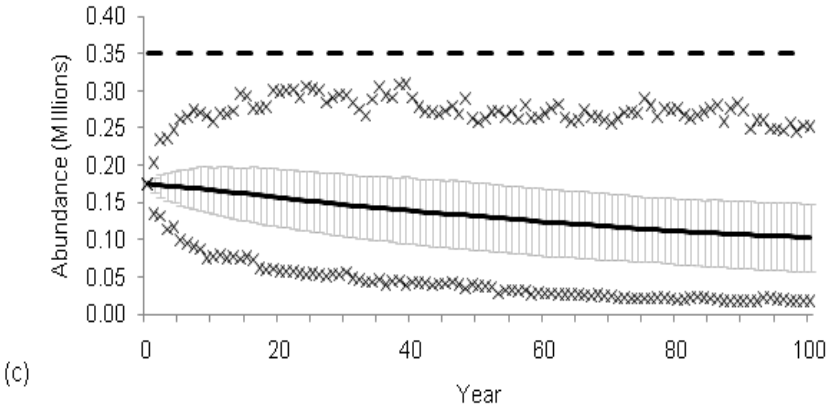

USDA

United States Department of Agriculture

Forest Service

Northern Research Station

General Technical Report NRS-49

Multiscale Habitat Suitability Index Models for Priority Landbirds in the Central Hardwoods and West Gulf Coastal Plain/Ouachitas Bird Conservation Regions

John M. Tirpak
D. Todd Jones-Farrand
Frank R. Thompson, III
Daniel J. Twedt
William B. Uihlein, III

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Extension of landscape-based population viability models to ecoregional scales for conservation planning

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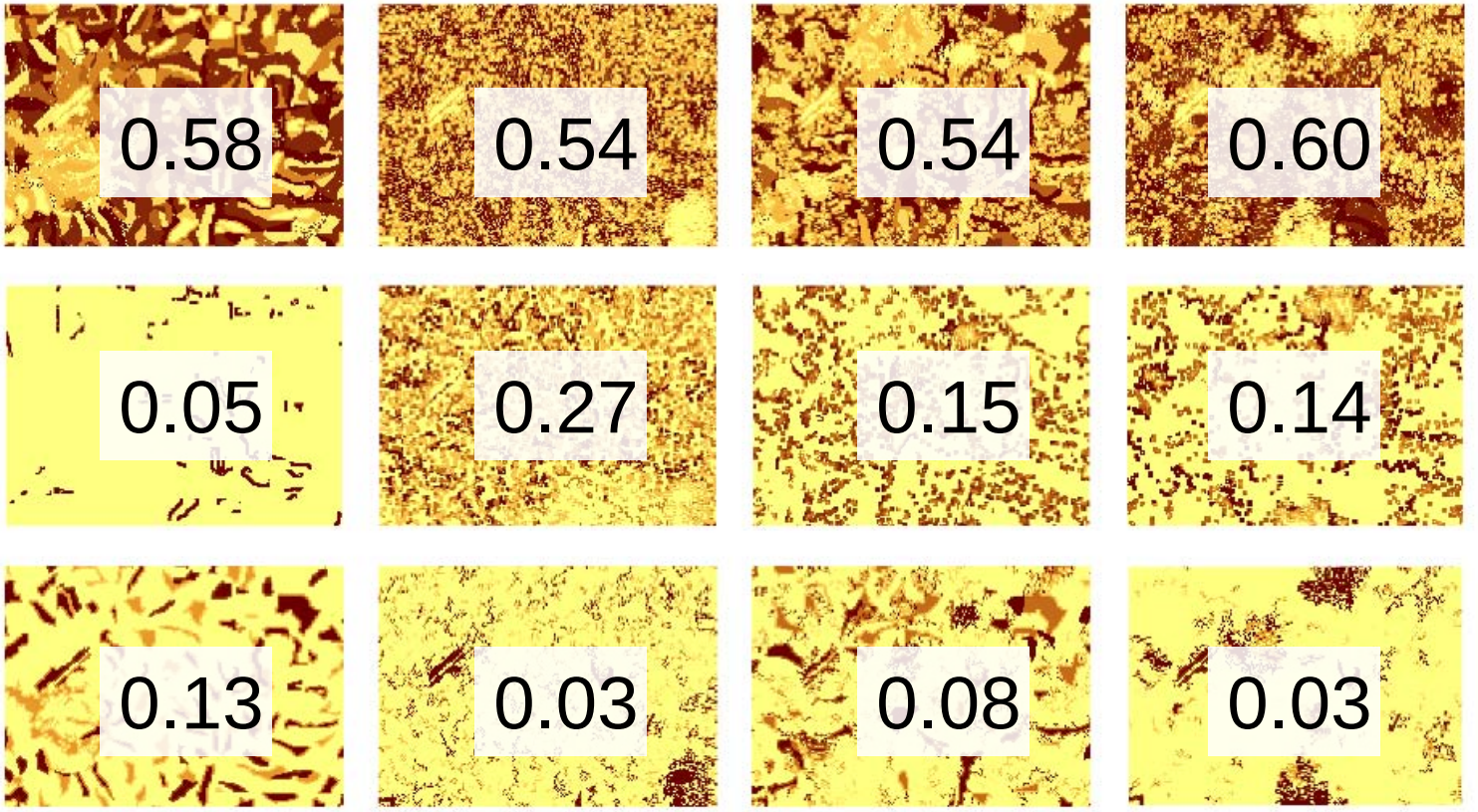
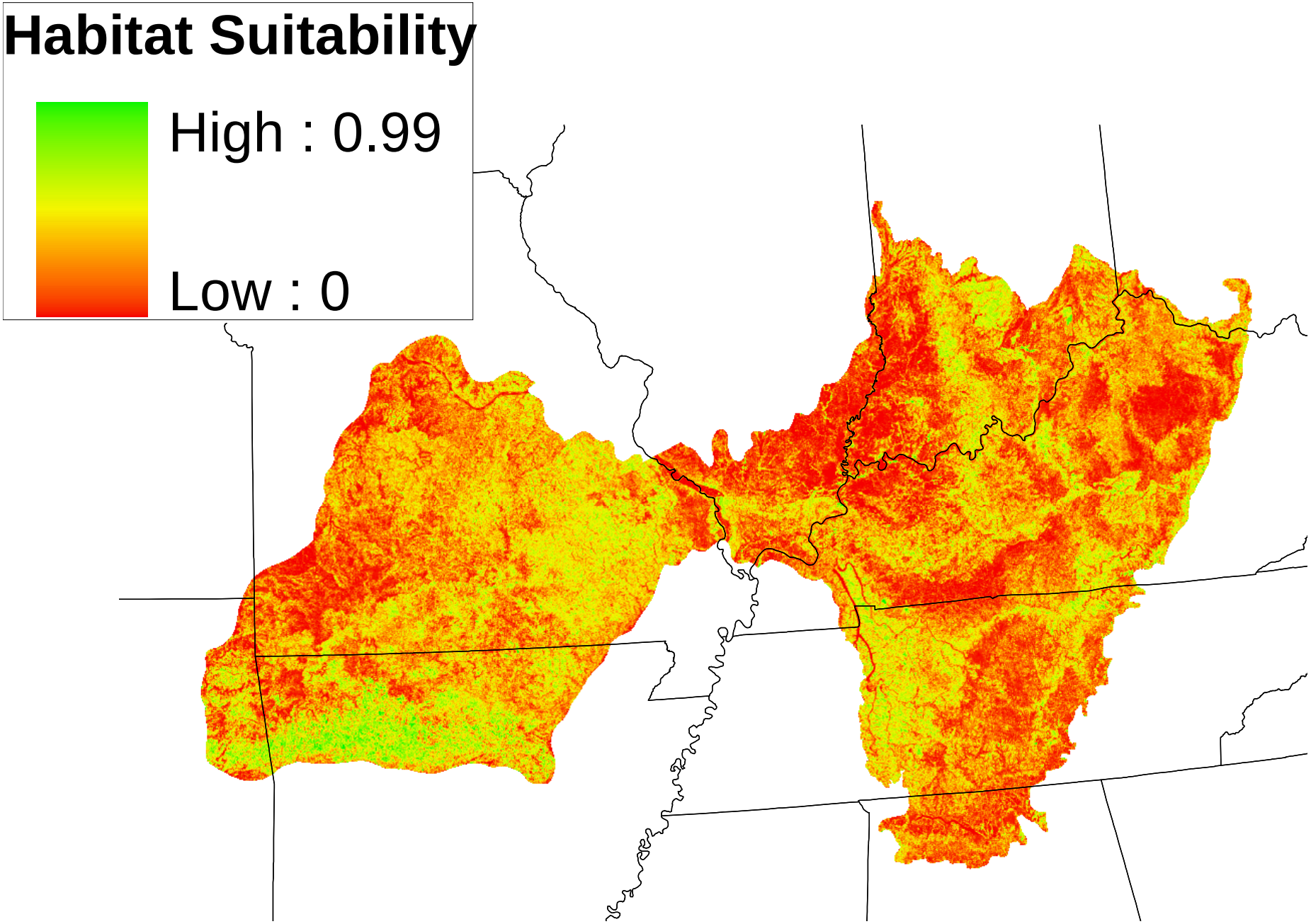
ARTICLE INFO

ABSTRACT

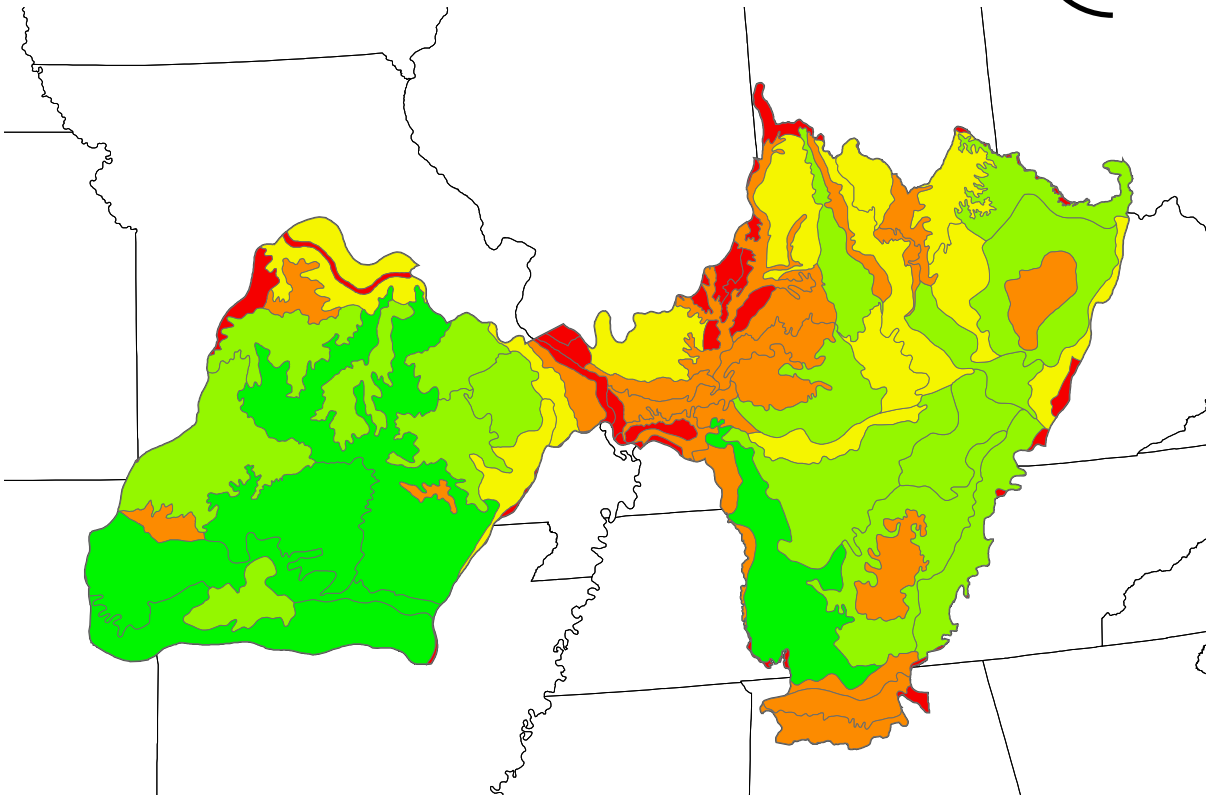
Habitat suitability



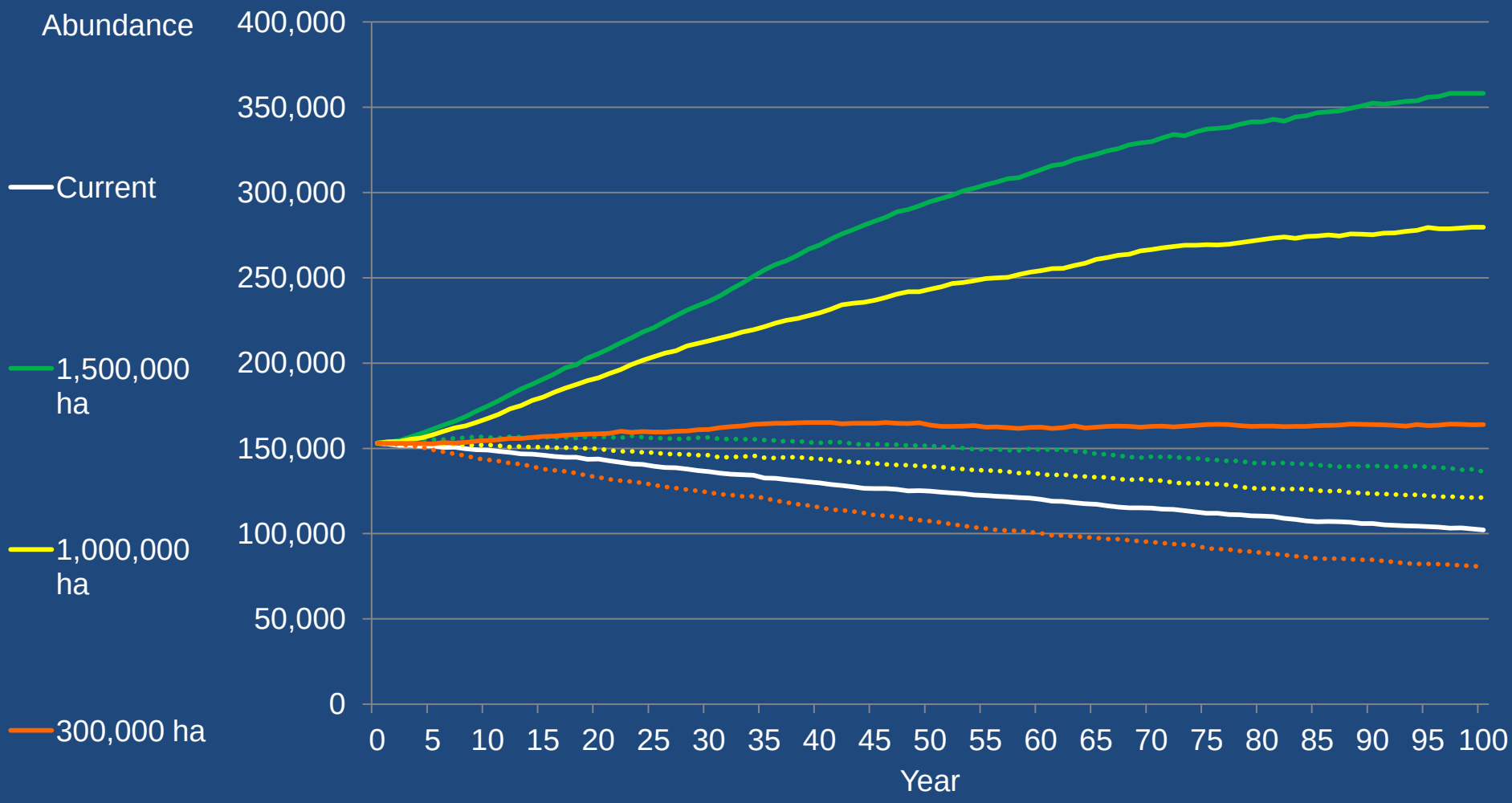

Habitat Suitability
High : 0.99
Low : 0

Calculate vital rates for each patch and project populations

$$\begin{pmatrix} m_1 S_0 & m_1 S_1 \\ S_0 & S_1 \end{pmatrix}$$



Projected response of regional PRAW to afforestation efforts



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