How Much Restoration & Where?

Using structured decision making to turn landscape priorities into efficient adaptation strategies in the Ozarks

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NCER

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GCPO

Steering Committee

State Wildlife Agencies

- AL DCNR, AGFC, FFWCC, KDFWR, LDWF, MDWFP, MDC, ODWC, TWRA, TPWD

Federal Agencies

- NOAA, NPS, USACE, USFWS, USFS, USGS

NGOs

- DU, NBCI, TNC (ABC, TCF)

Universities

- MS State, (Auburn)

The GCPO aims to *define, design & deliver* landscapes capable of sustaining desired natural and cultural resources

Vision

Our vision of success

Our vision is to ensure natural and cultural landscapes capable of sustaining healthy ecosystems, clean water, fish, wildlife, and human communities in the 180-million-acre Gulf Coastal Plains & Ozarks region through the 21st century.

Mission

Our GCPO LCC mission

The mission of the Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative is to define a shared vision for sustainable natural and cultural resources in the face of a changing climate and other threats; design strategies to achieve that vision; and deliver results on the ground through leadership, partnerships, contributed resources, evaluation and refinement over time.

SHC Element	Sub-element/Product	Gulf Resources
Biological Planning	Biological Planning Units	
	Priority Species	
	Population Objectives	
	Limiting Factors	
	Species/Habitat Models	
Conservation Design	Landscape/Habitat Assessment	
	Assessment of Conservation Estate	
	Decision Support Tools	
	Habitat Objectives	
	Integrate Multiple Species Objectives	
Conservation Actions	Program Objectives	
	Habitat Delivery Mechanisms	
Outcome-based Monitoring	Conservation Tracking System	
	Habitat Inventory and Monitoring Program	
	Population Monitoring Program	
Assumption-driven Research	Species/Habitat Model Assumptions	
	Conservation Treatment Assumptions	
	Keyfactor/Sensitivity Analyses	
	Spatial Data Analyses	

Science

Delivery

Science

Elements of the Problem

Large Region

– Restoration on private lands

Complexity

– Cumulative impacts/responses

– Conflicting objectives

Uncertainty

– Present & Future changes

Ambiguity

– Sustainable, landscapes, etc.

Discontinuity

– Data doesn't match objectives

Solutions to the Problem

Clear Objectives

– What & How much

Transparent Assumptions

– Species-habitat relationships

– Current conditions

– Expected changes

Strategic Framework

– Learn by doing

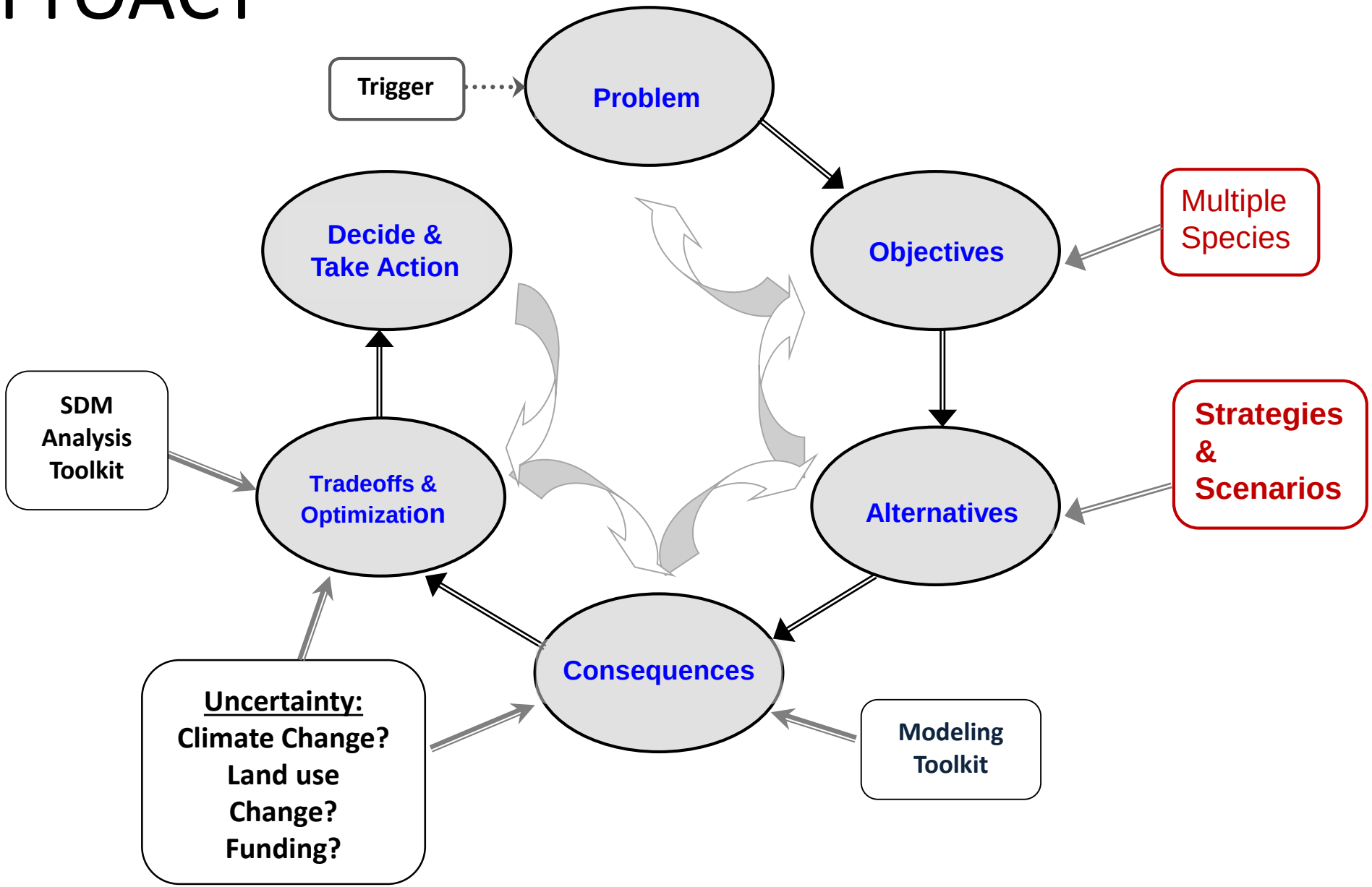
Structured Decision Making & Scenario Modeling

What is Structured Decision Making?

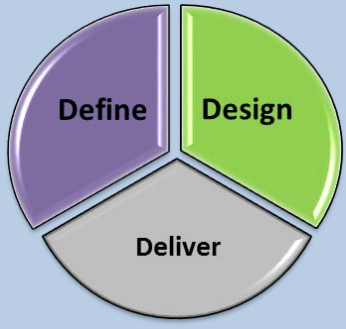
"A formalization of common sense for decision problems which are too complex for informal use of common sense."

-Ralph Keeney, 1982

PrOACT


Trigger
Problem
Objectives
Multiple Species
Alternatives
Strategies & Scenarios
Consequences
Modeling Toolkit
Uncertainty:
Climate Change?
Land use Change?
Funding?
Tradeoffs & Optimization
SDM Analysis Toolkit
Decide & Take Action

Moving towards Proactive Conservation



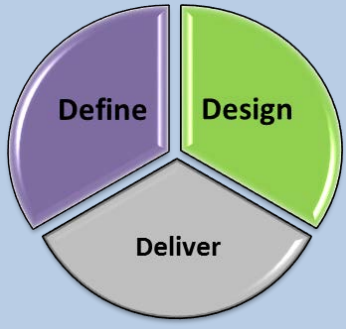
For complex decisions with substantial uncertainty, scenario modeling provides a way to evaluate alternative sets of actions

ALTERNATIVES

OBJECTIVES

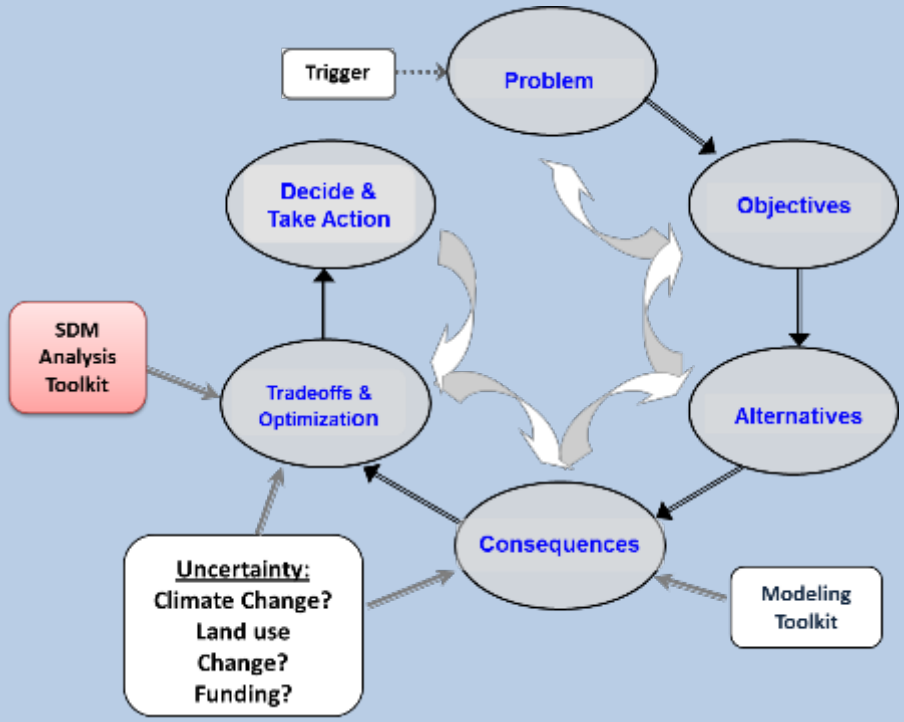
	Portfolio 1	Portfolio 2	. . . . .	. . . . .	Portfolio n
Species 1	7	9	. . . . .	. . . . .	3
Species 2	1	5	. . . . .	. . . . .	11
:	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
:	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
Species n	2	4	. . . . .	. . . . .	1
Time	11	2	. . . . .	. . . . .	8
Cost	3	6	. . . . .	. . . . .	2

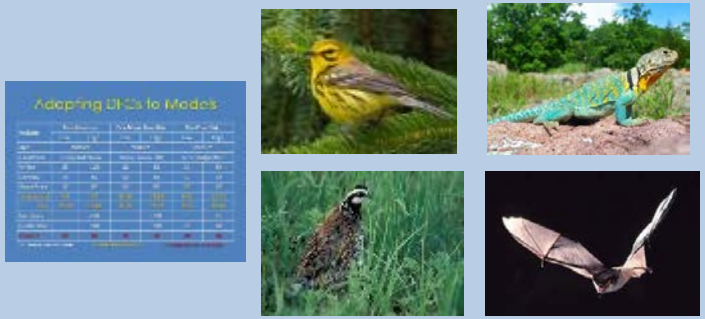
Moving towards Proactive Conservation



Strategy Framework for dynamic decision making (OZHI pilot project)

- DFCs & CHJV Habitat Objectives for forest habitat systems





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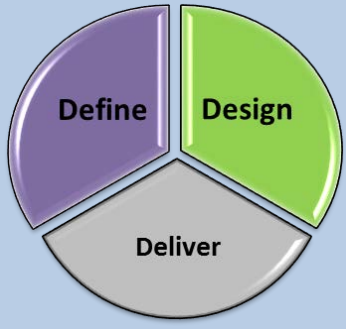

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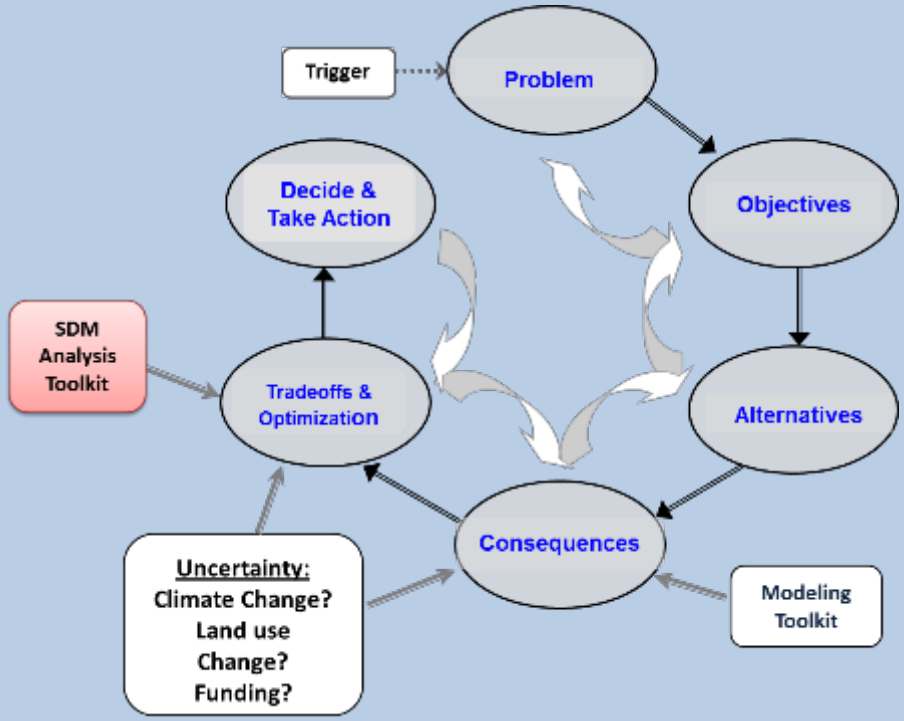
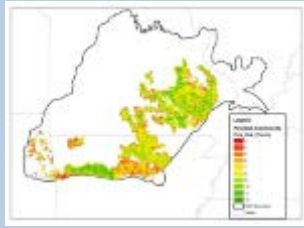
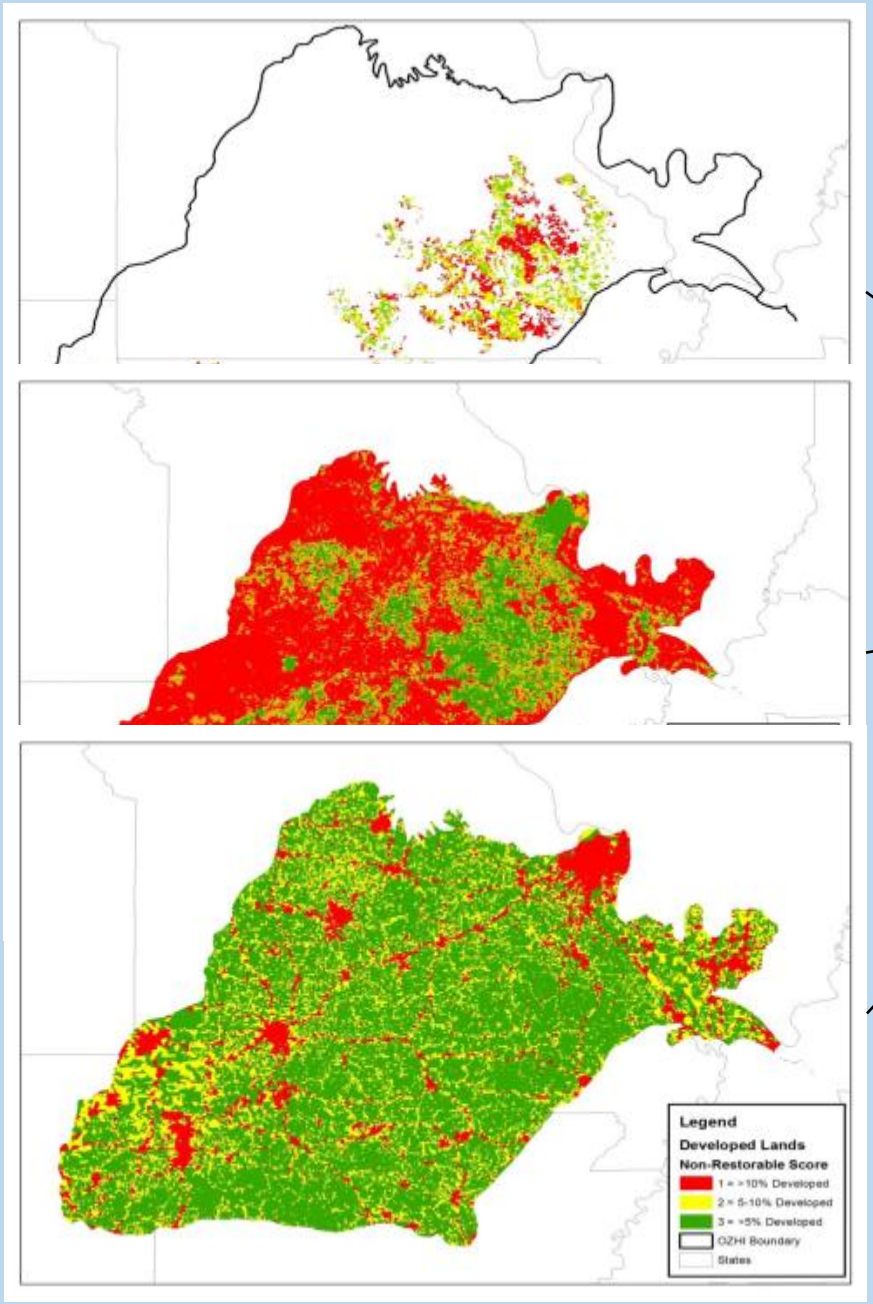
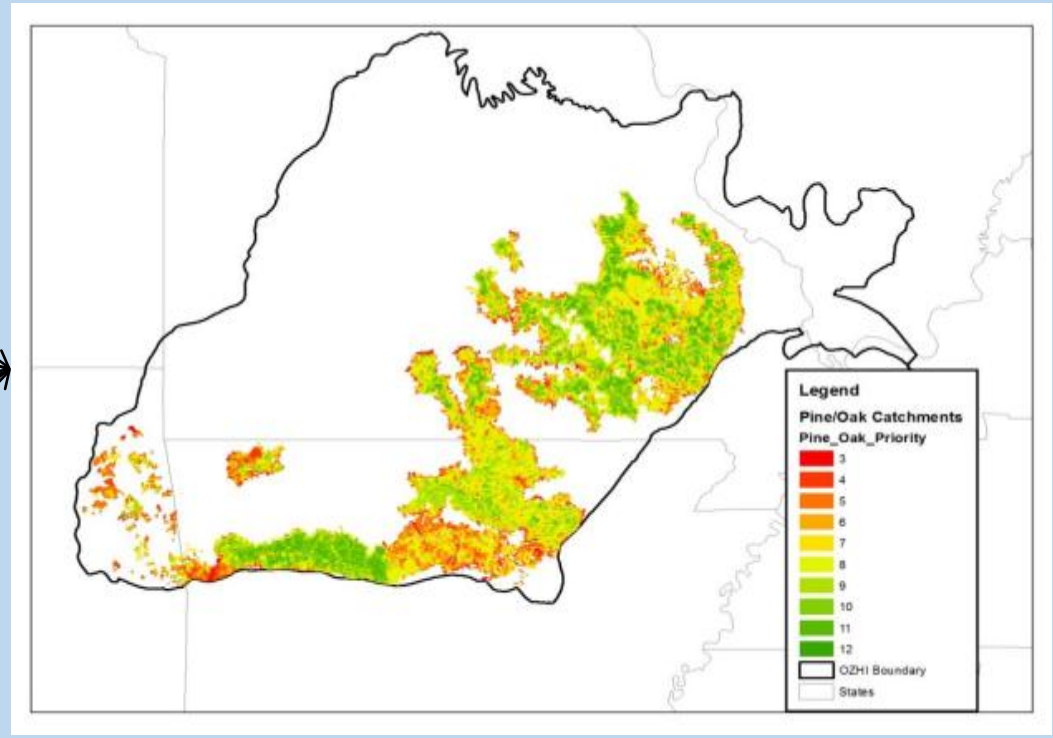


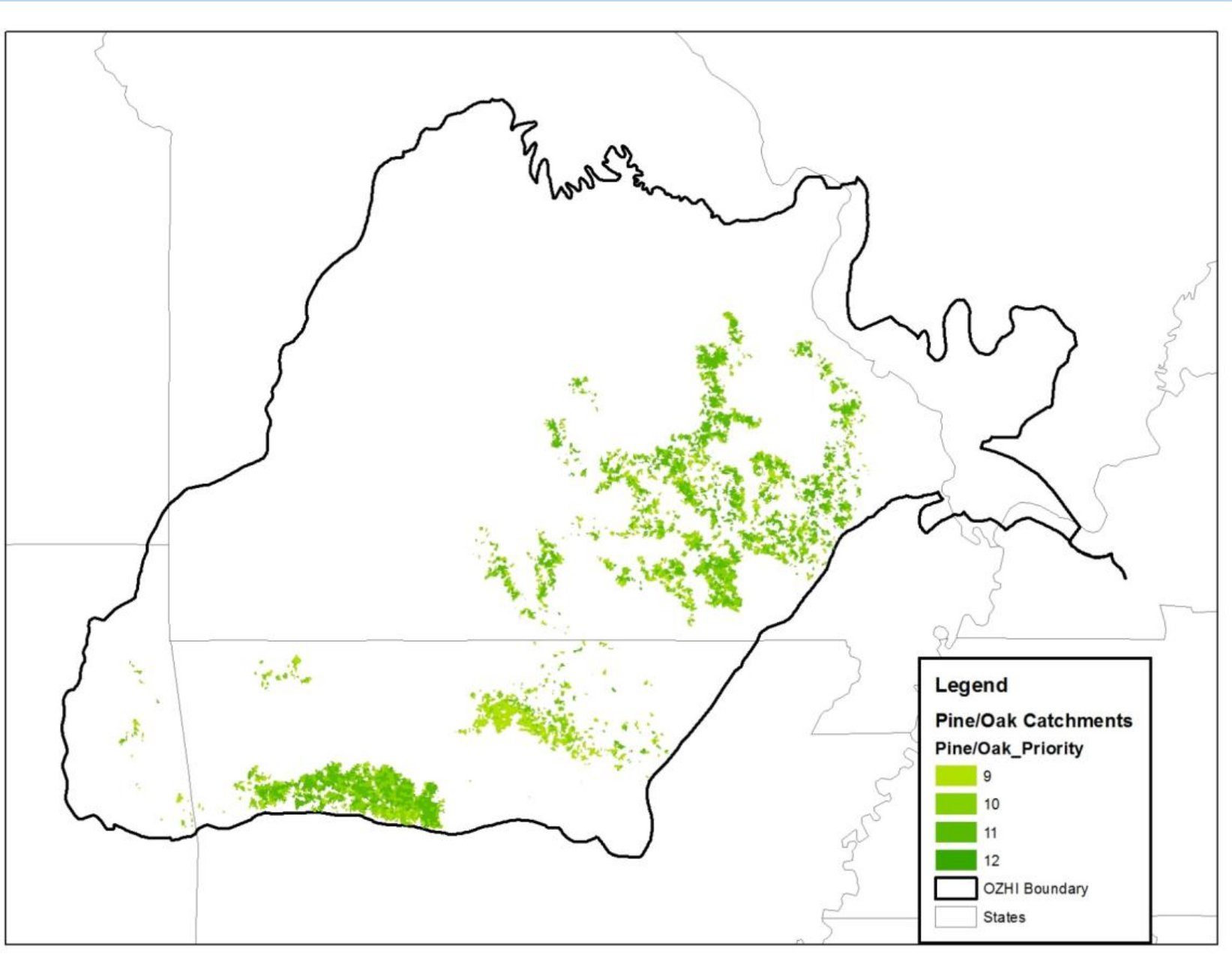


Ozark Highlands CCS pilot project used a Rule Set

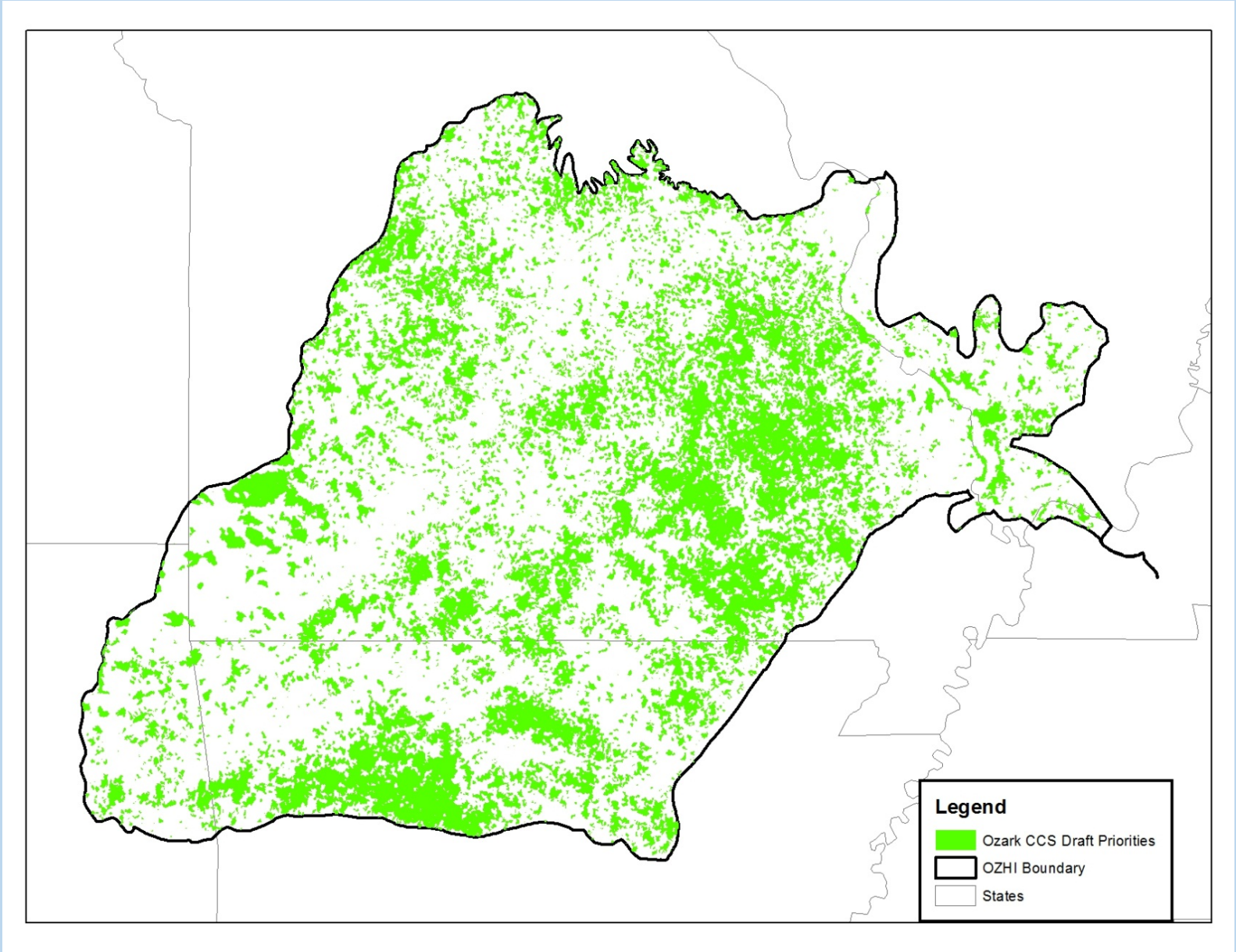




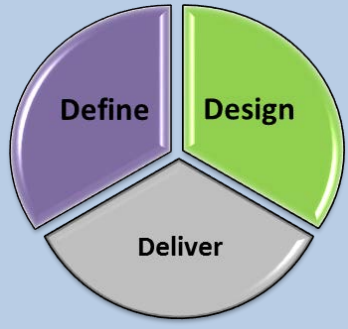
Rule 6: Is the catchment a high priority?



Repeat for 9 Forested Habitat Types & Inform with CHJV Habitat Objectives



Moving towards Proactive Conservation



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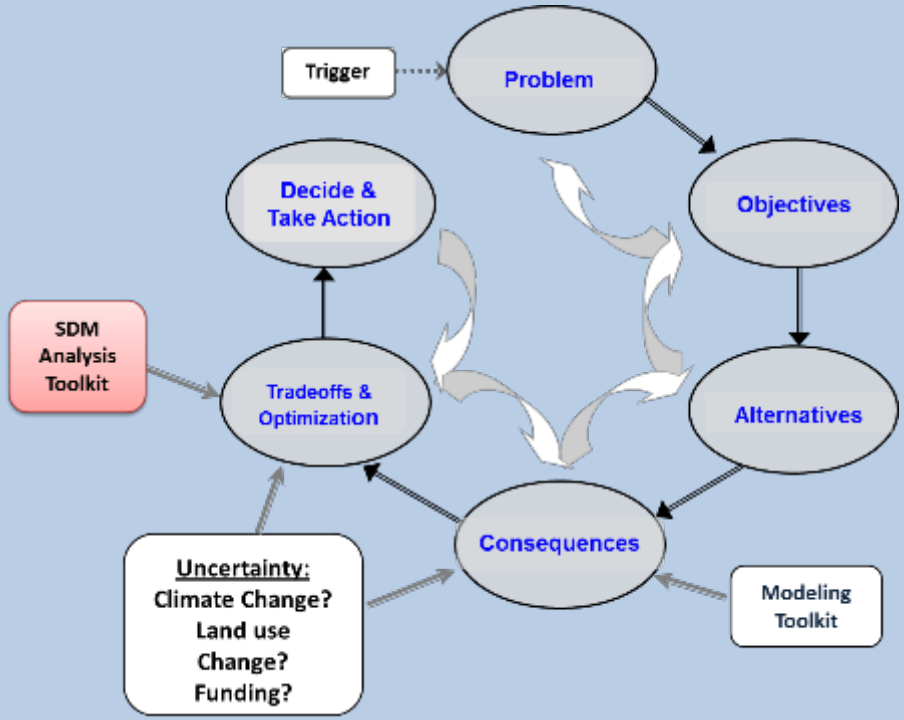
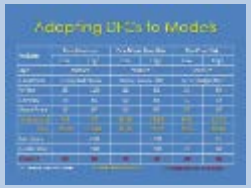
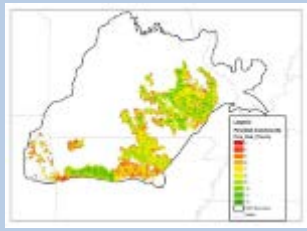
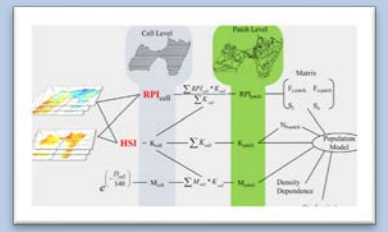


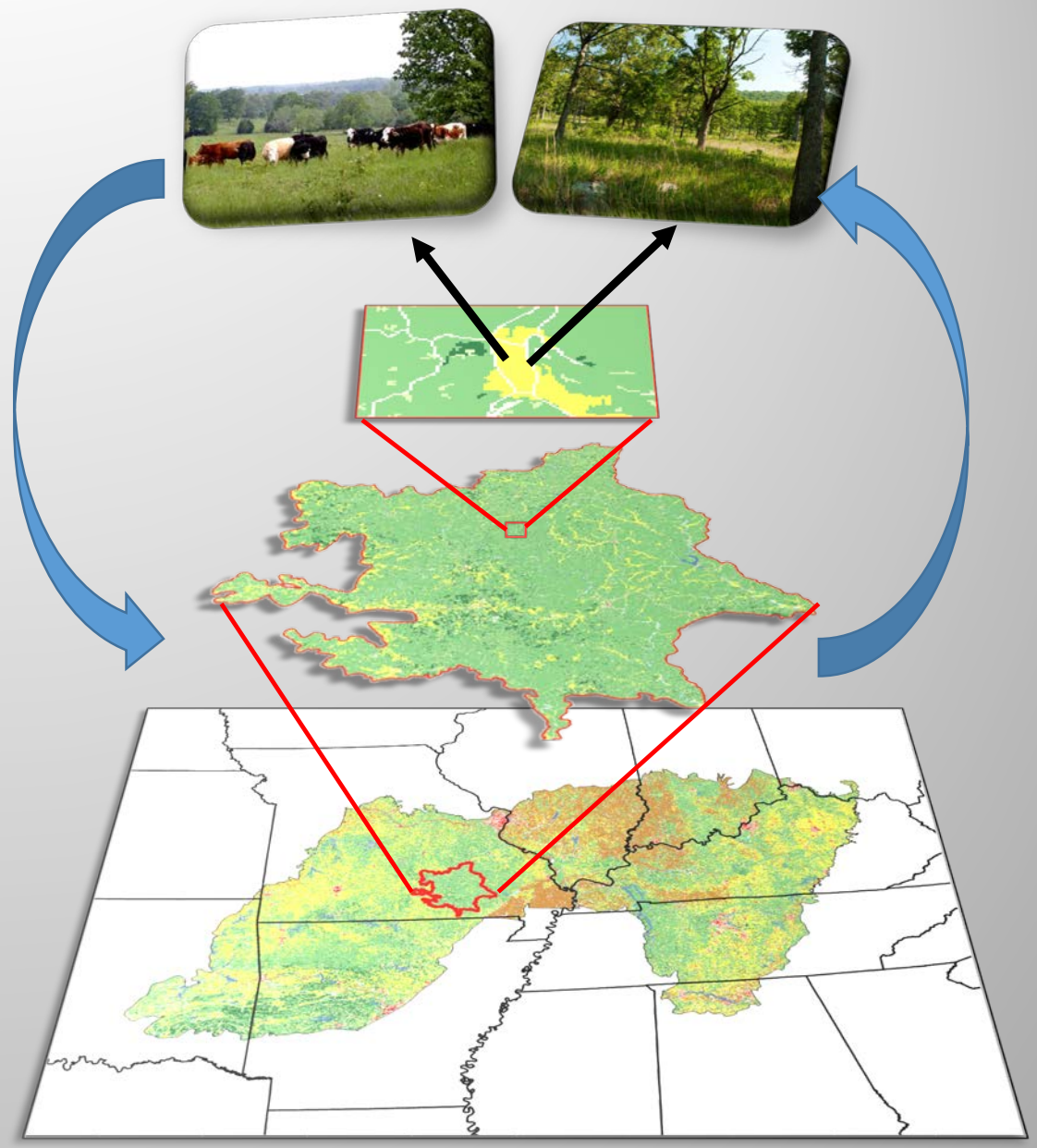






Landscape-based Regional Population Models

1. Regional growth depends on processes occurring across all scales!
   - 900 m^2 ←→ >100,000's km^2
2. Planner's Paradox
   - *Translating regional goals into local actions requires understanding the effects of local actions on regional growth*



USDA

United States Department of Agriculture

Forest Service

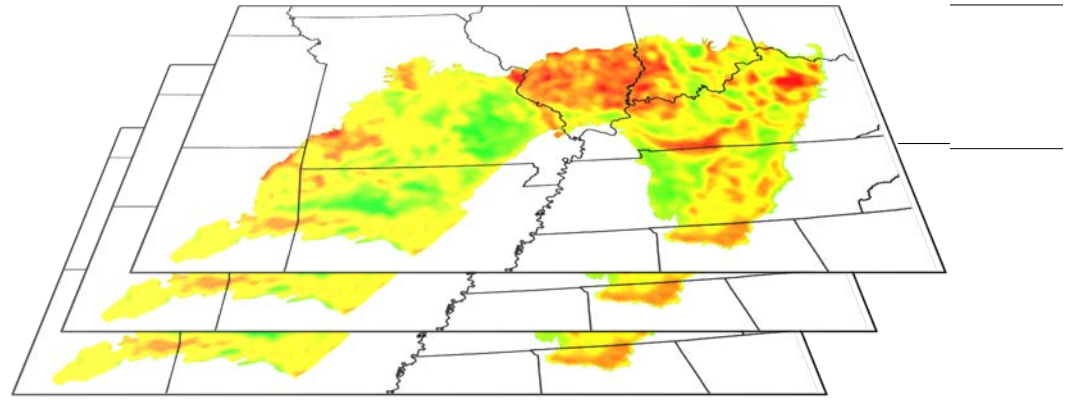
Northern Research Station

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

Carrying Capacity and Abundance



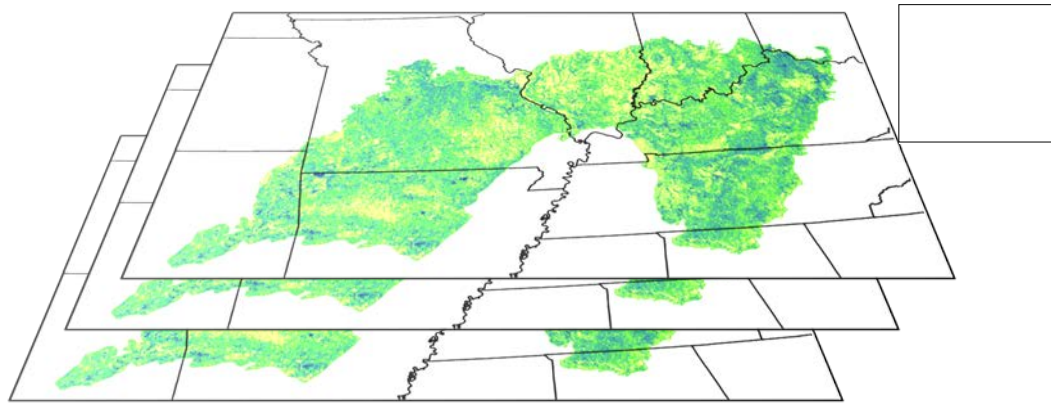
Global Change Biology

Global Change Biology (2013) **19**, 1064–1074, doi: 10.1111/gcb.12117

Temperature can interact with landscape factors to affect songbird productivity

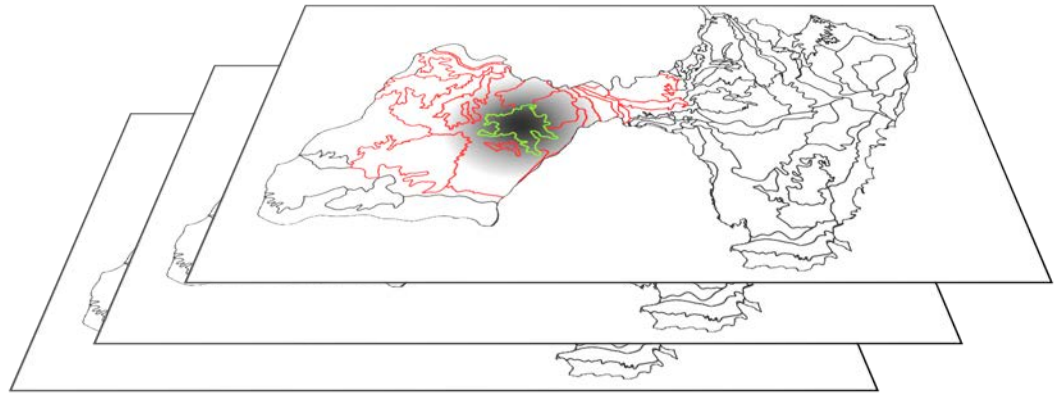
W. ANDREW COX*, FRANK R. THOMPSON III†, JENNIFER L. REIDY* and JOHN FAABORG‡
*Department of Fisheries and Wildlife Sciences, 302 ABNR, University of Missouri, Columbia, MO 65211, USA, †U.S.D.A. Forest Service Northern Research Station, 202 ABNR, University of Missouri, Columbia, MO 65211, USA, ‡Division of Biological Sciences, University of Missouri, 105 Tucker Hall, Columbia, MO 65211, USA

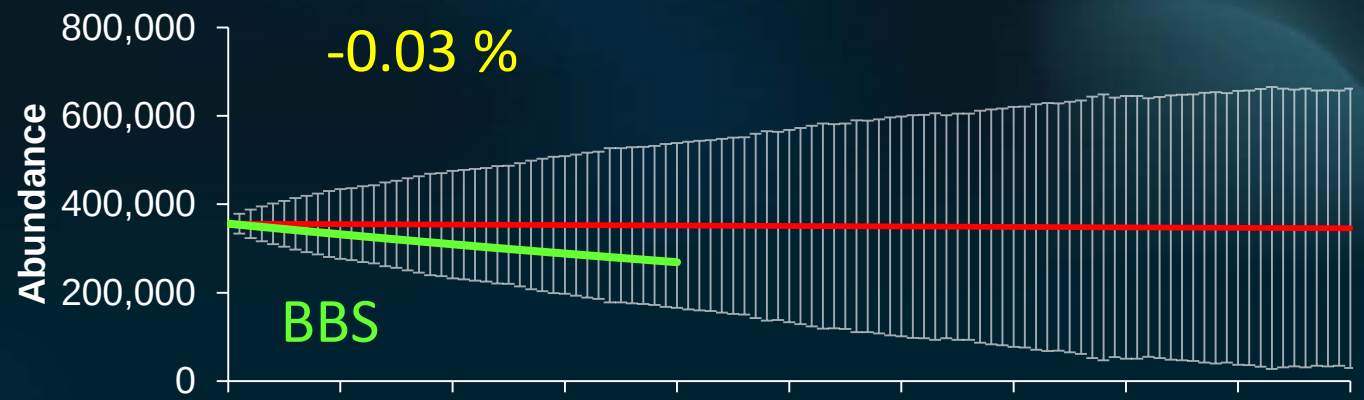
Productivity

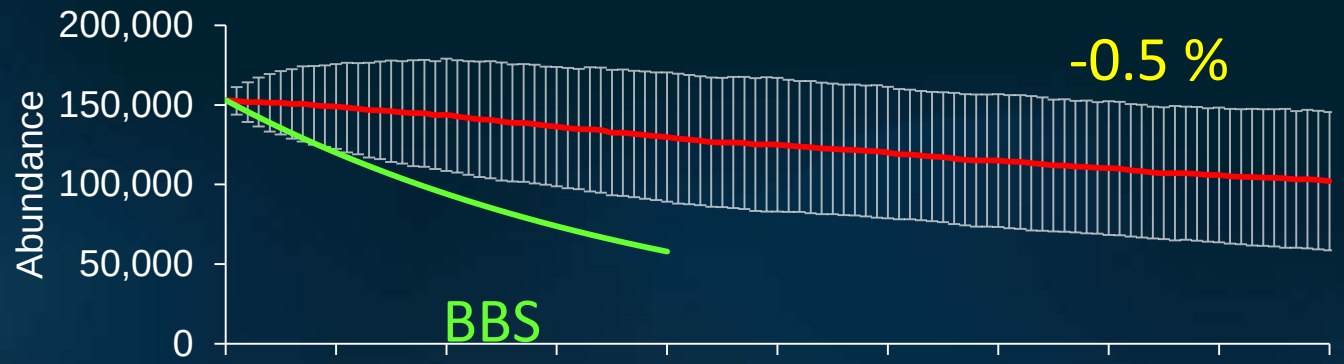


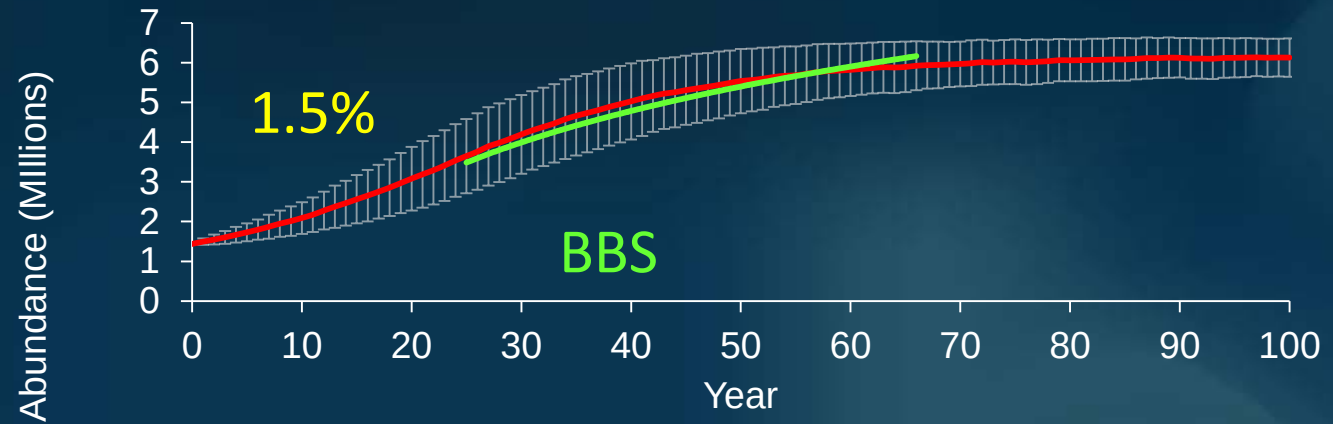
Dispersal

- Cell-level movements
- Habitat Dependent
- Distance Dependent

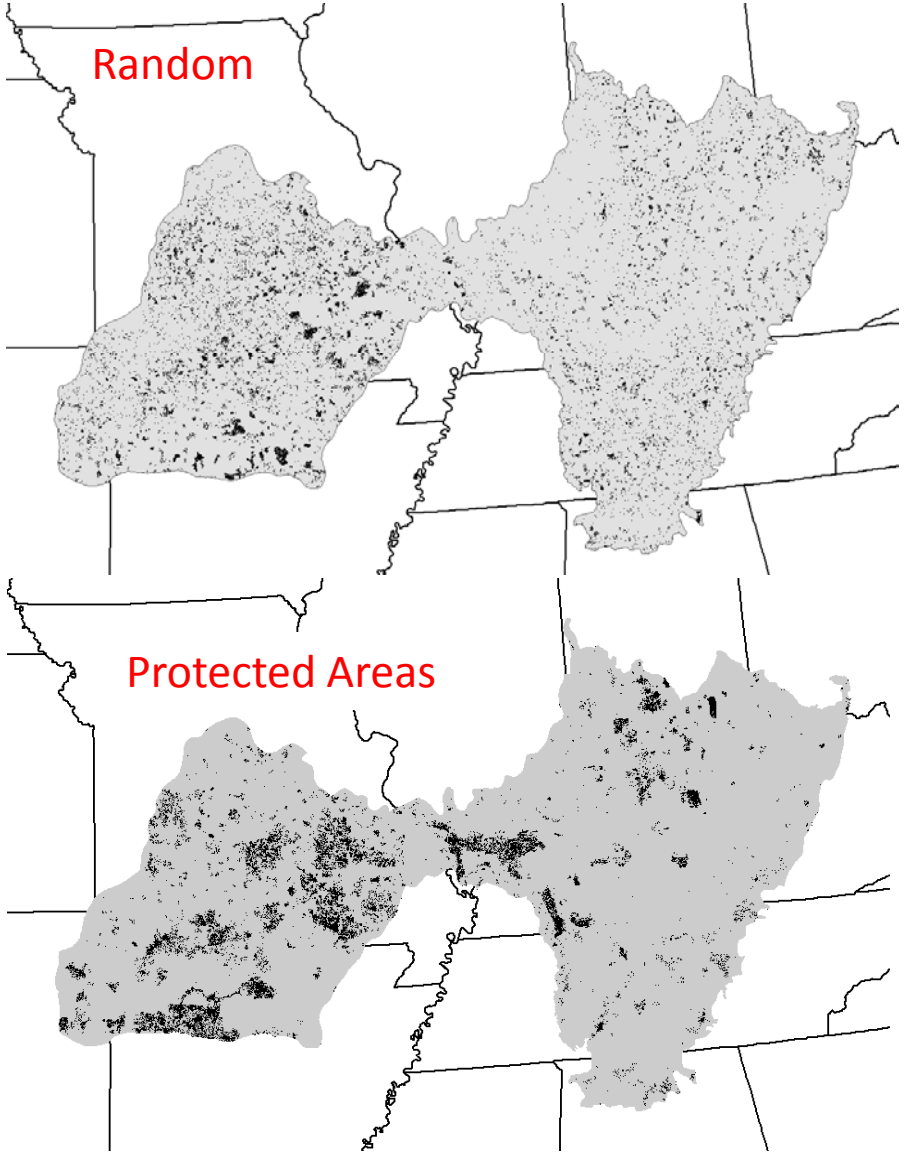


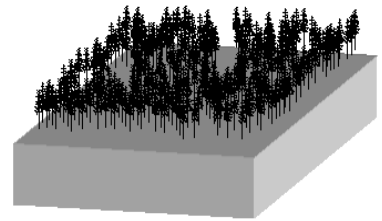

800,000
600,000
400,000
200,000
0
Abundance
-0.03 %
BBS


200,000
150,000
100,000
50,000
0
Abundance
-0.5 %
BBS


7
6
5
4
3
2
1
0
Abundance (MIllions)
1.5%
BBS
0
10
20
30
40
50
60
70
80
90
100
Year

Conservation Scenarios
Habitat Restoration

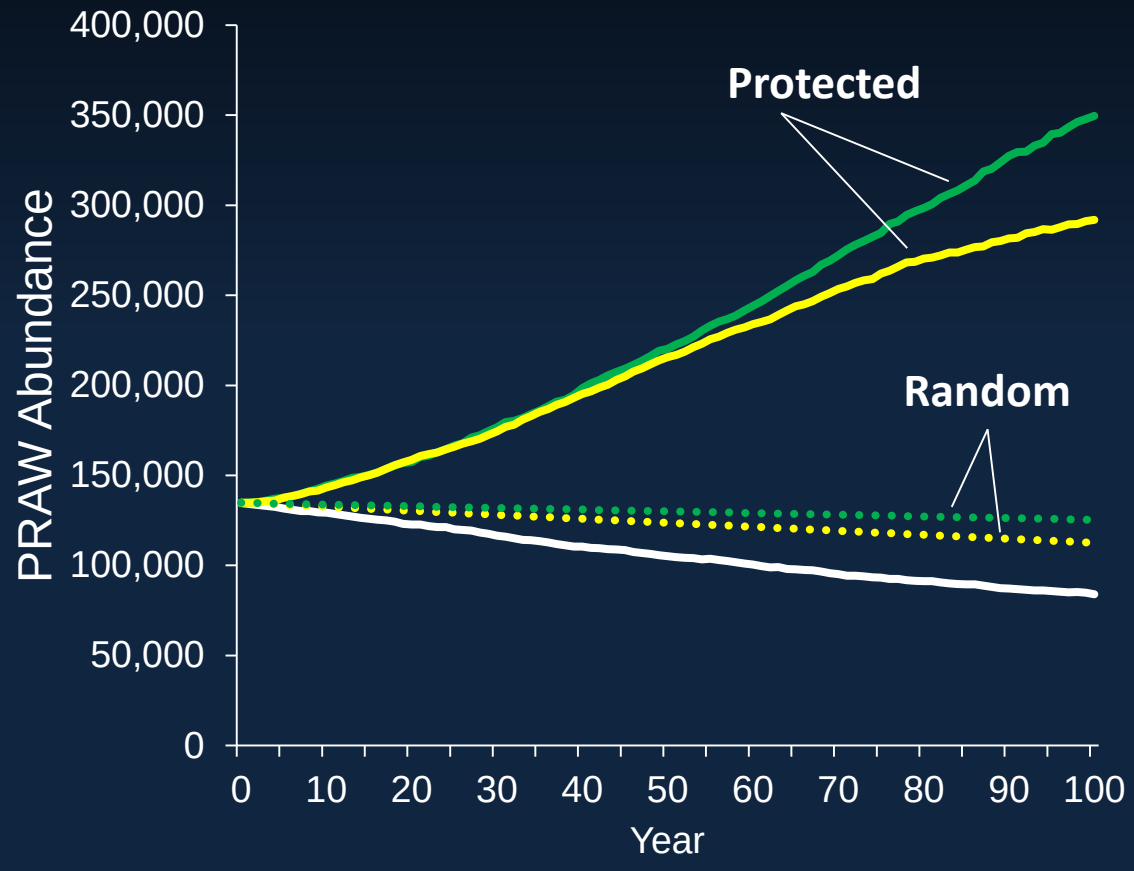




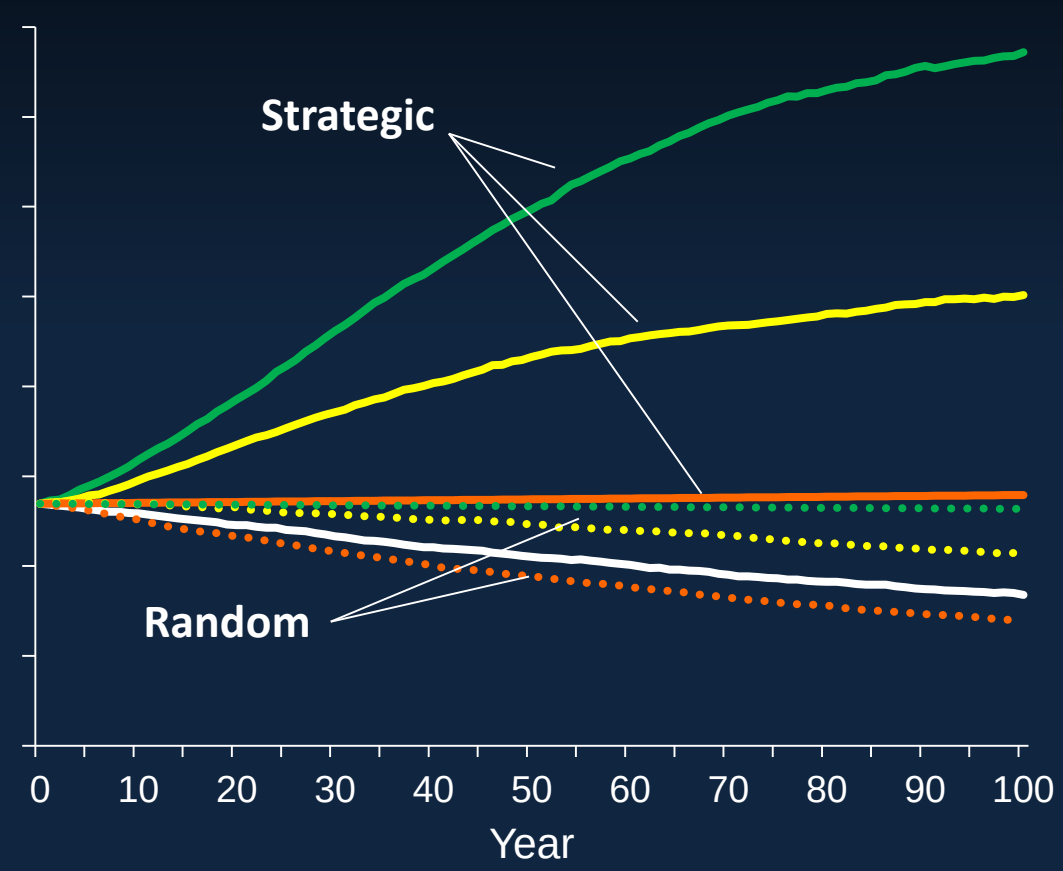
North Central Region
Forest Management Guide

Conservation Needs to be Strategic

Habitat Restoration

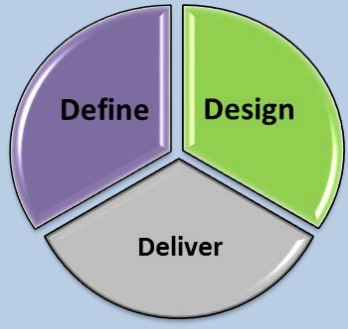


Afforestation



Current
2,000,000 ha
1,000,000 ha
300,000 ha

Moving towards Proactive Conservation



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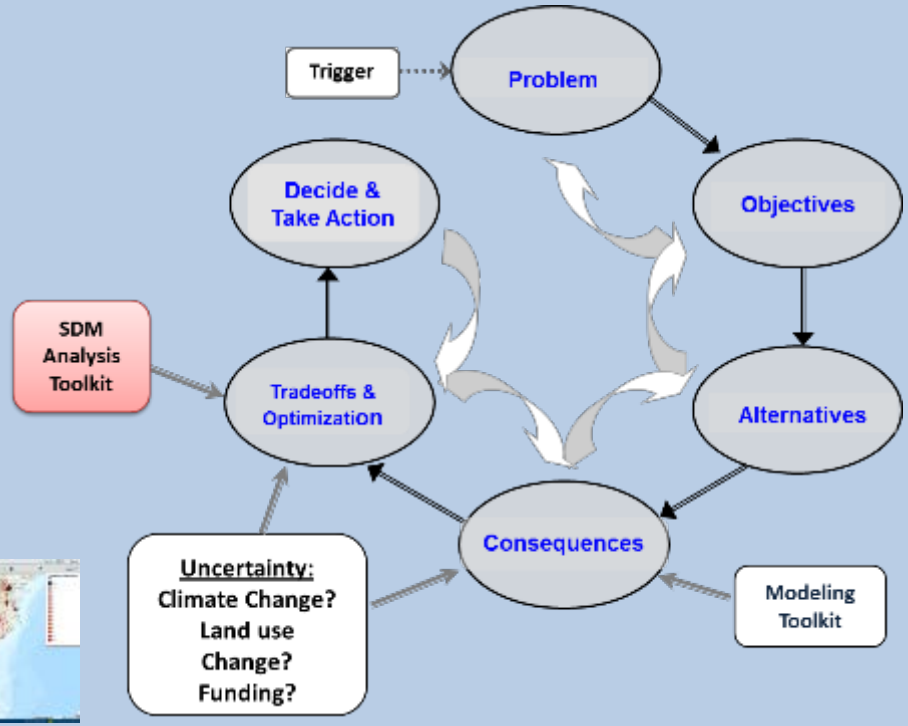
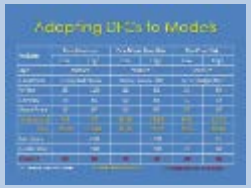
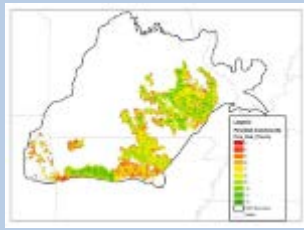
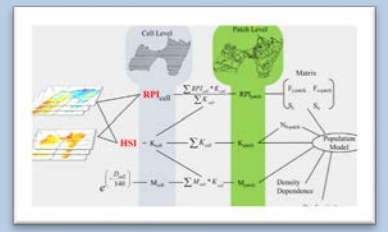




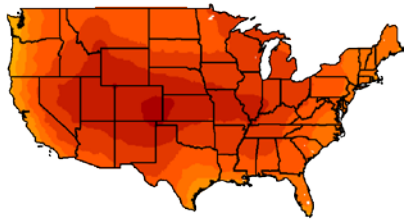




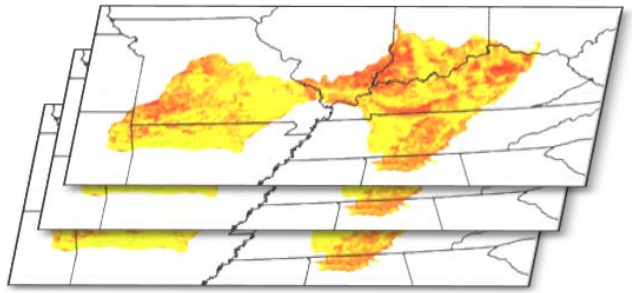
Process-based Approaches

- We have projections of climate
- We know how forests grow
- Species habitat
- Factors that affect reproduction and survival
- Movements and dispersal

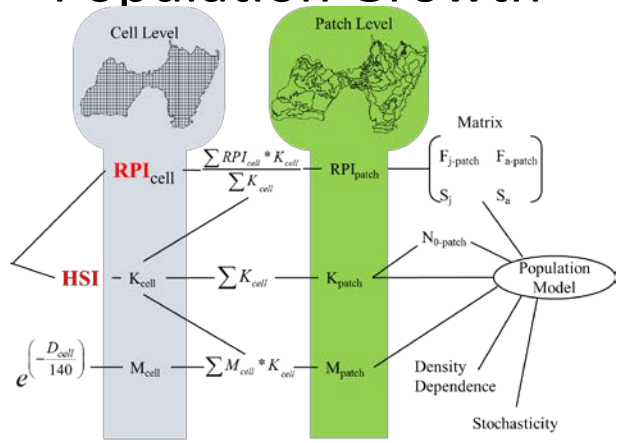
Climate Model



Simulated Landscapes



Population Growth



Landscapes & Forest Processes

Climate Model

- Temperature
- Precipitation
- Solar radiation

Ecosystem Model

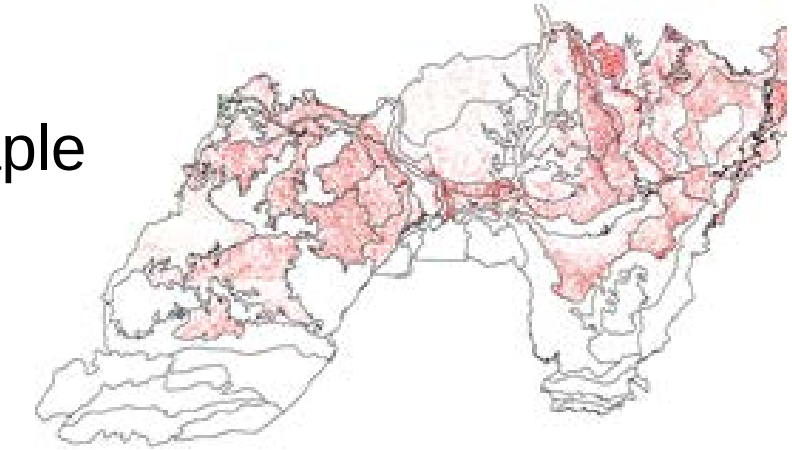
- Location
- Tree vital rates
- **Climate**
- Soil characteristics

Landscape Model

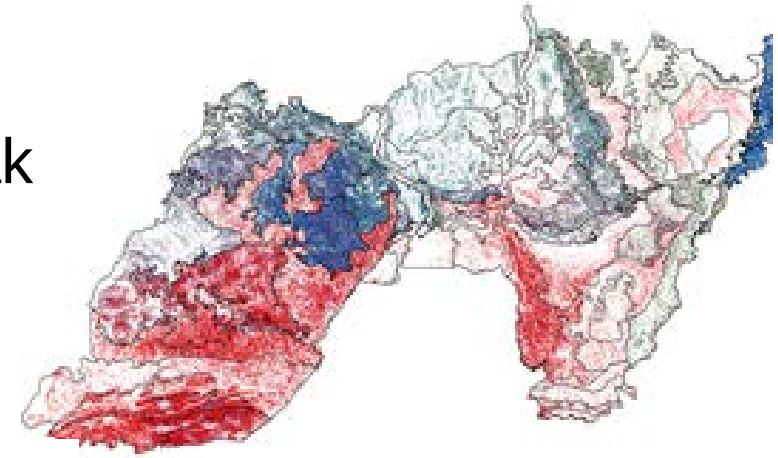
- **Tree establishment, growth**
- Seed dispersal
- Vegetative reproduction
- Longevity
- Shade tolerance
- Fire tolerance
- Disturbance regime
- Management regime

Landscapes & Forests under climate change

Sugar maple



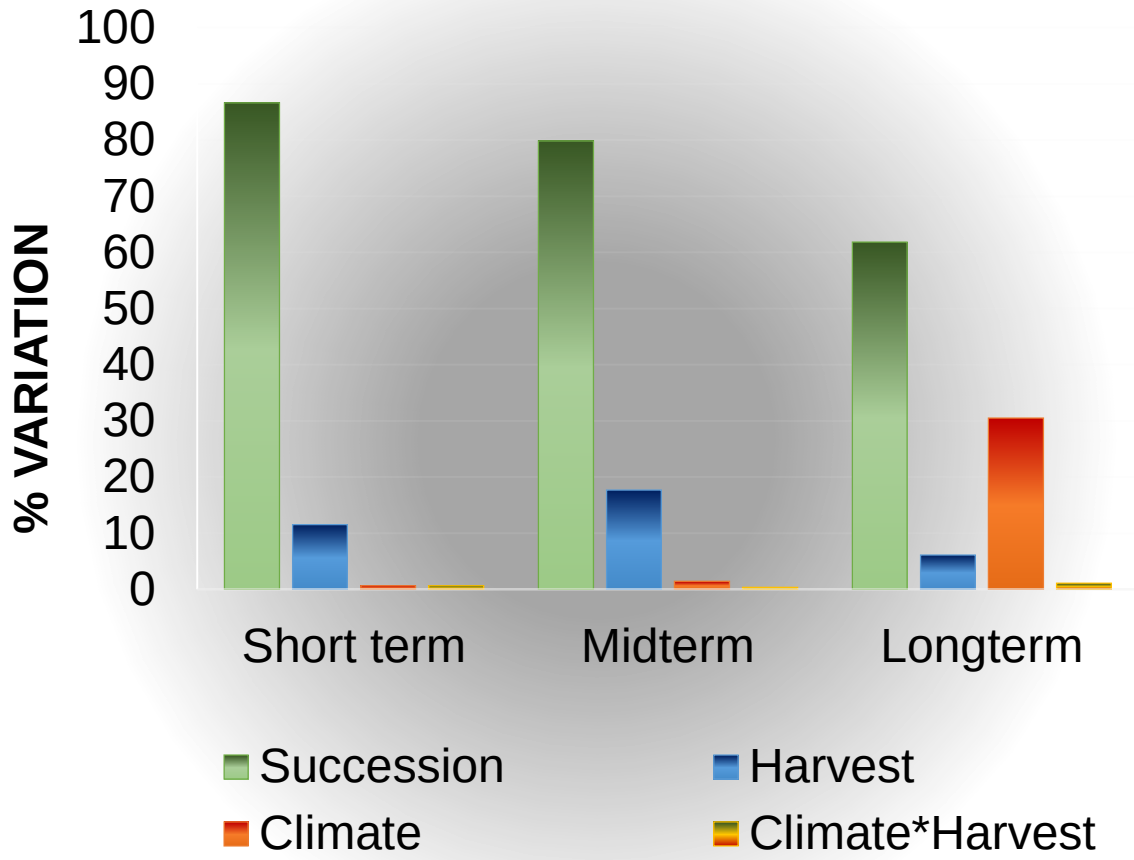
White oak



Extinction

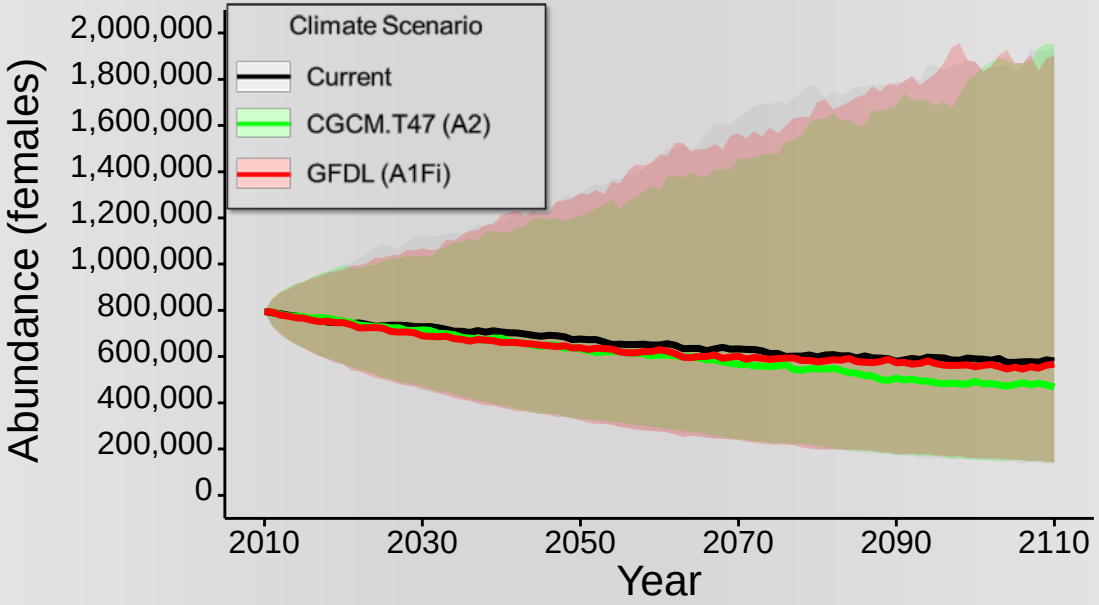
Colonization

Persistence

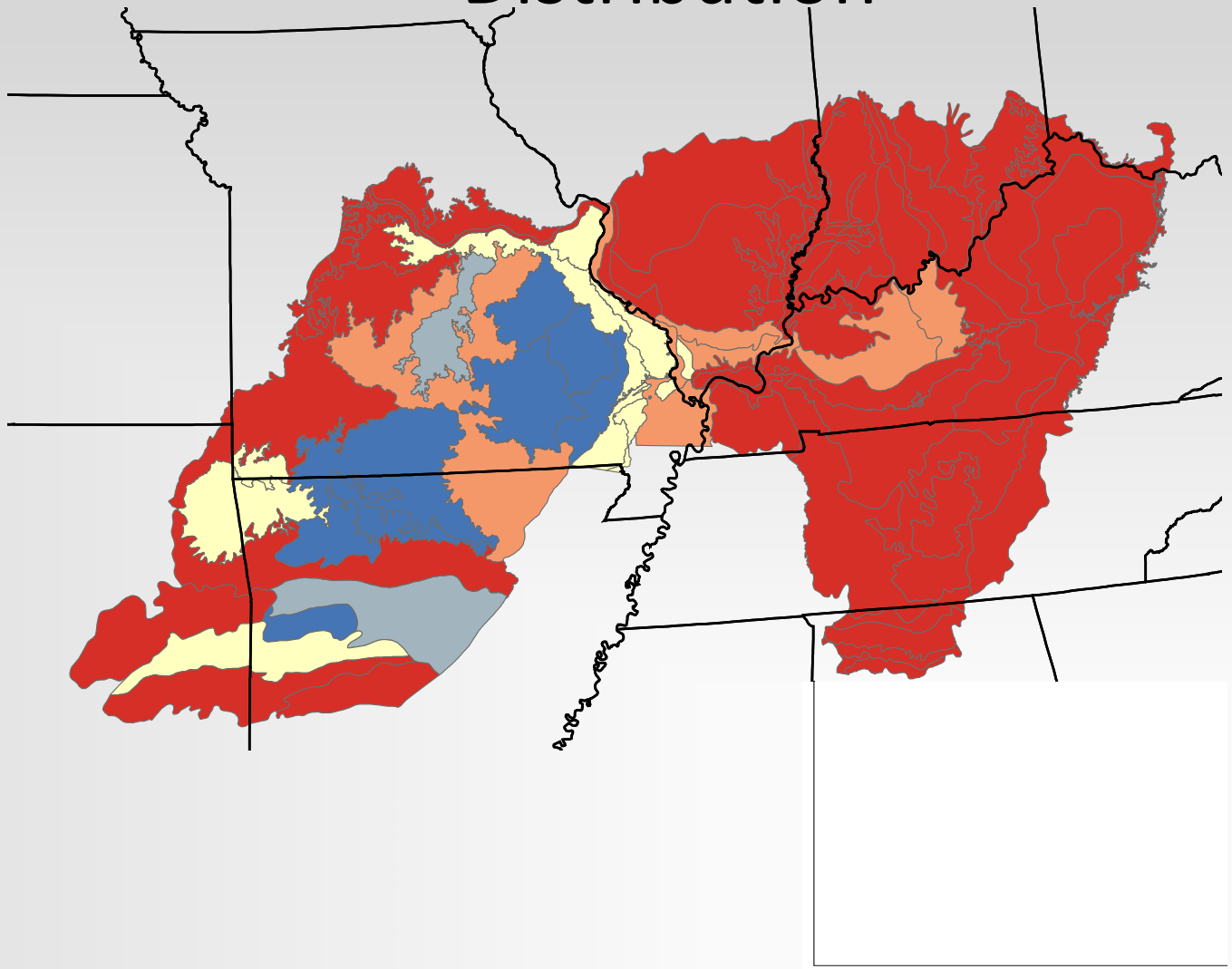


Climate change impacts on Wood Thrush

Population Size

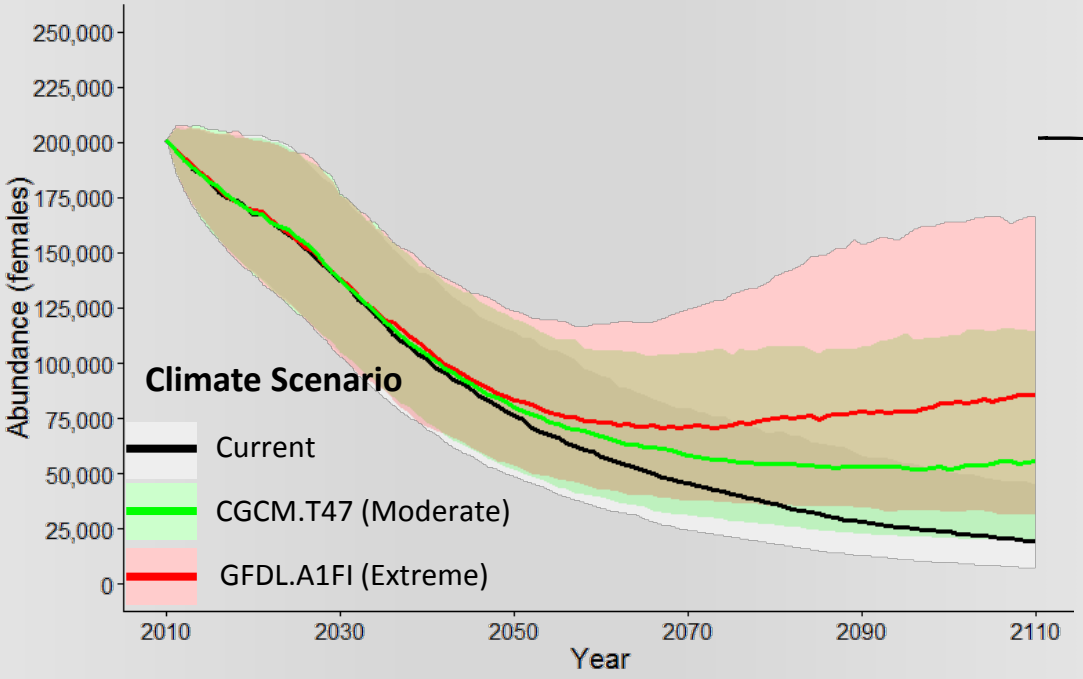


Distribution

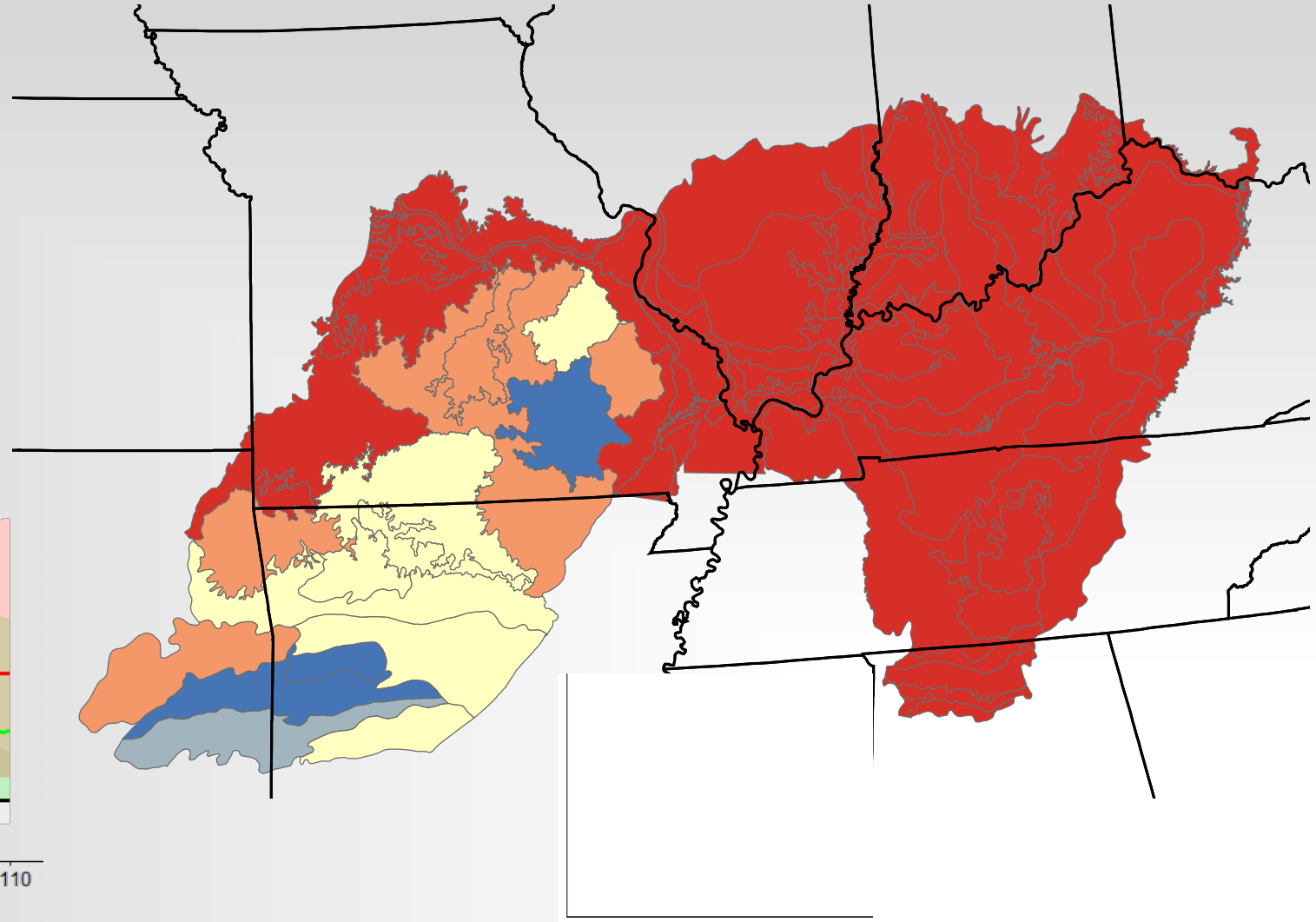


Climate change impacts on Prairie Warblers

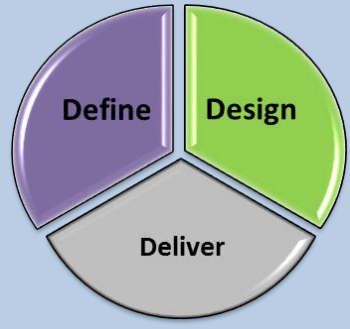
Population Size



Distribution



Moving towards Proactive Conservation



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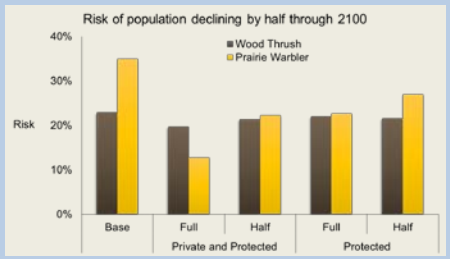
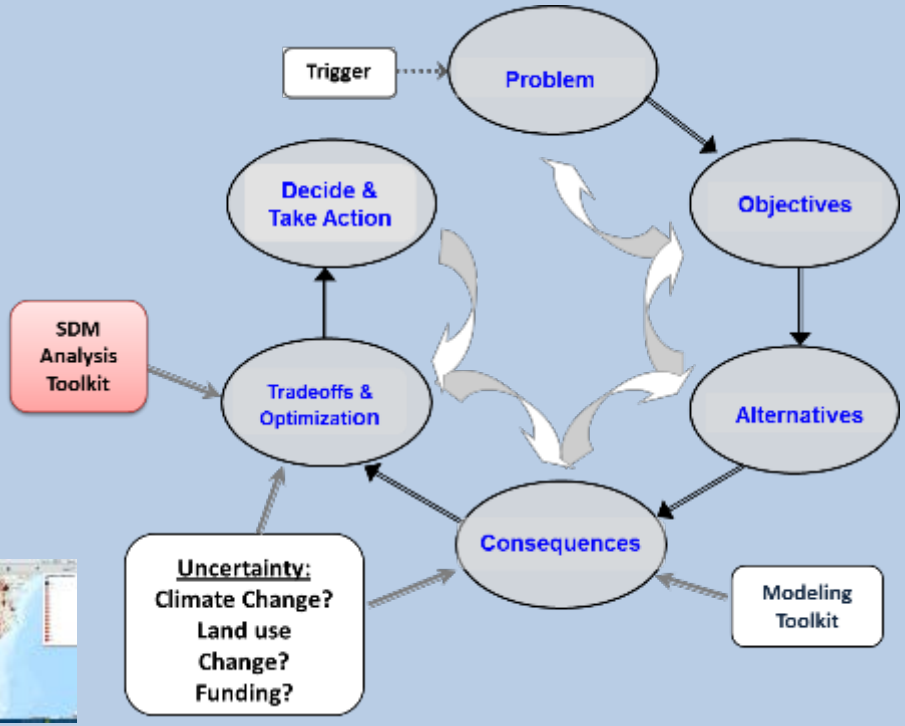
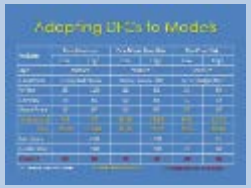
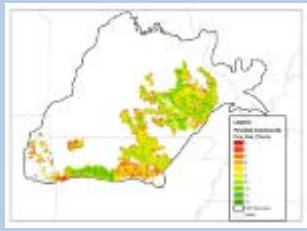
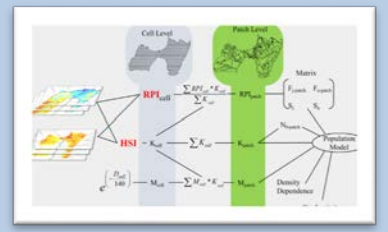
- Species Models & Future Projections
- Adaptation Strategies evaluated in terms of sustainable wildlife populations



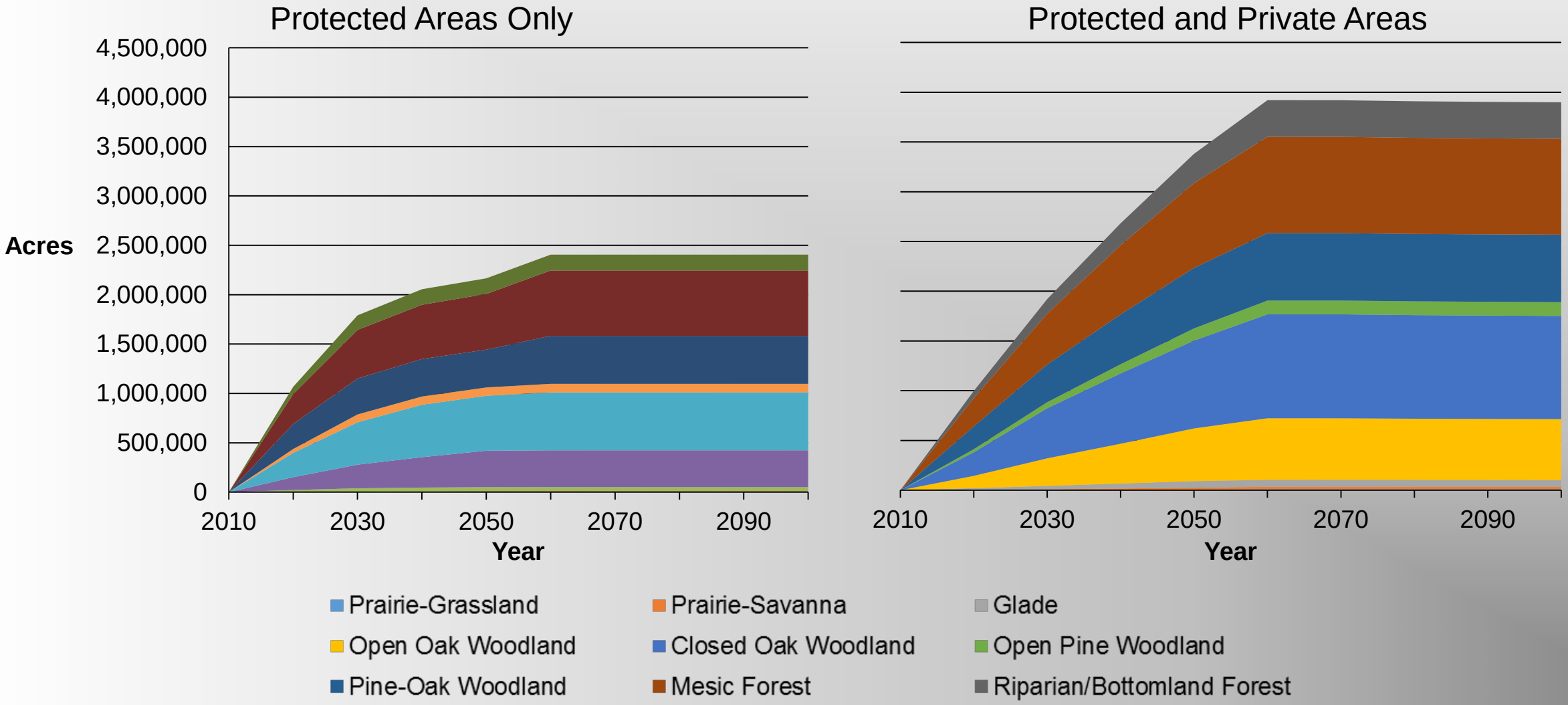






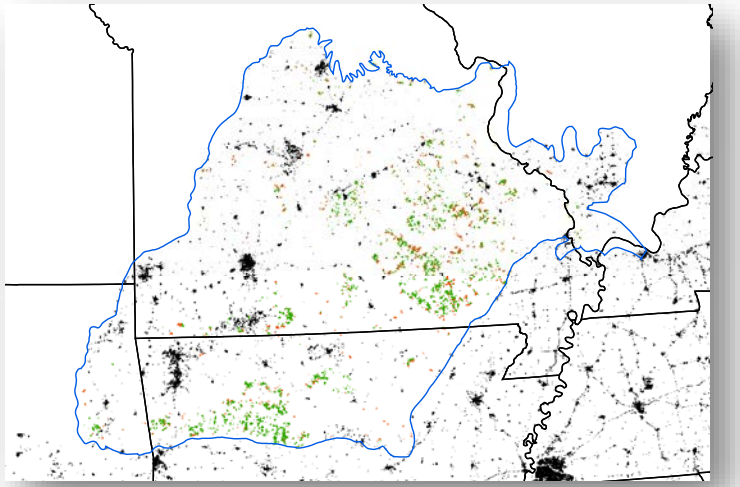


Comprehensive Conservation Strategy
CHJV Acreage Targets (≈3 million ac)

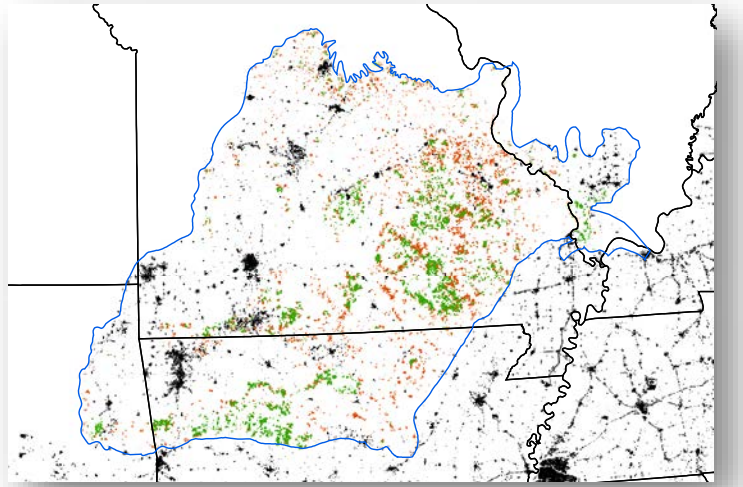


Comprehensive Conservation Strategy

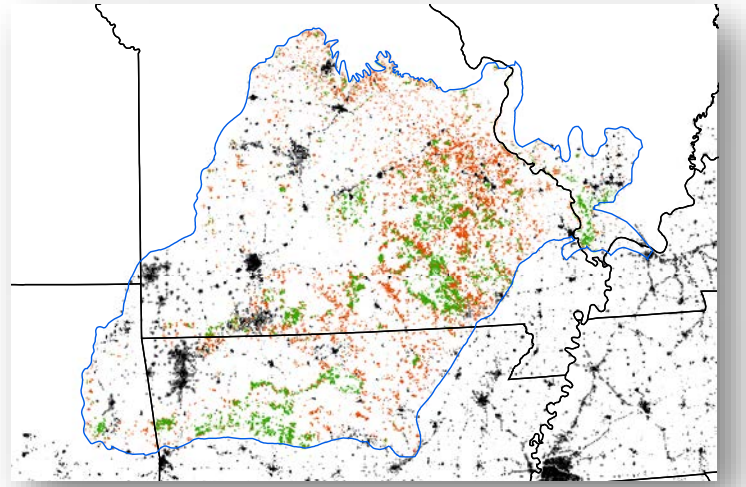
2020



2040



2060



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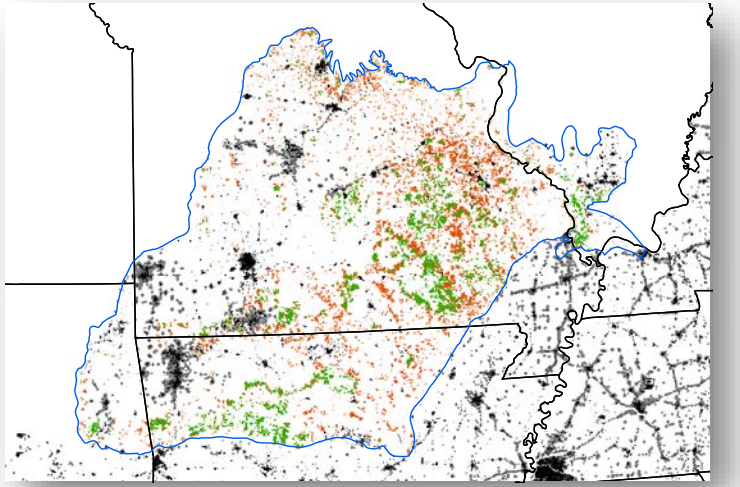
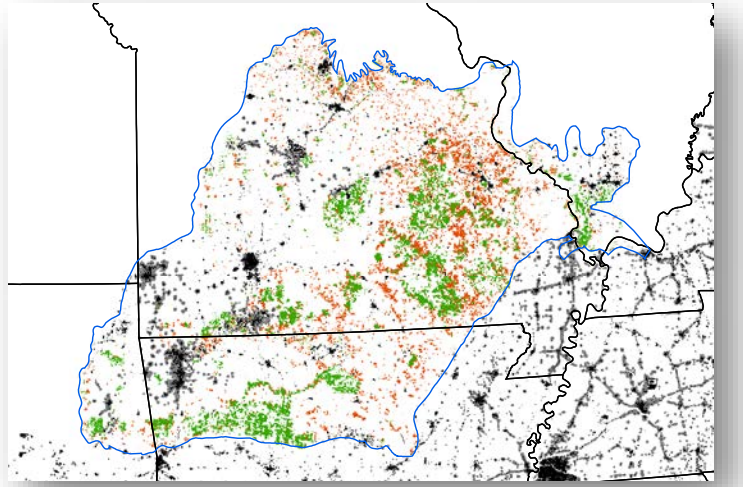
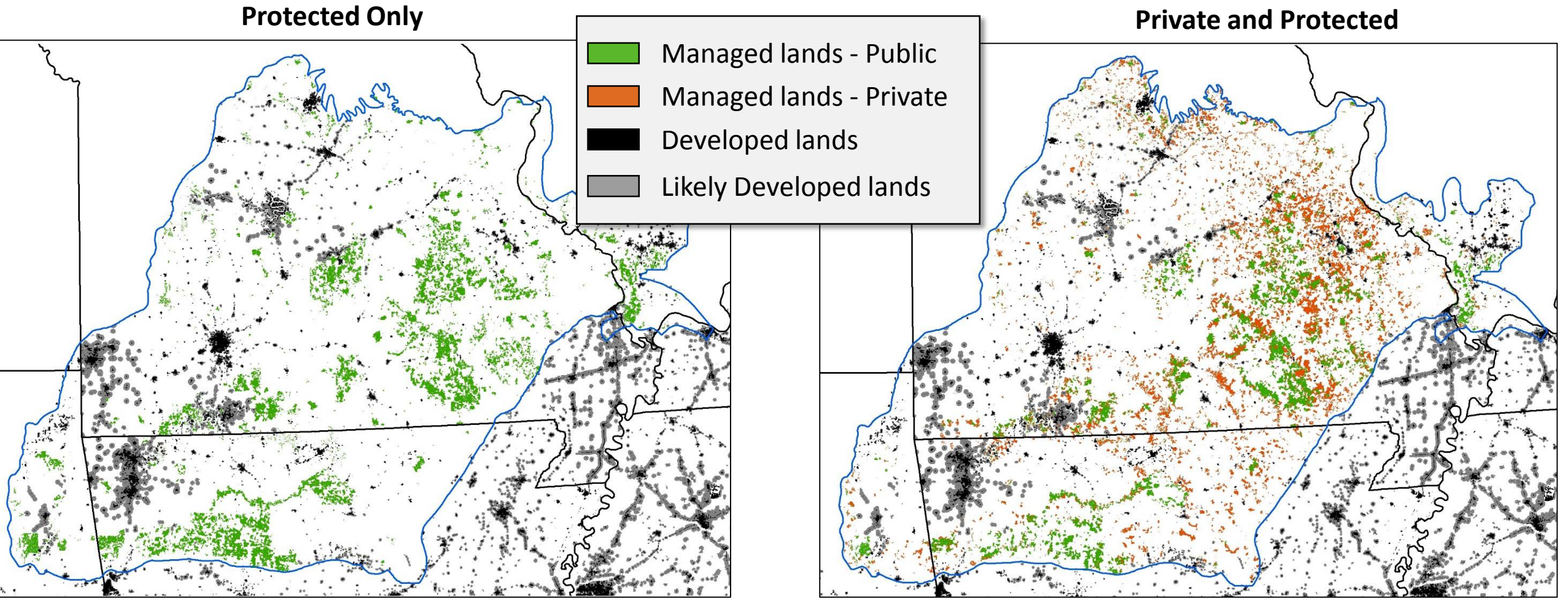


2100

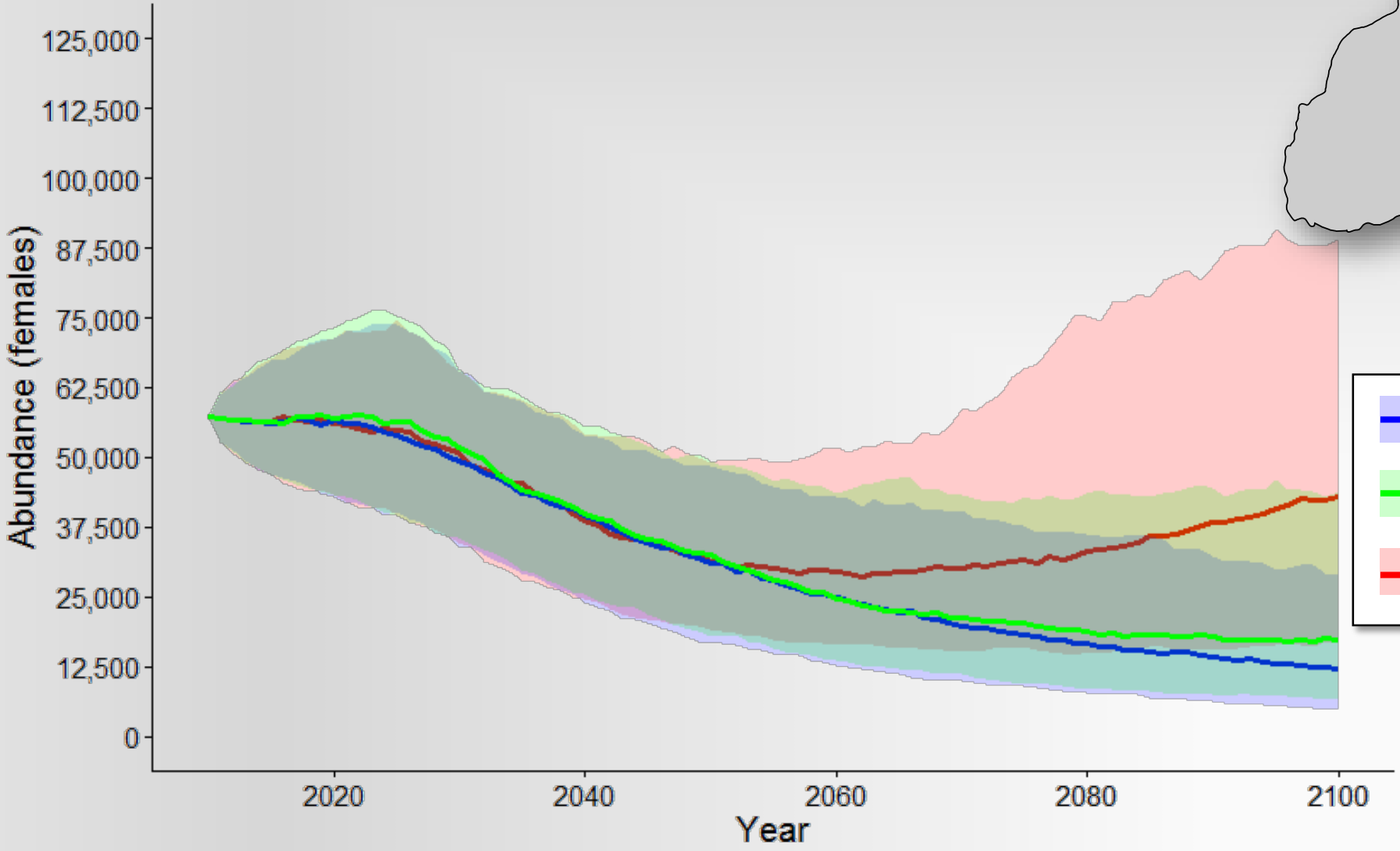


- Managed lands - Public
- Managed lands - Private
- Developed lands
- Likely Developed lands

Managed lands in 2100



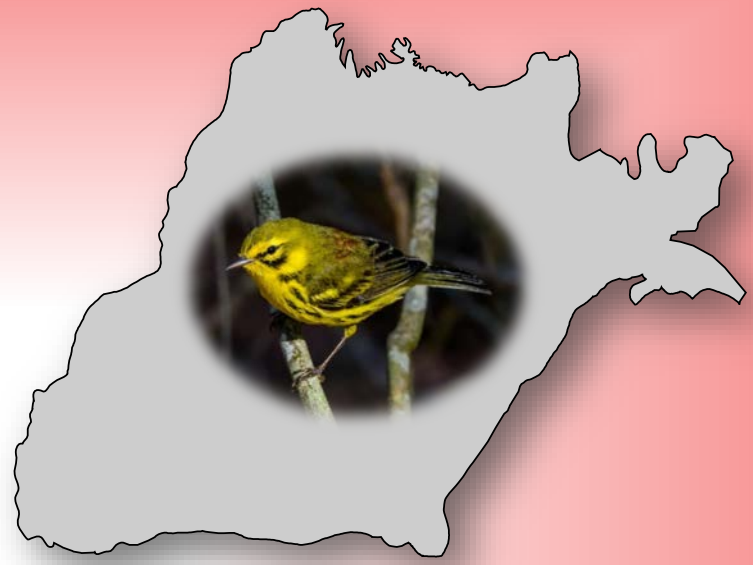
Prairie Warbler without CCS

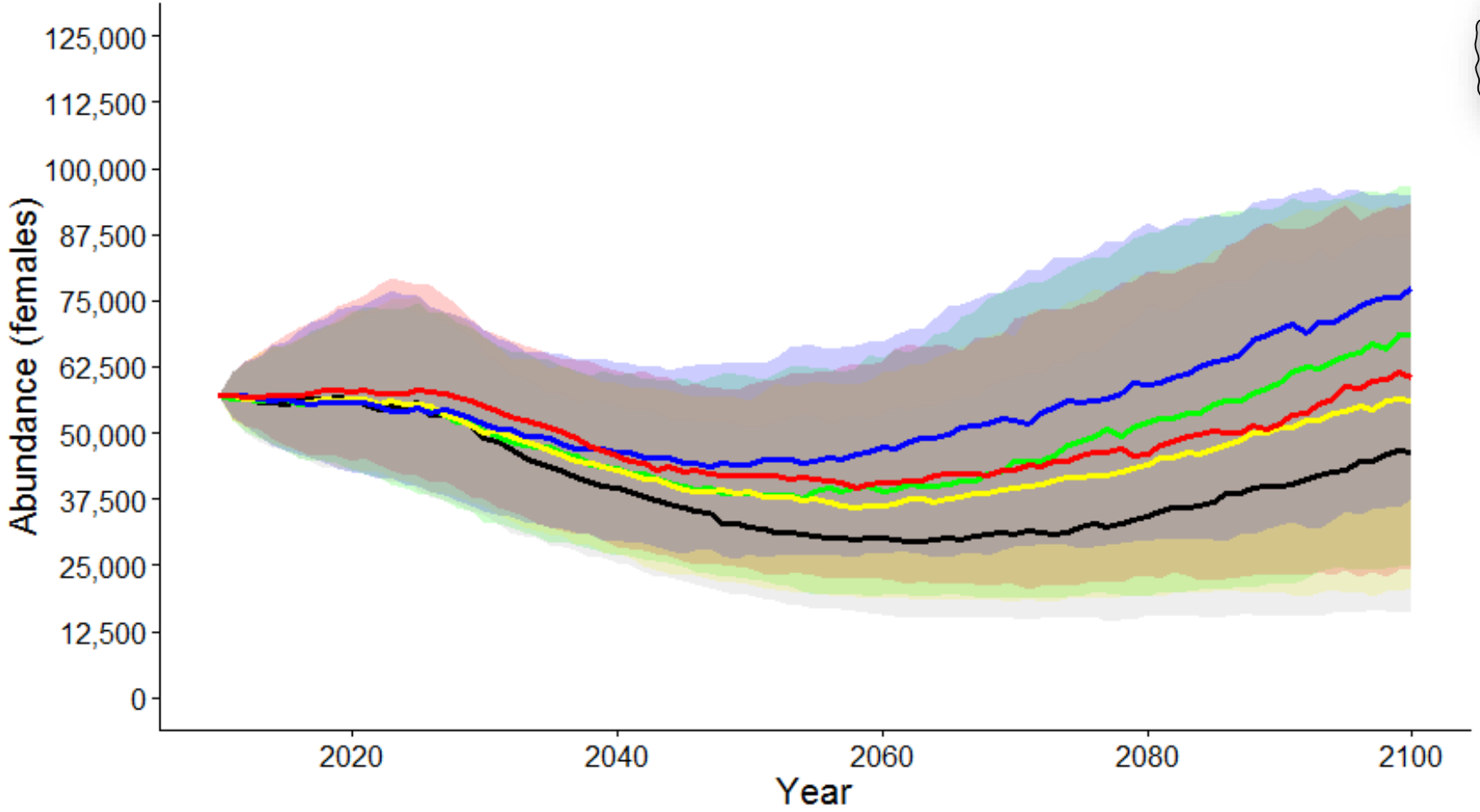


Climate Scenario

- Current
- CGCM3.T47 (Moderate)
- GFDL.A1FI (Extreme)

Prairie Warbler with CCS under Extreme Climate Change

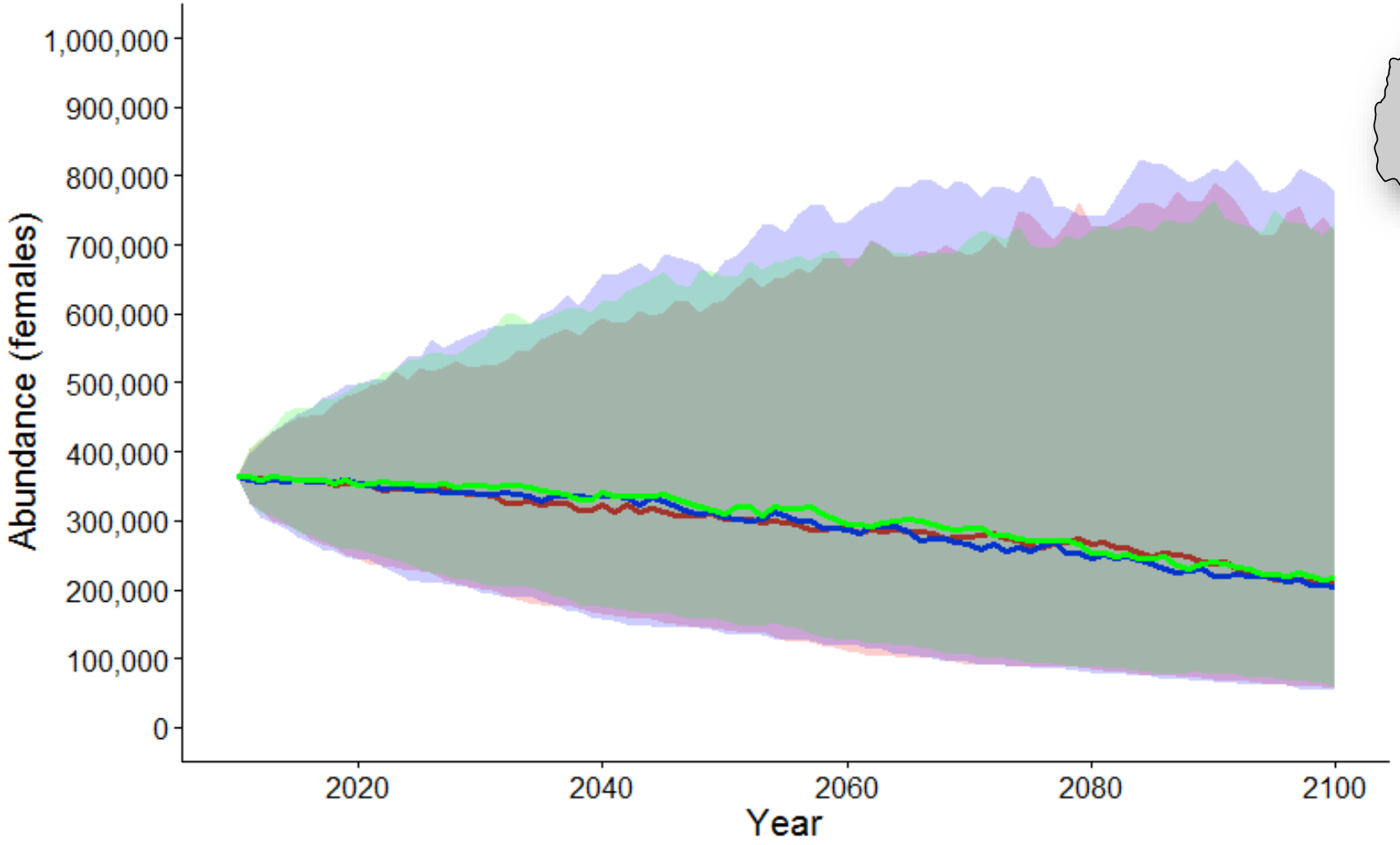




Conservation Scenario

- Base
- Private and Protected-Full
- Private and Protected-Half
- Protected - Full
- Protected - Half

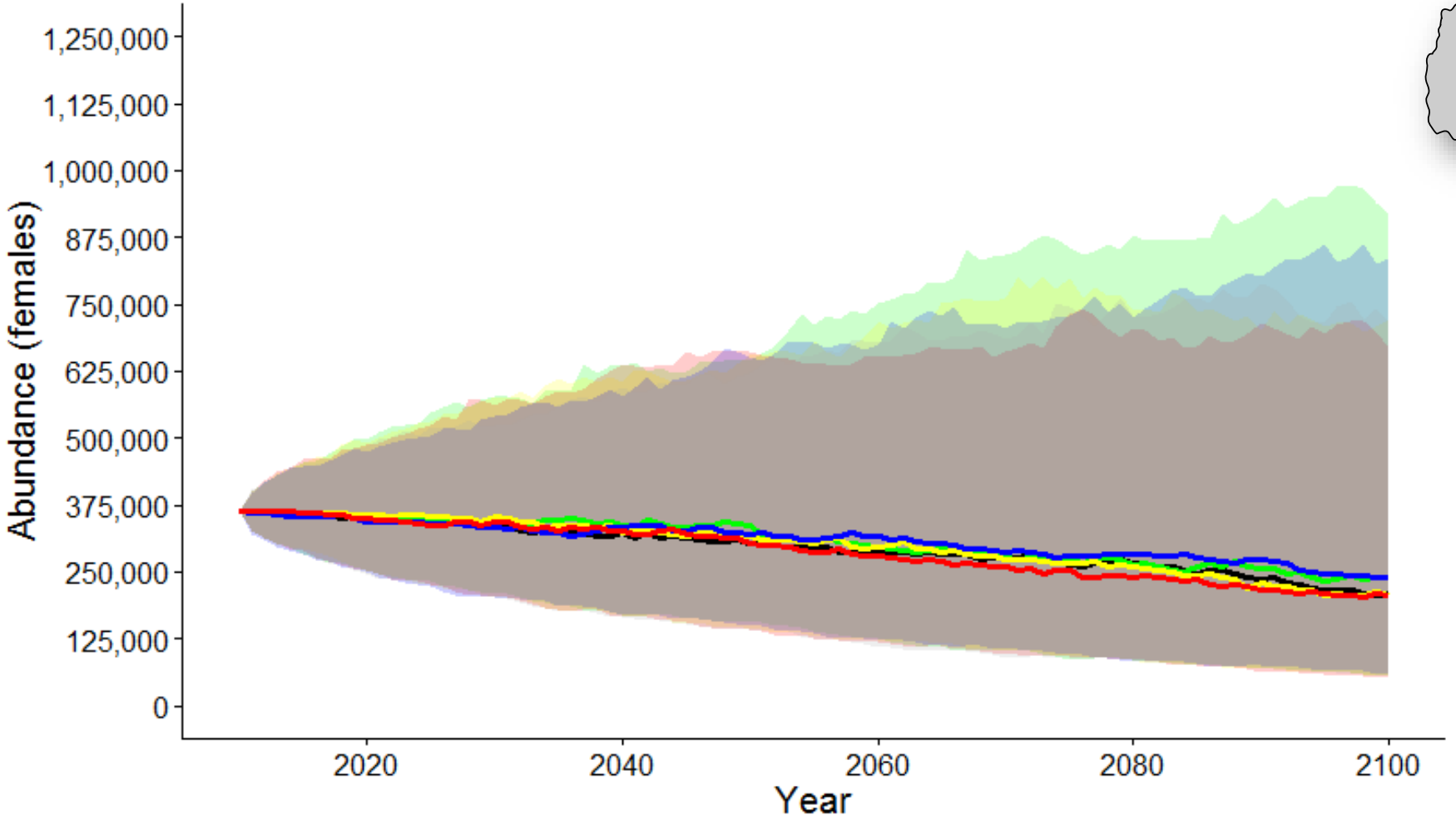
Wood Thrush without CCS



Climate Scenario

- Current
- CGCM3.T47 (Moderate)
- GFDL.A1FI (Extreme)

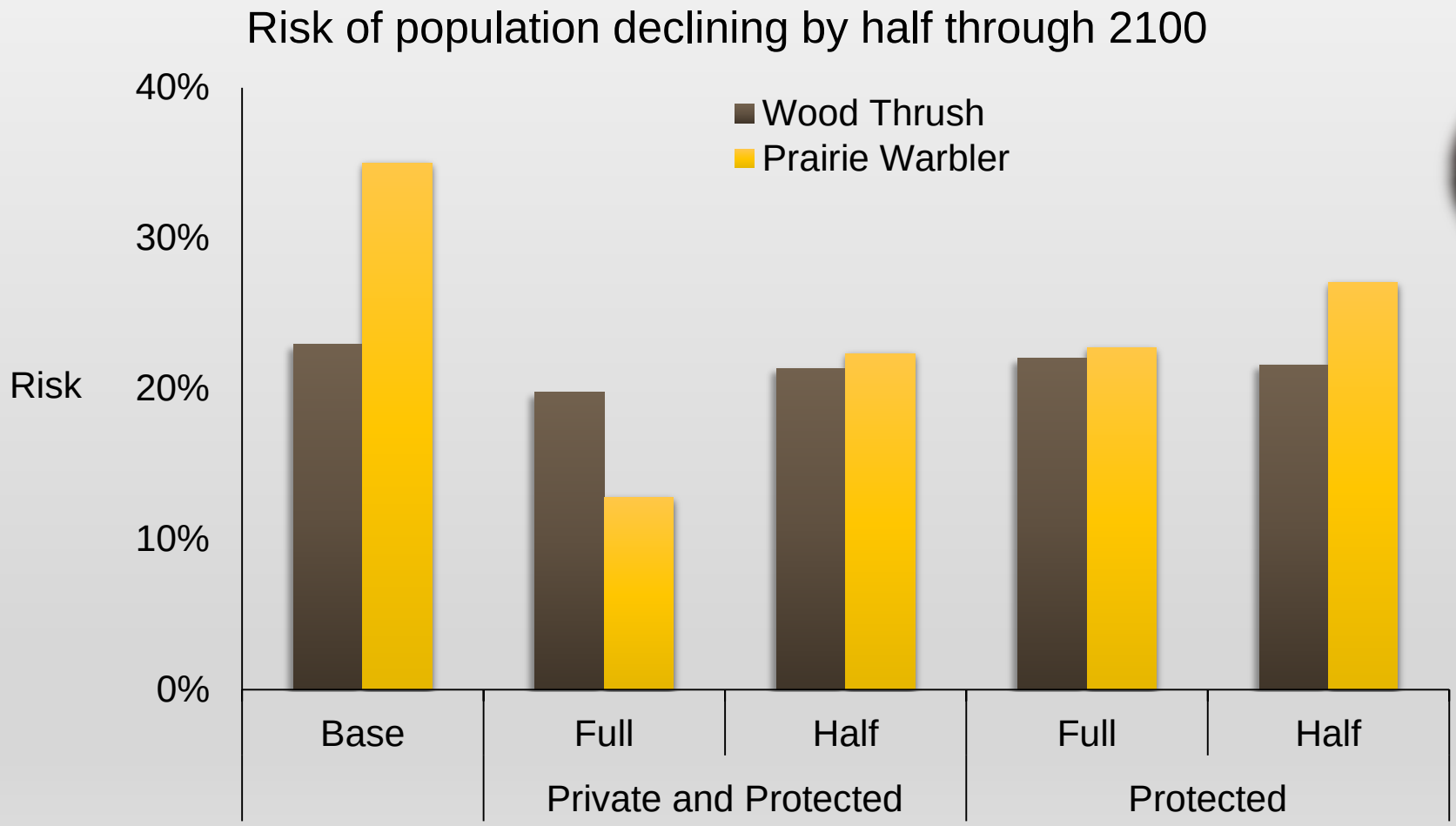
Wood Thrush with CCS under Extreme Climate Change



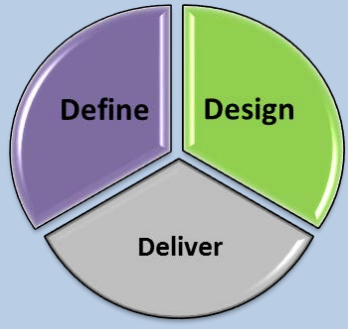
Conservation Scenario

- Base
- Private and Protected-Full
- Private and Protected-Half
- Protected - Full
- Protected - Half

Multiple species and Multiple Climates….



Moving towards Proactive Conservation



Strategy Framework for dynamic decision making (OZHI pilot project)

- DFCs & CHJV Habitat Objectives for forest habitat systems
- Landscape Prioritization
- Species Models & Future Projections
- Adaptation Strategies evaluated in terms of sustainable wildlife populations
- Tradeoffs within & among habitat systems