THE IMPORTANCE OF REGIONAL AND LANDSCAPE CONTEXT AND CLIMATE CHANGE TO NORTHERN BOBWHITE MANAGEMENT

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Background

con·text

noun

the circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood and assessed

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SCIENCE

Regional Forest Fragmentation and the Nesting Success of Migratory Birds

Scott K. Robinson,* Frank R. Thompson III,
Therese M. Donovan, Donald R. Whitehead, John Faaborg

Forest fragmentation, the disruption in the continuity of forest habitat, is hypothesized to be a major cause of population decline for some species of forest birds because fragmentation reduces nesting (reproductive) success. Nest predation and parasitism by cowbirds increased with forest fragmentation in nine midwestern (United States) landscapes that varied from 6 to 95 percent forest cover within a 10-kilometer radius of the study areas. Observed reproductive rates were low enough for some species in the most fragmented landscapes to suggest that their populations are sinks that depend for perpetuation on immigration from reproductive source populations in landscapes with more extensive forest cover. Conservation strategies should consider preservation and restoration of large, unfragmented "core" areas in each region.

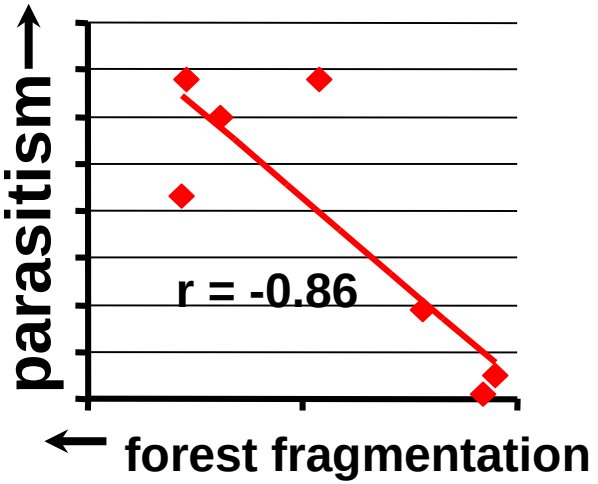
Factors Affecting Songbird Nest Success Occur at Multiple Scales

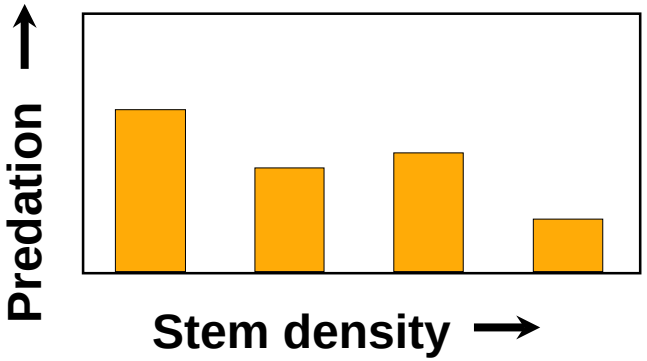
Biogeographic Effects

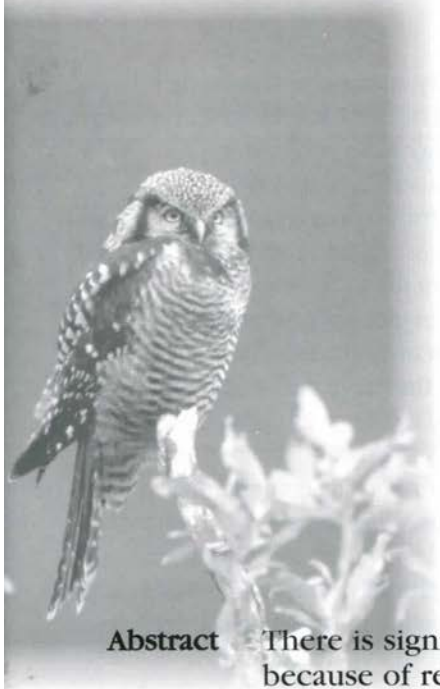
Landscape-Level Effects

Habitat and Patch Effects

Nest site





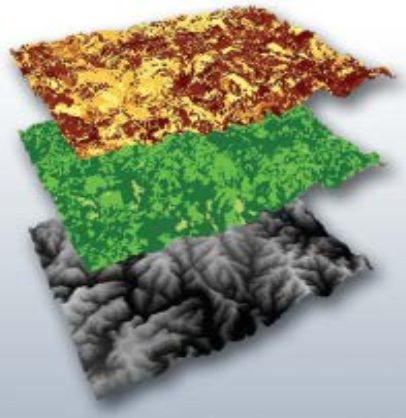


Conservation approaches for woody, early successional communities in the eastern United States

by Frank R. Thompson, III, and Richard M. DeGraaf

Abstract There is significant concern about the status of some early successional wildlife because of recent declines in populations and amount of habitat in the eastern United States (U.S.). We review types of semi-wooded, early successional habitats in the eastern U.S. and information on their status, and discuss management and planning approaches for their conservation. These habitats are dominated by persistent shrubs, seedling–sapling-sized trees, grasses, and forbs. The area of seedling–sapling forests and many natural shrubland habitats have declined in most of the eastern U.S. Silviculture creates early successional habitats primarily by regenerating stands. The selection of a regeneration method, size and distribution of cuts, and rotation age or reentry period influence availability of these habitats. Multi-scale planning approaches can be used to address regional concerns for these habitats and biological diversity, while facilitating landscape and local planning. We suggest that management for early successional communities is an important issue that should be addressed in

Wildlife Society Bulletin 2001, 29(2):483–494



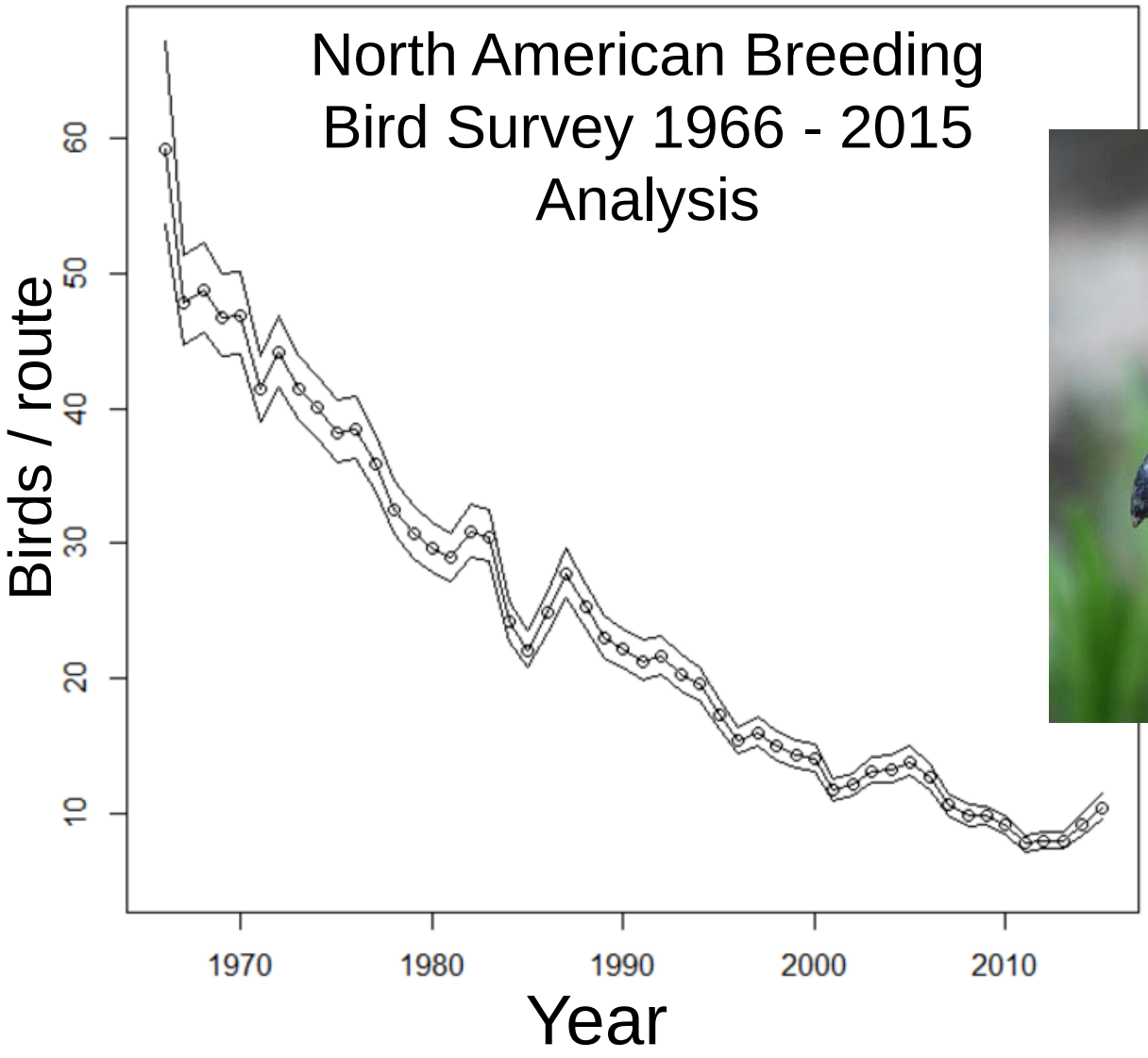
Models for Planning Wildlife Conservation in Large Landscapes

Joshua J. Millspaugh
Frank R. Thompson, III

Northern bobwhite juvenile survival, habitat selection and adult demographics in southwestern Missouri

Emily Sinnott, Frank Thompson, University of Missouri
Tom Thompson, Missouri Department of Conservation

Range-wide trend for Northern Bobwhite



Restoration of Northern Bobwhite populations will require:

- Many years of landscape-scale habitat restoration to halt the regional decline of bobwhites
- Purposeful management and habitat restoration on public and private lands and include practices such as prescribed fire to return disturbance to these landscapes
- Management focused only at the local scale needs to be very intensive and often fails

The National Bobwhite Conservation Initiative 2.0

- is a range-wide plan for recovering bobwhites
- provides a starting point for conservation planning
- includes a tool to aid planning and implementation of conservation at national, regional, state, and local scales
- It identifies high, medium and low-priority areas for bobwhite restoration, to help agencies and organizations more effectively target management
- provides a framework for continual improvements to its conservation planning tool such as climate change and urban growth and incorporating other grassland species

The National Bobwhite Conservation Initiative 2.0

Areas for improvement in NBCI 2.0

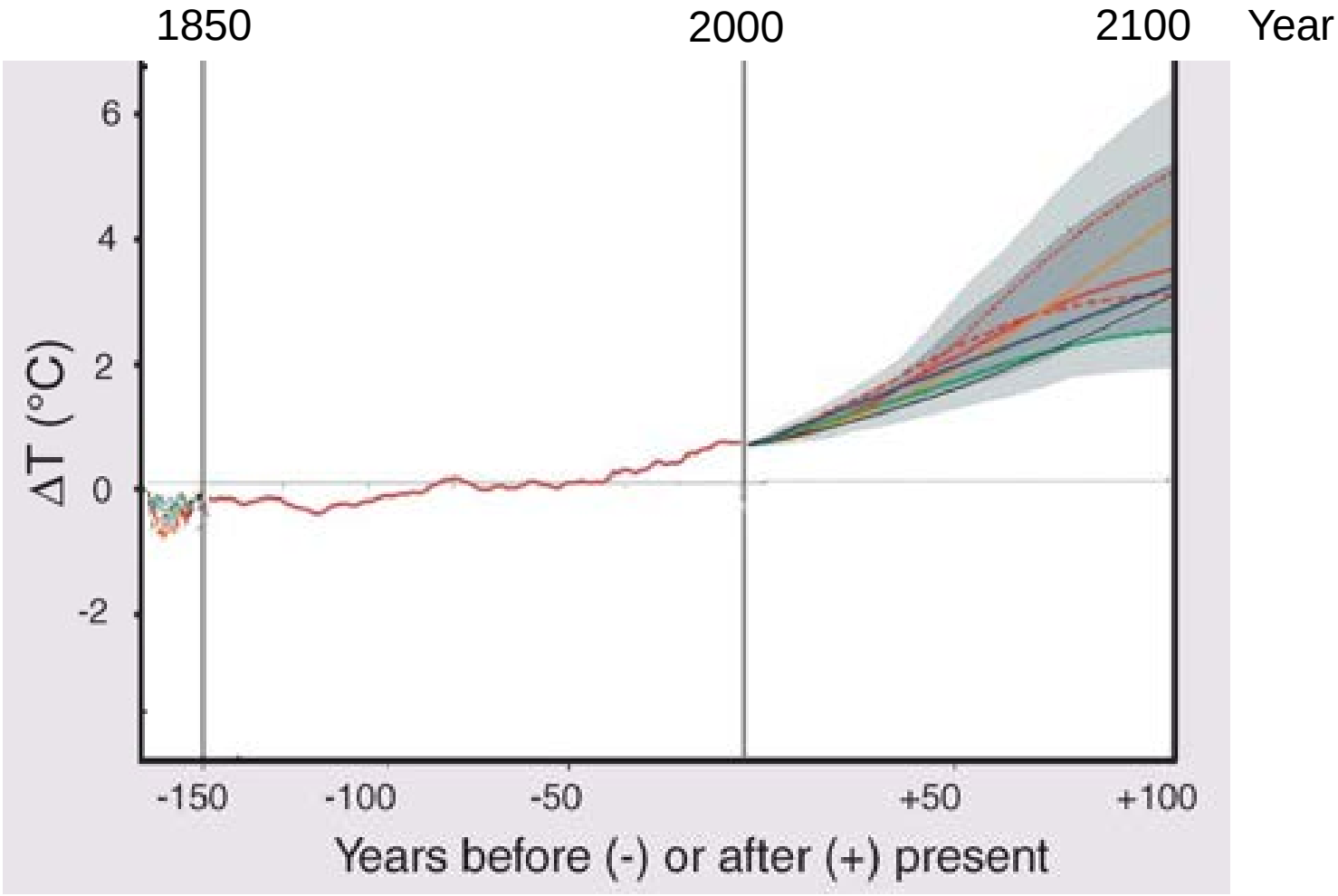
- planning for climate change and urban growth
- incorporating other grassland or disturbance dependent species

Outline

- Describe how three important aspects of regional and landscape context are projected to change over the next 60-100 years
  - Climate, land use, forests

- Demonstrate how conservation that acknowledges these aspects of context and scale can be more effective
  - report on some modeling tools and planning efforts that accounted for landscape context, succession, management, urbanization, and climate change.

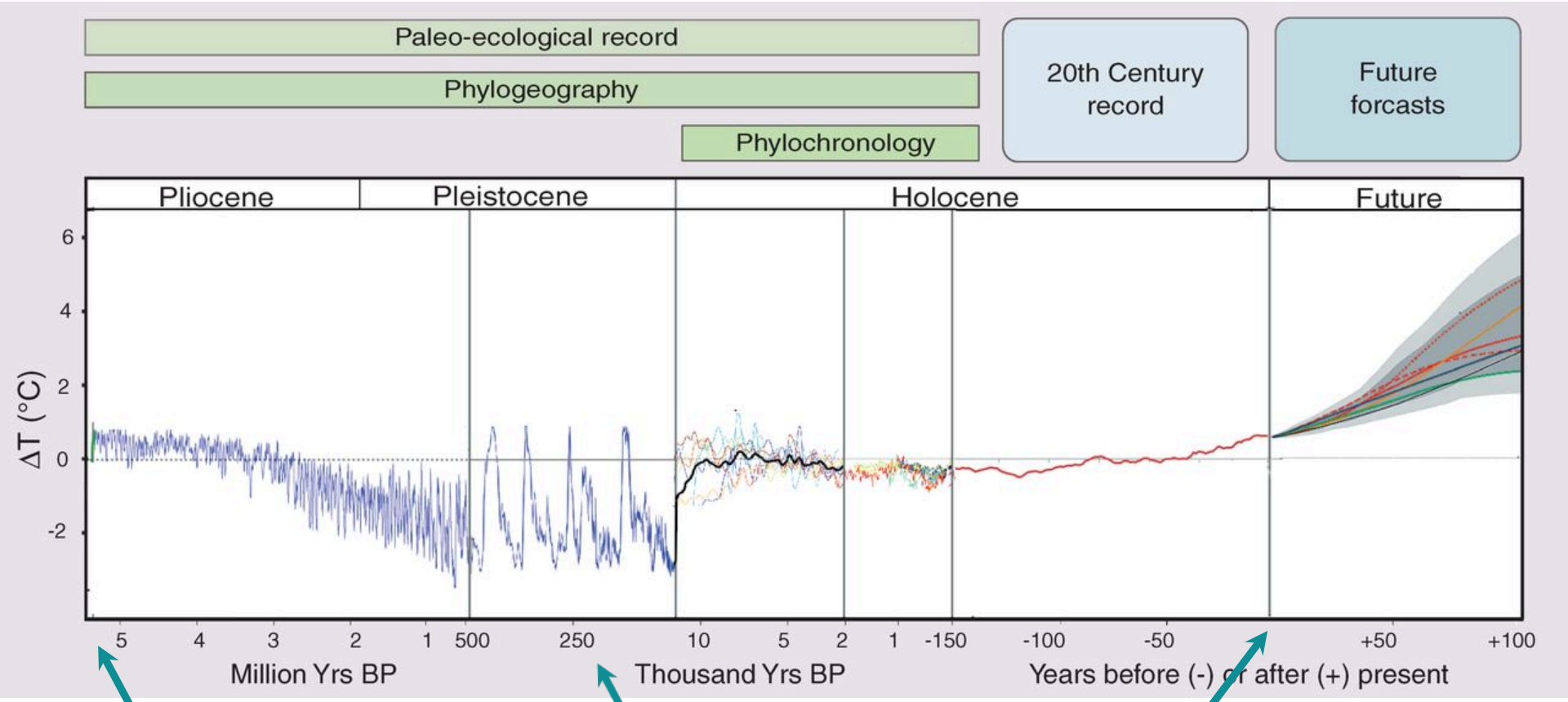
Climate change



Craig Moritz, and Rosa Agudo Science 2013;341:504-508

Science
AAAS

Past and future temperature change



Humans first appear

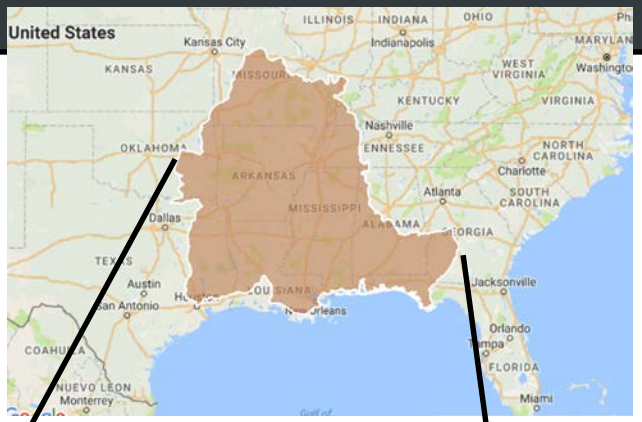
Ice age

Present

Craig Moritz, and Rosa Agudo Science 2013;341:504-508

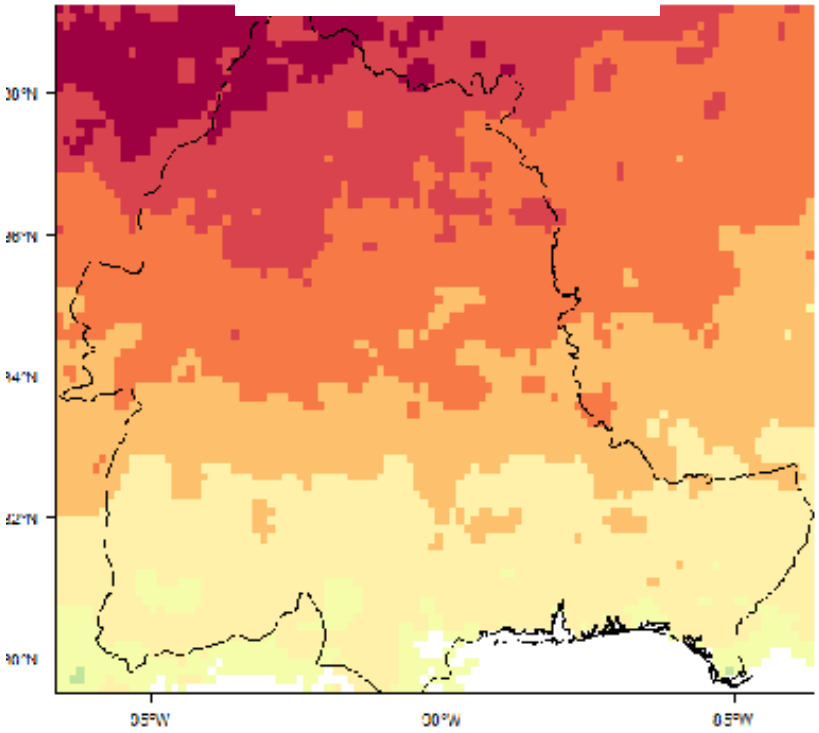
Science AAAS

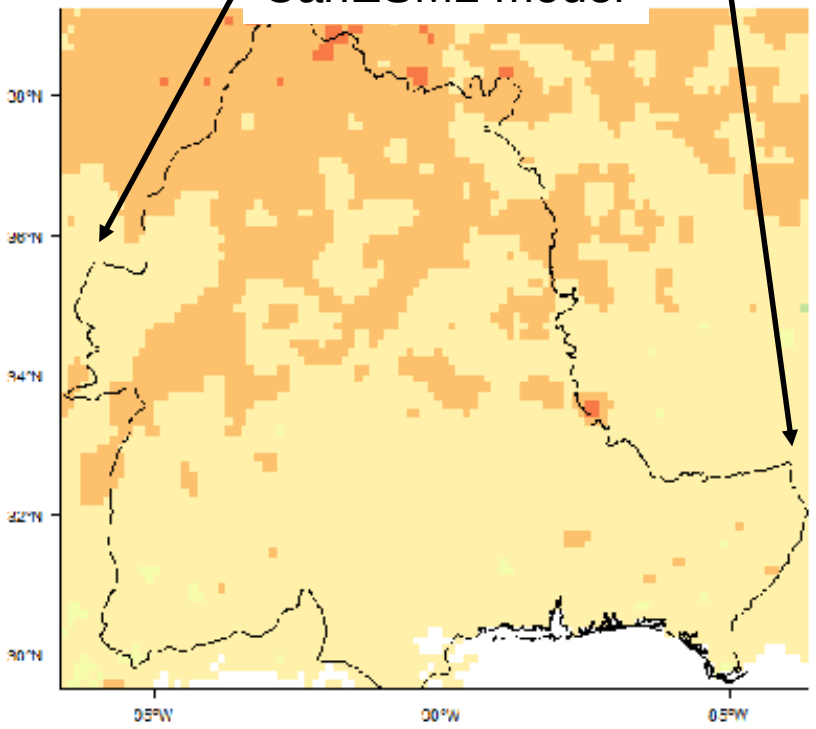
Mean maximum summer temperature difference °C

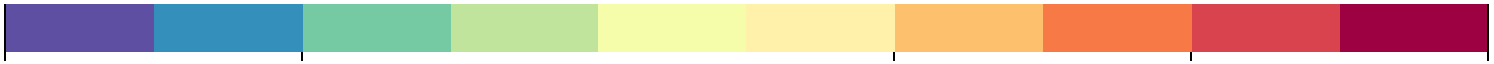


Access 1-0 model

CanESM2 model

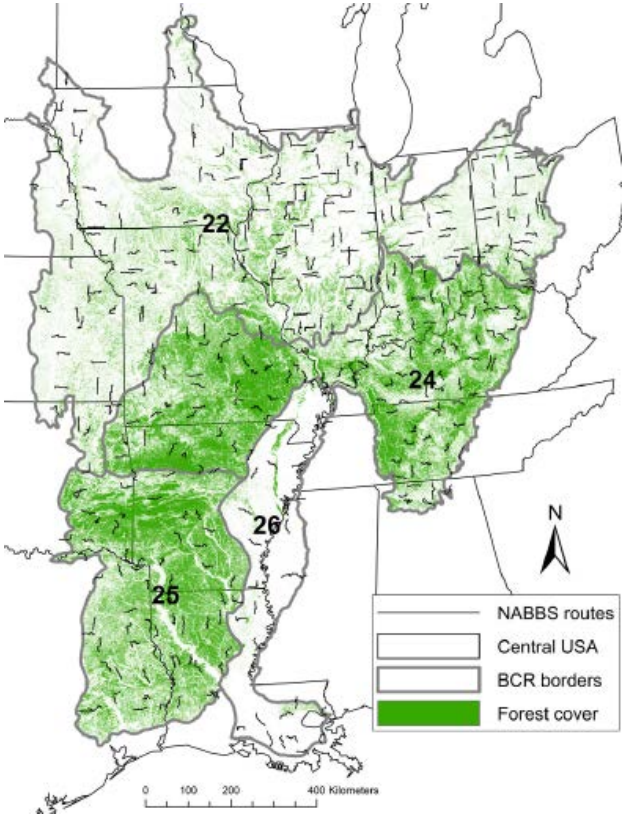


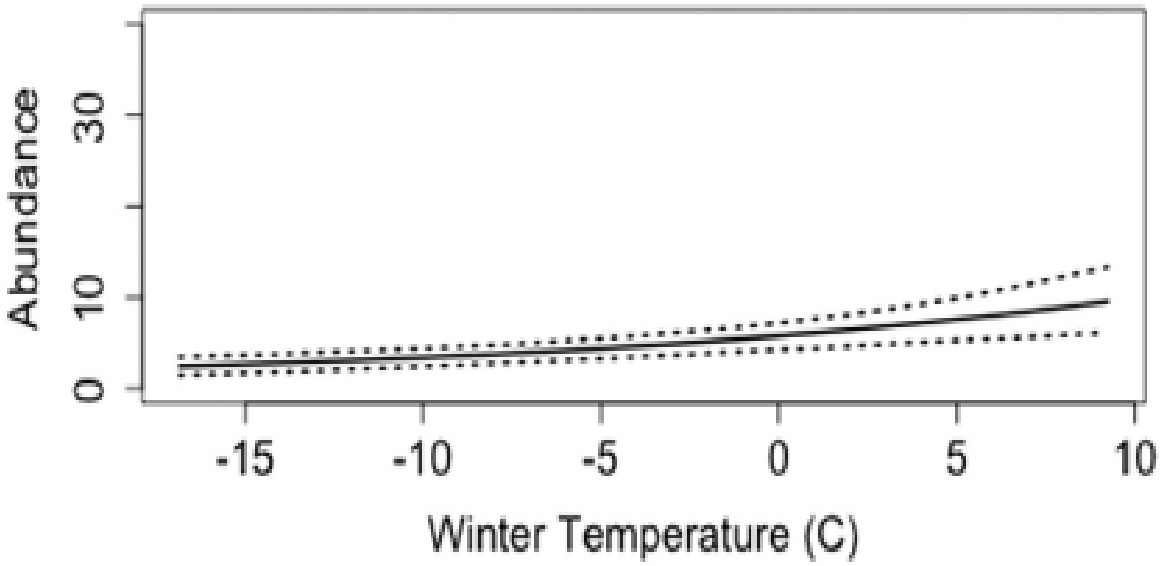




0 2 4 6 8 10 °C

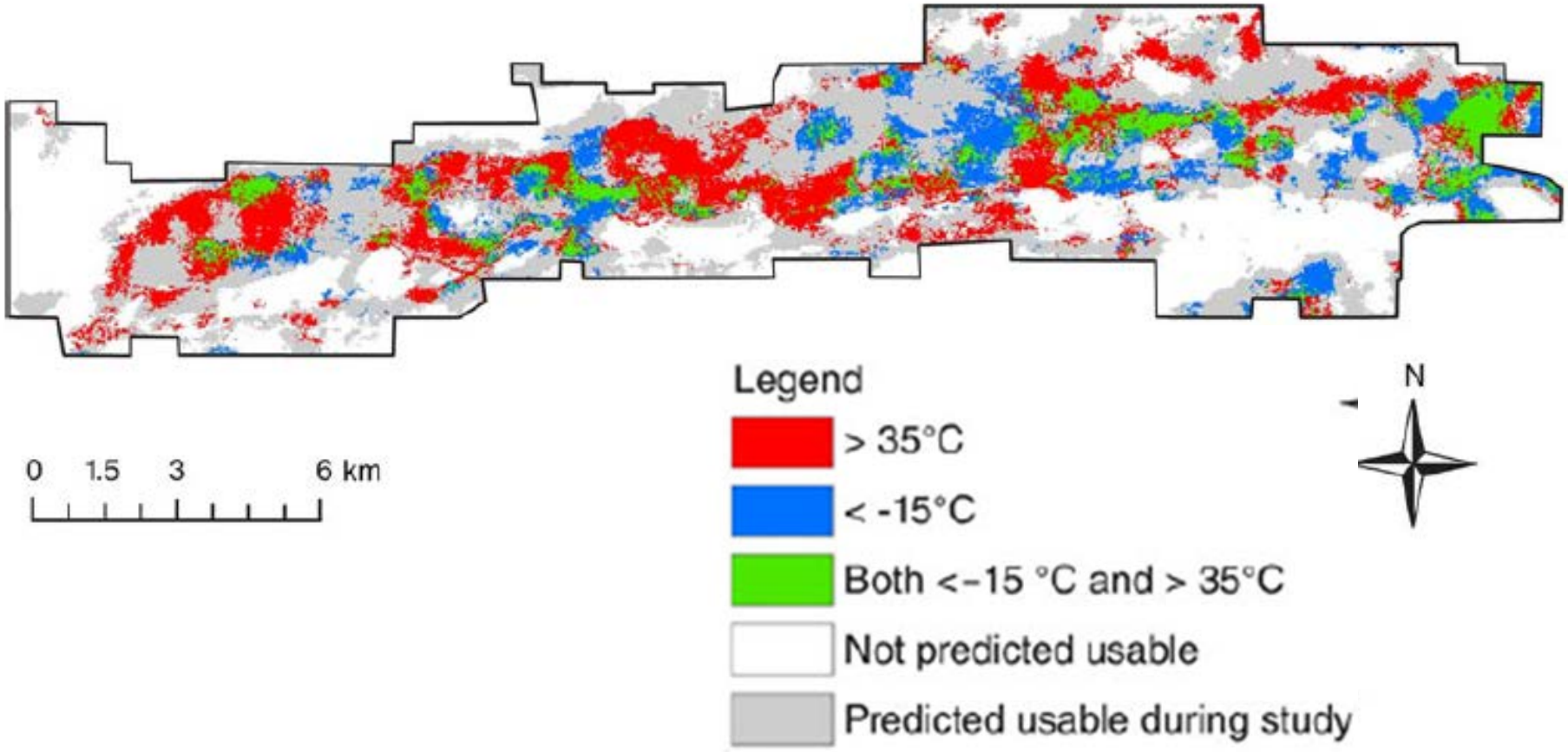
Climate and Northern Bobwhite abundance





Citation: LeBrun, J. J., W. E. Thogmartin, F. R. Thompson III, W. D. Dijak, and J. J. Millspaugh. 2016. Assessing the sensitivity of avian species abundance to land cover and climate. Ecosphere 7(6):e01359. 10.1002/ecs2.1359

Climate, space use, and survival



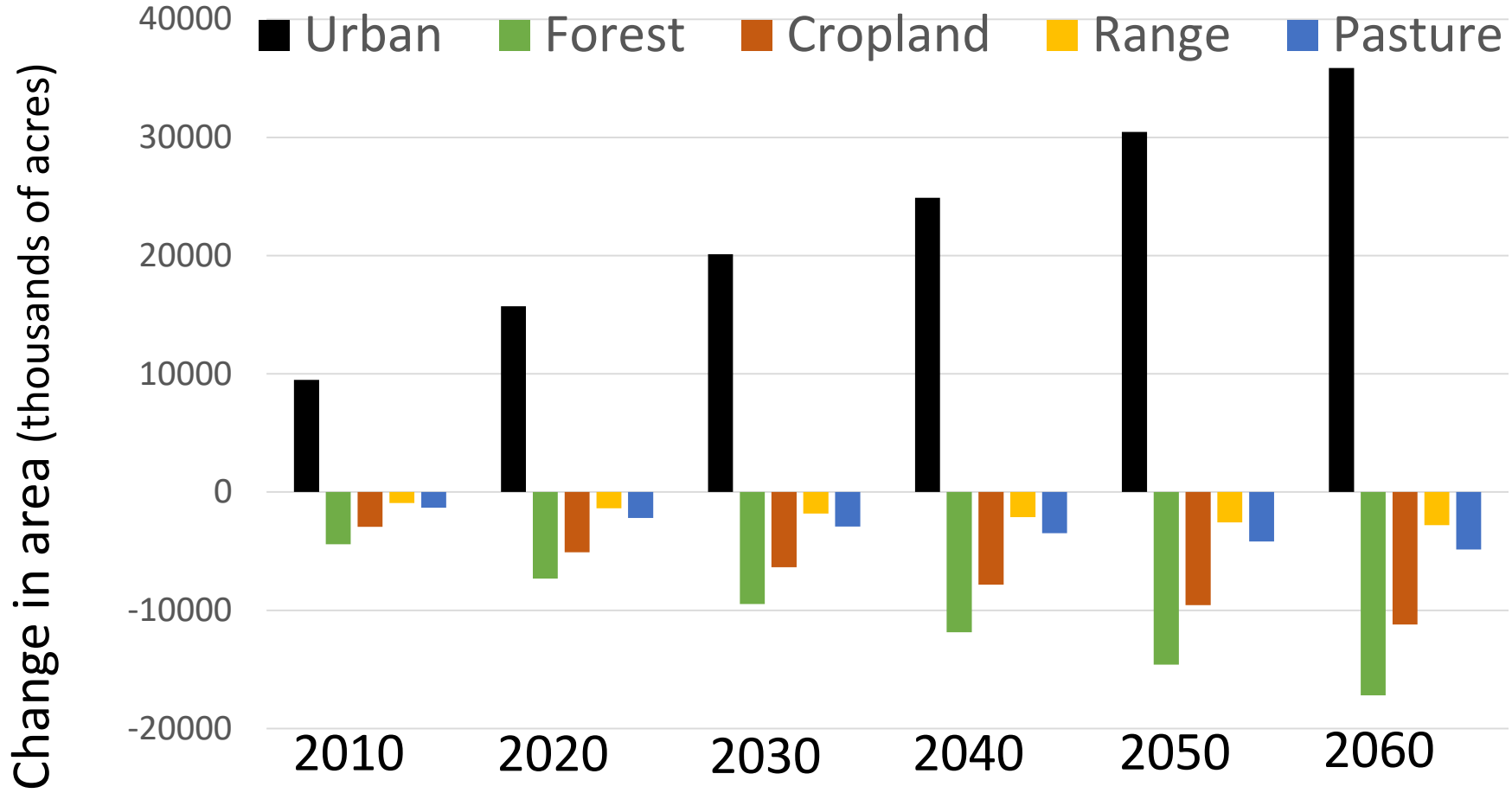
Extreme climatic events constrain space use and survival of a ground-nesting bird
EVAN P . TANNER1, R. DWAYNE ELMORE, SAMUEL D. FUHLENDORF, CRAIG. A. DAVIS, DAVID K. DAHLGREN and JEREMY P. ORANGE. Global Change Biology (2016), doi: 10.1111/gcb.13505

Regional context: land use change

Southern Forest Futures Project

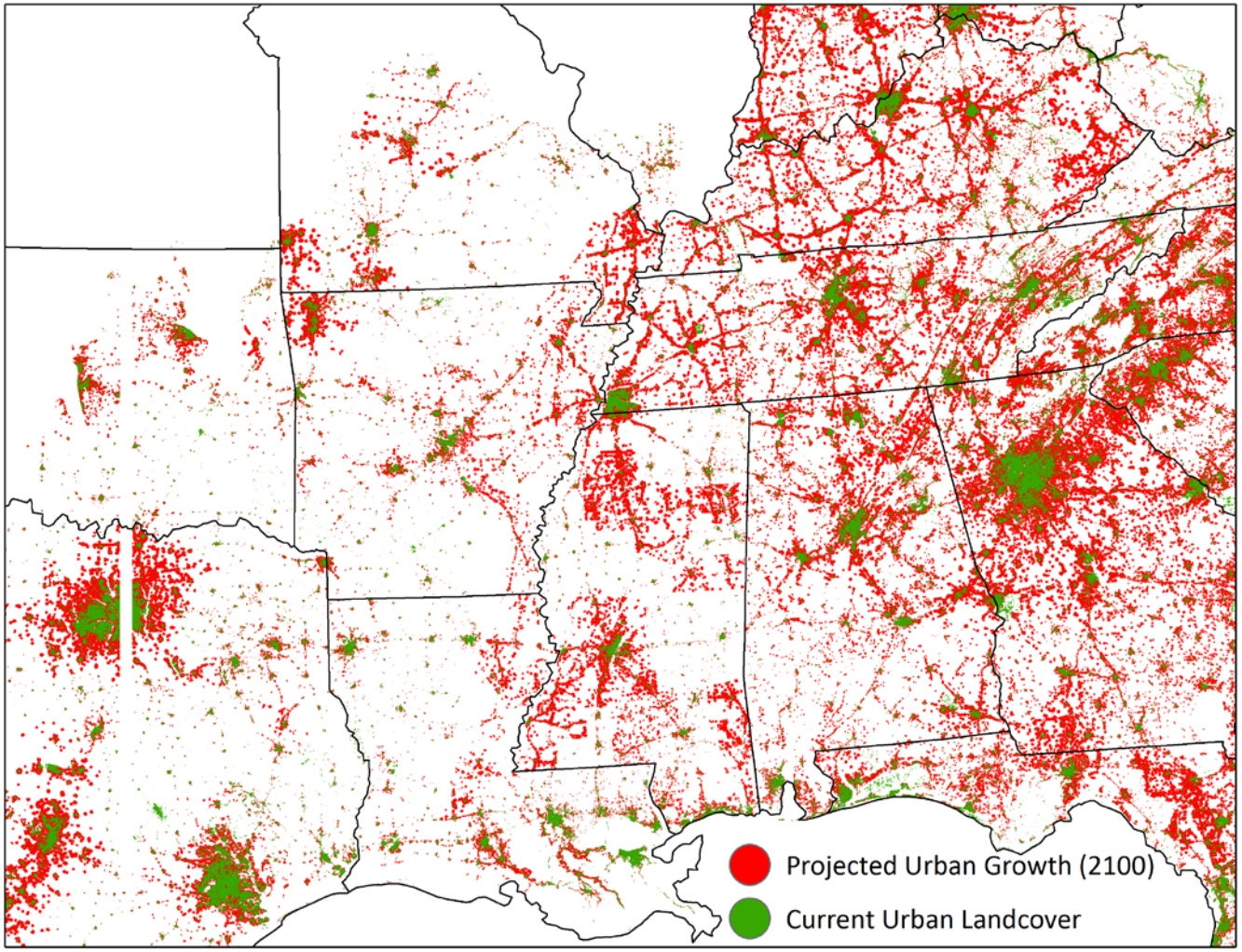
Wear, David N.; Greis, John G., eds. 2013. The Southern Forest Futures Project: technical report. Gen. Tech. Rep. SRS-178. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 542 p.

Changes in urban, forest, cropland, range, and pasture land use in the Southeastern U.S. 2010–2060.



Values are averaged across predictions for the four Cornerstone futures developed in the Southern Forest Futures Project (Wear and Greis 2013)

Projected urban growth



Belyea, C.M., and Terando, A.J. 2015. Urban Growth Modeling for the SAMBI Designing Sustainable Landscapes Project. <http://www.basic.ncsu.edu/dsl/urb.html>

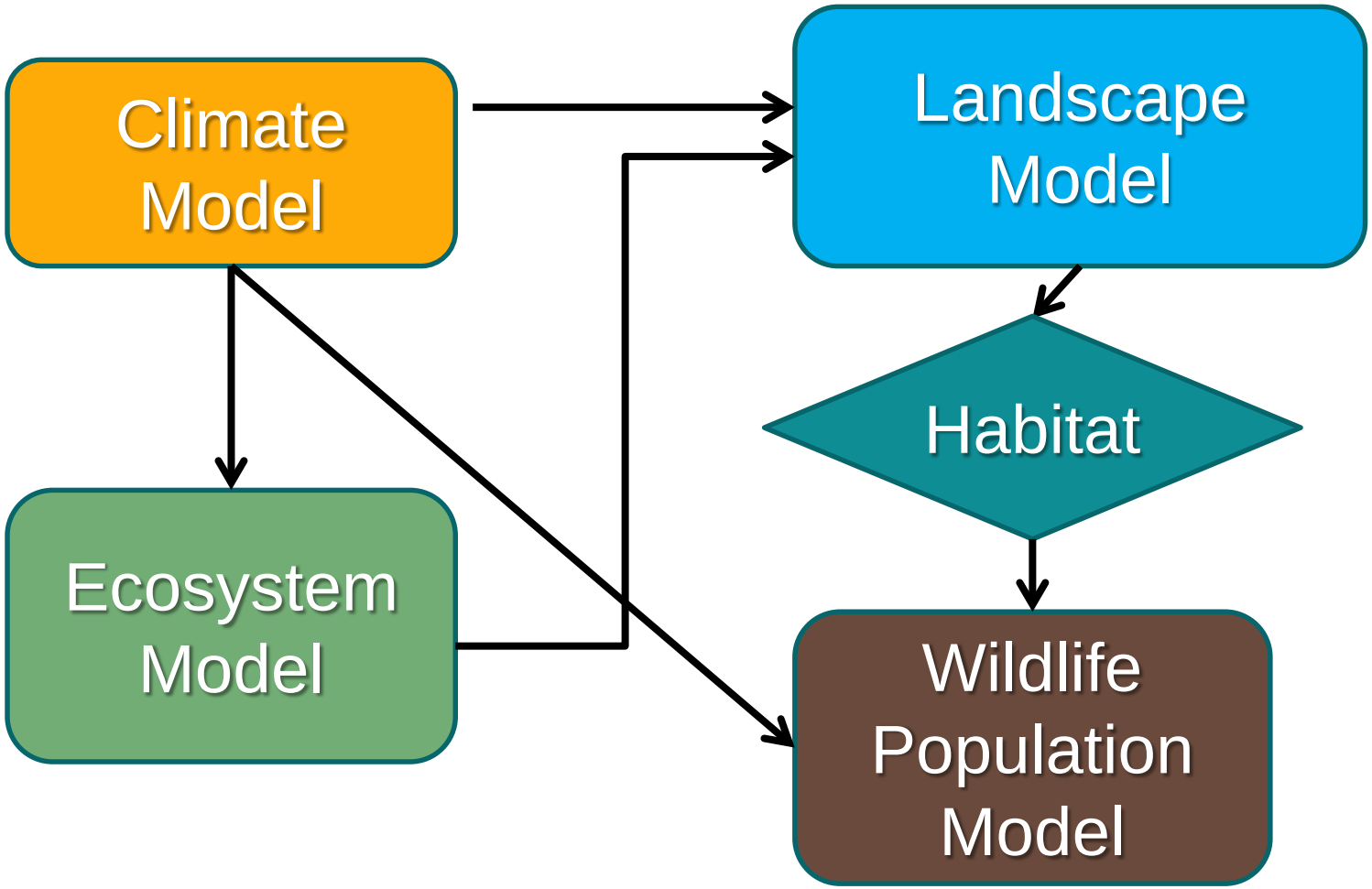
LINKING CLIMATE, ECOSYSTEM AND LANDSCAPE MODELS TO INFORM VULNERABILITY ASSESSMENTS AND LANDSCAPE CONSERVATION DESIGN

Frank R. Thompson III, Bill Dijak; US Forest Service Northern Research Station

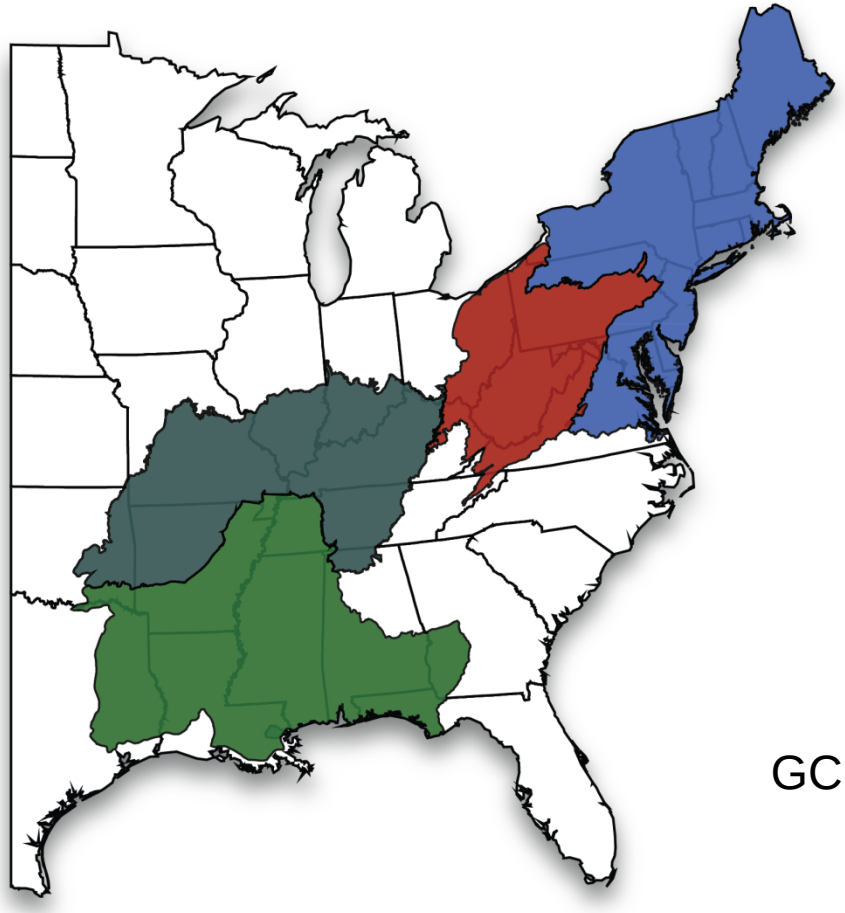
Hong S. He, Tom Bonnot, Jacob S. Fraser, Wen J. Wang;

University of Missouri School of Natural Resources

Modeling Approach



Application of LANDIS PRO modeling framework in vulnerability assessments and adaptation planning



North Atlantic

NECSC, US Forest Service, North Atlantic LCC

NIACS Climate Change Response Framework

- Central Hardwoods
- Central Appalachians
- Mid-Atlantic
- New England

Gulf Coastal Plains and Ozarks

GCPO LCC,MU, US Forest Service, NECSC,

MU

NECSC Northeast Climate Science Center

LANDSCAPE CONSERVATION COOPERATIVES

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

Approach to forecasting future forests

Climate models

Down-scaled predictions:

- Temperature
- Precipitation
- Solar radiation
- Wind

Ecosystem Simulation

LINKAGES

Inputs:

- Location
- Tree spp. traits
- **Climate**
- Soil properties

Landscape Simulation

LANDIS PRO

Inputs:

- Growth
- Aging
- Seed dispersal
- Species establishment
- Carrying capacity
- Competition
- Disturbance regime
- Management regime
- Urban growth

LINKAGES VS. LANDIS PRO

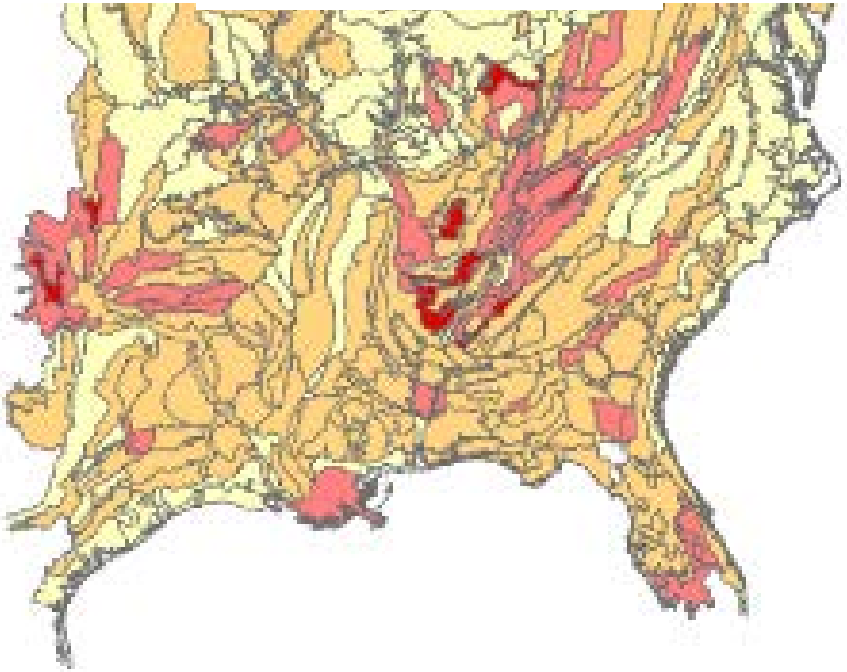
- LINKAGES
  - Potential species habitat based on individual species predicted future growth and survival (fundamental niches)
  - Potential maximum growing capacity (maximum productivity or K)
- LANDIS PRO
  - Simulates changes in forest composition and structure over time (species realized niches); can include forest management, fire, and urbanzation

Linkages: Climate change will affect maximum basal area (tree carrying capacity)

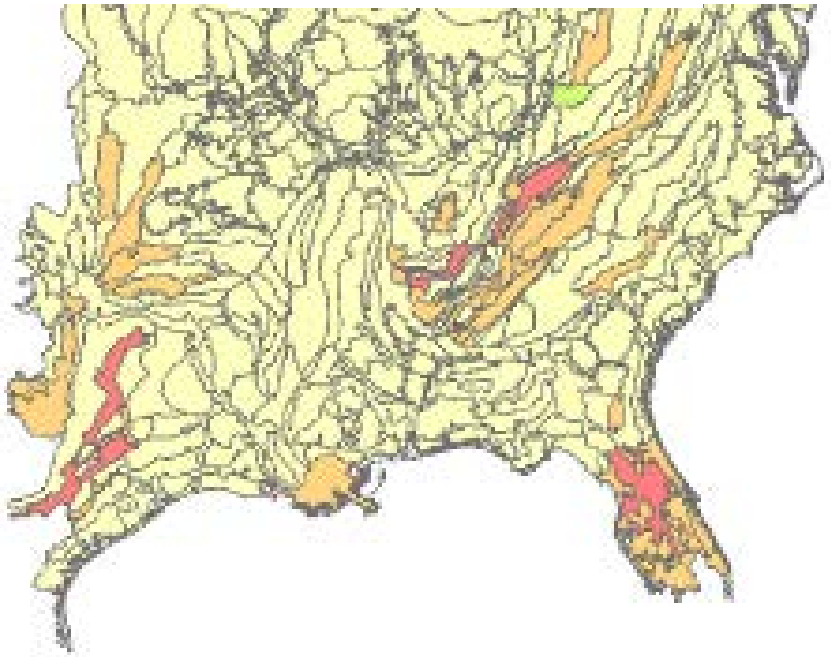
Sites on some landforms and soils will transition from closed forest to more open forest

- 5-20% Increase
- < 5% Change
- 5-20% Decrease
- 20-40% Decrease
- 40-60% Decrease
- > 60% Decrease

Access 1-0 model



GFDL-CM3 model



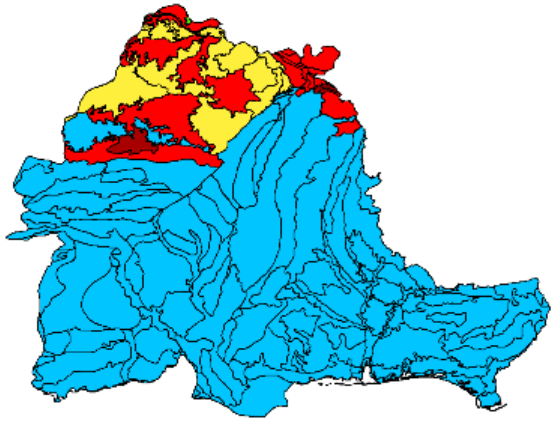
GCPO LCC


United States
ILLINOIS
INDIANA
OHIO
Kansas City
Indianapolis
KANSAS
MISSOURI
WEST VIRGINIA
KENTUCKY
VIRGINIA
Nashville
OKLAHOMA
TENNESSEE
NORTH CAROLINA
Charlotte
ARKANSAS
Atlanta
SOUTH CAROLINA
MISSISSIPPI
Dallas
ALABAMA
GEORGIA
TEXAS
Austin
San Antonio
LOUISIANA
New Orleans
Jacksonville
Orlando
Tampa
COAHUILA
FLORIDA
NUEVO LEON
Monterrey
Miami

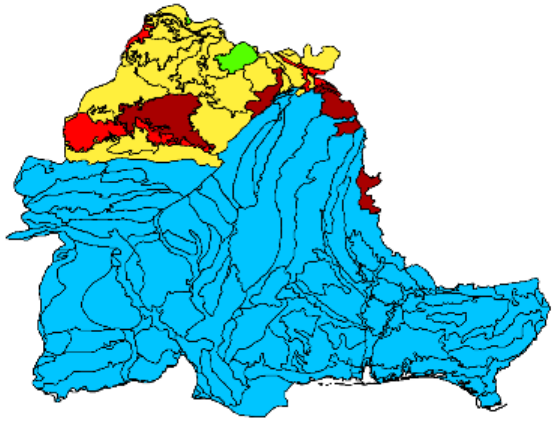
LINKAGES: Change in potential growth and establishment in 2100

Shortleaf pine

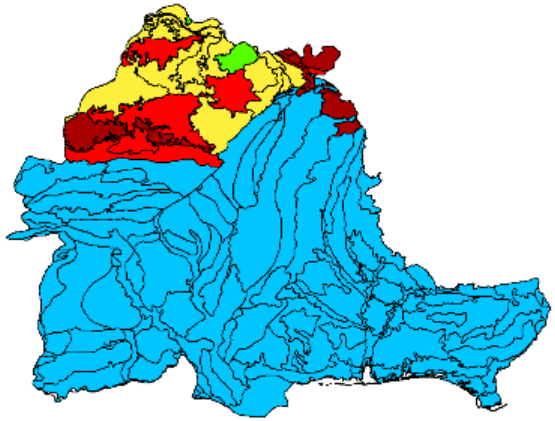
ACCESS1-0 RCP 8.5



CanESM2 RCP 8.5



GFDL-CM3 RCP 8.5

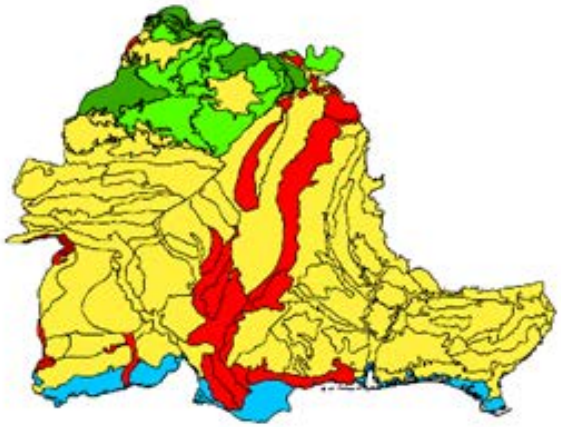


Not Present
Extirpated
Large Decrease
Small Decrease
No Change
Small Increase
Large Increase
Colonization

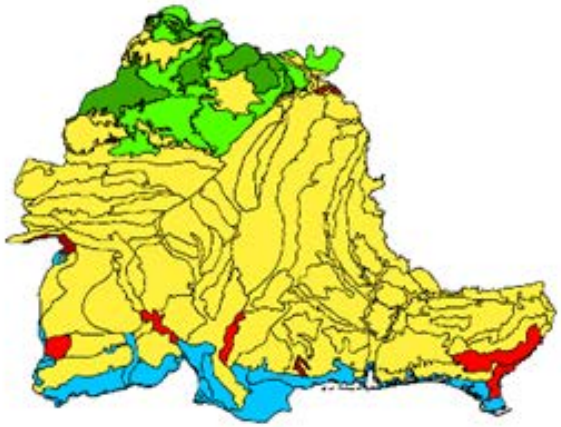
LINKAGES: Change in potential growth and establishment in 2100

Loblolly pine

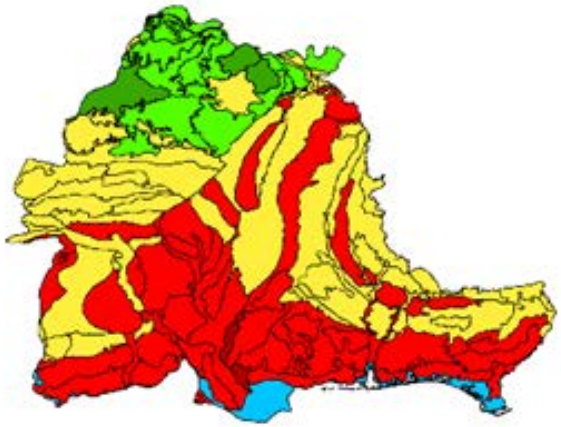
ACCESS1-0 RCP 8.5



CanESM2 RCP 8.5



GFDL-CM3 RCP 8.5

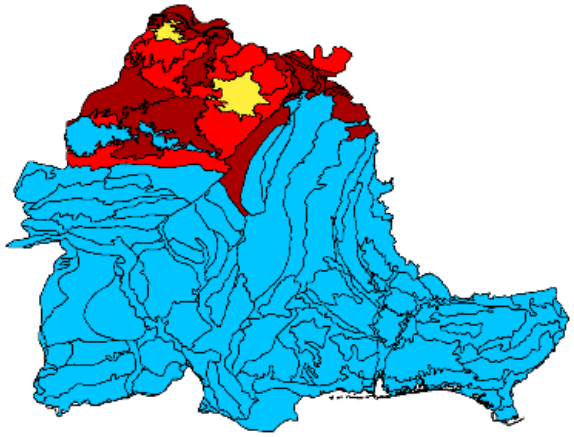


Not Present
Extirpated
Large Decrease
Small Decrease
No Change
Small Increase
Large Increase
Colonization

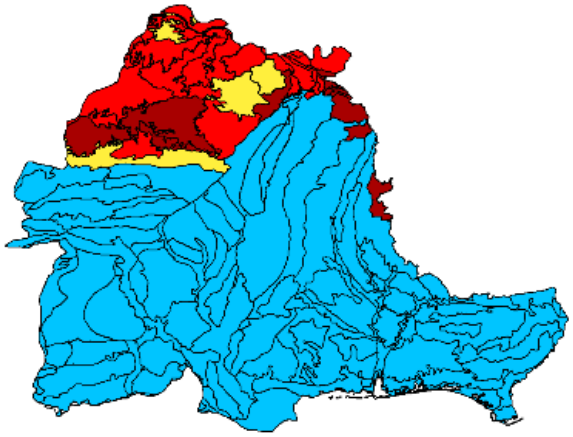
LINKAGES: Change in potential growth and establishment in 2100

White oak

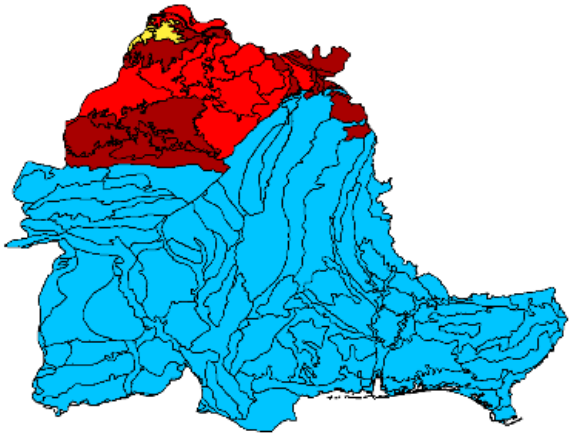
ACCESS1-0 RCP 8.5



CanESM2 RCP 8.5



GFDL-CM3 RCP 8.5



Not Present

Extirpated

Large Decrease

Small Decrease

No Change

Small Increase

Large Increase

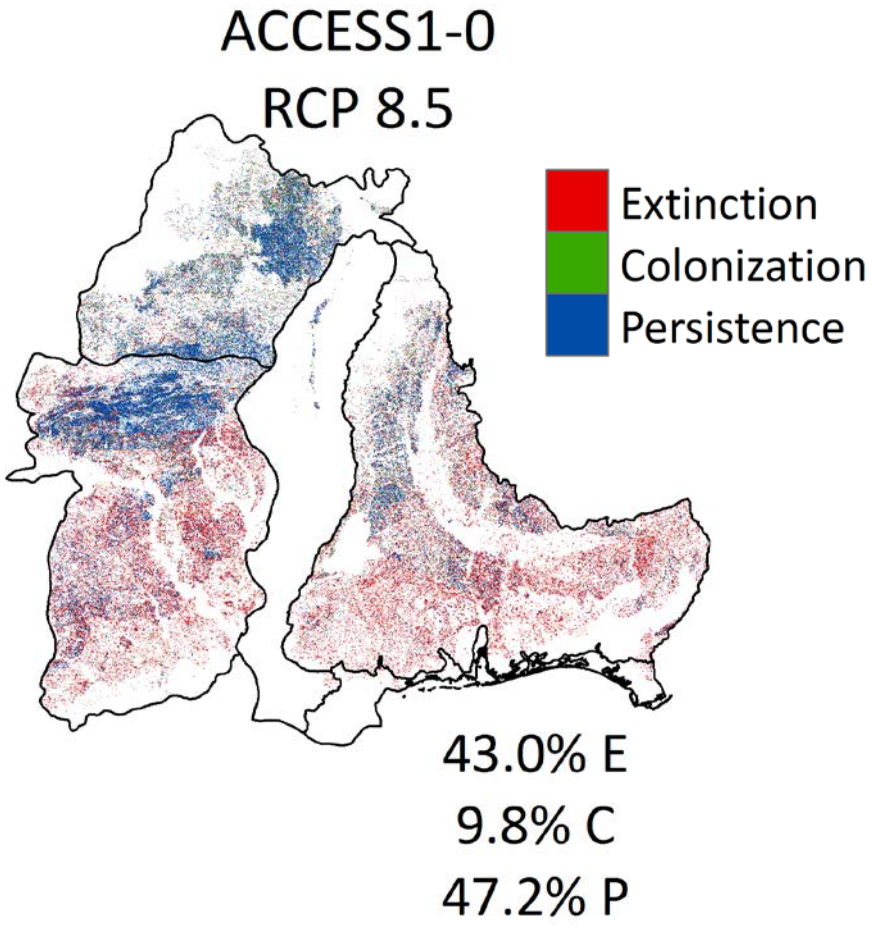
Colonization

LANDIS: Predicted change in species occurrence from 2000 to 2100

Example

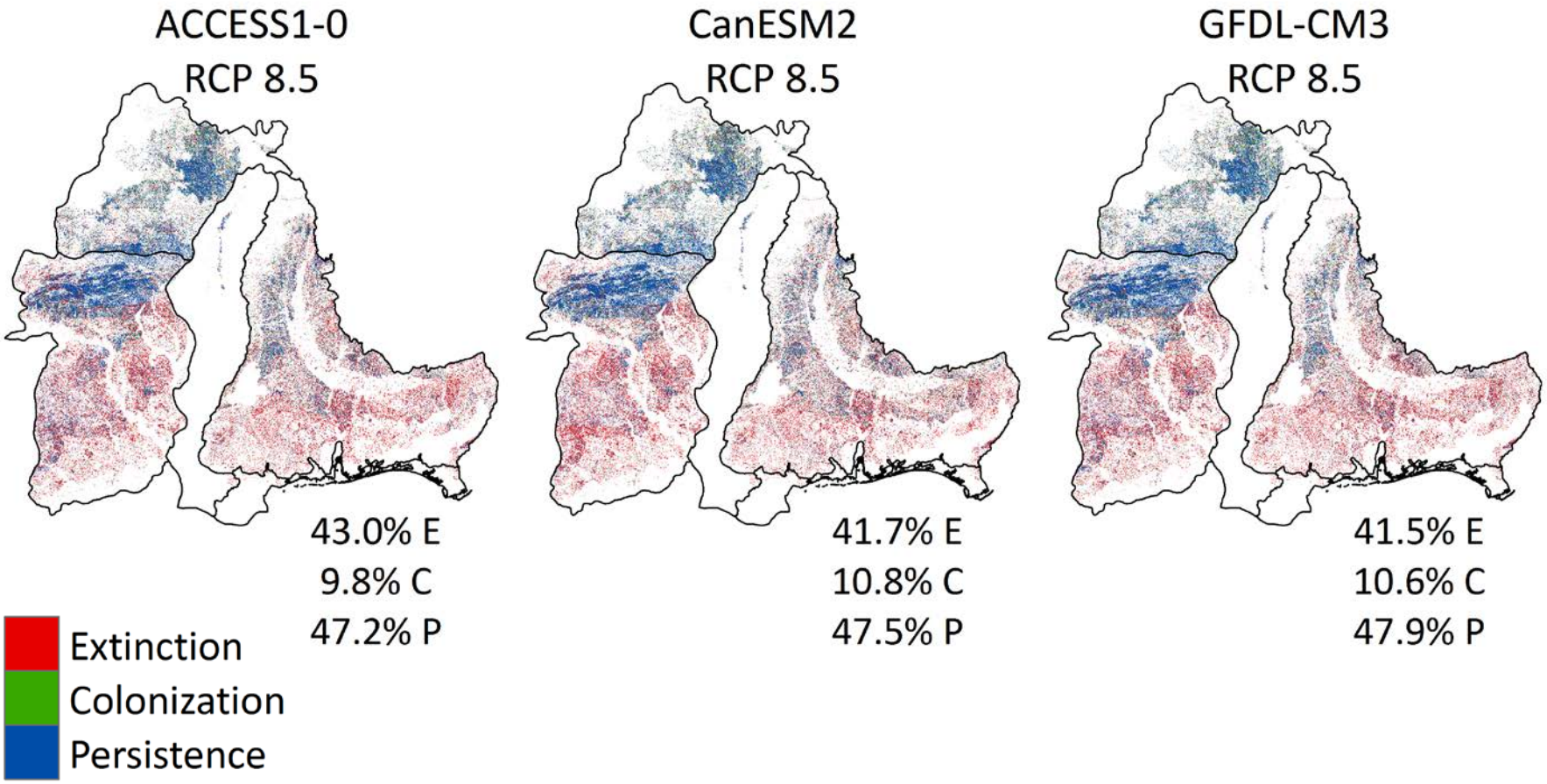
Model includes:

- Climate change (3 GCMs)
- Losses to urbanization
- Forest succession
- Current levels forest management and fire



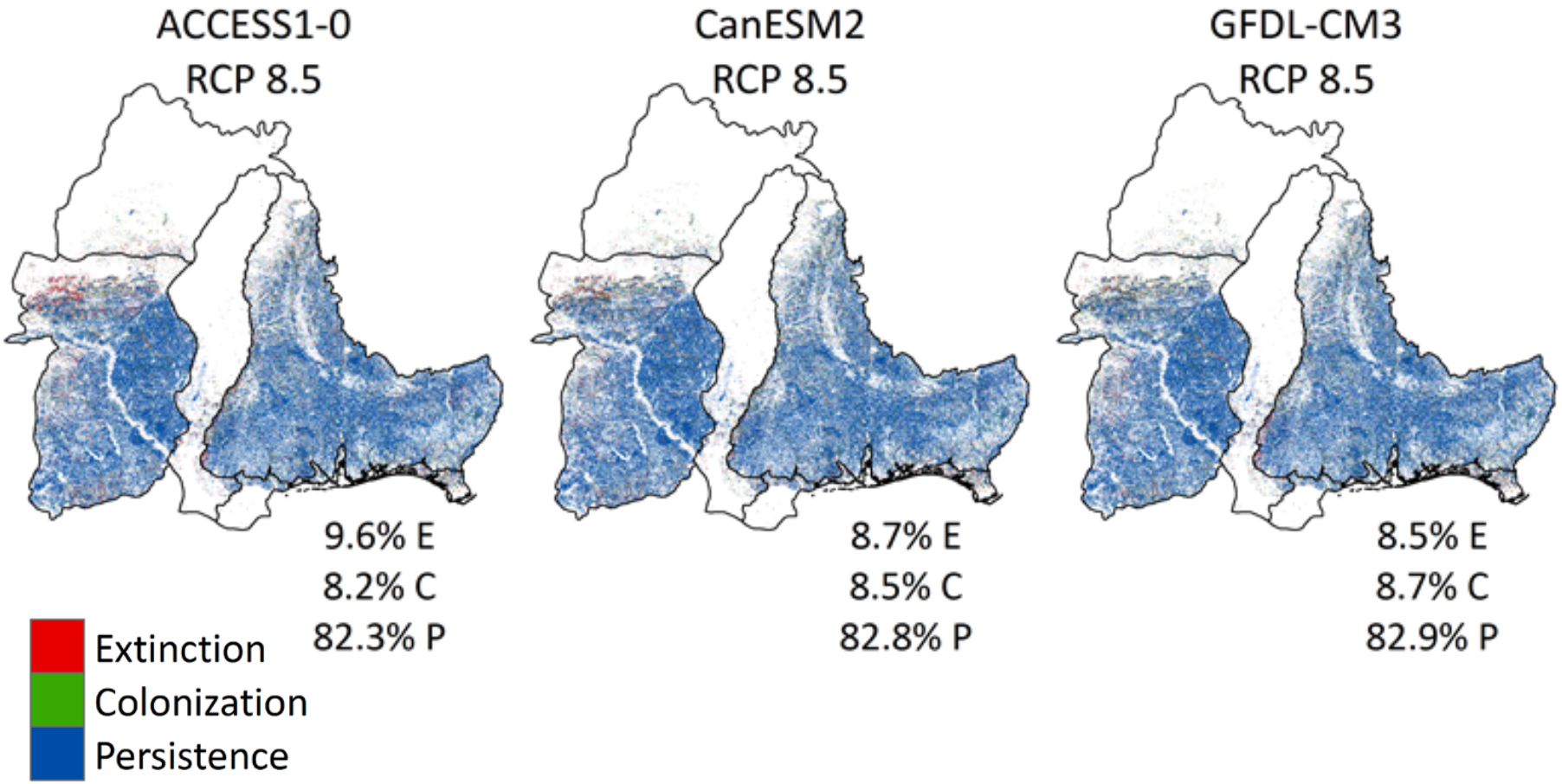
LANDIS: Predicted change in species occurrence from 2000 to 2100

Shortleaf pine



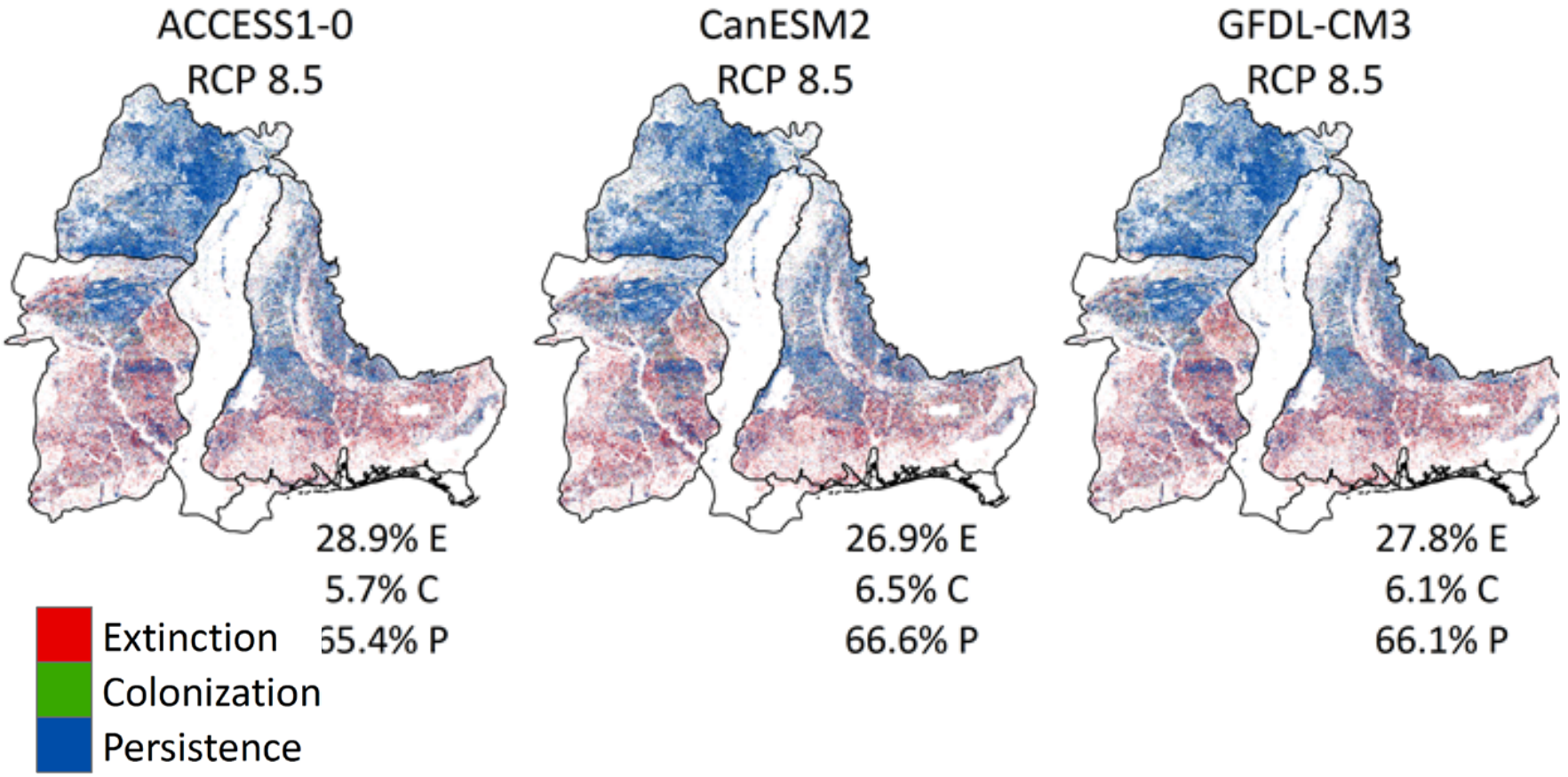
LANDIS: Predicted change in species occurrence from 2000 to 2100

Loblolly pine



LANDIS: Predicted change in species occurrence from 2000 to 2100

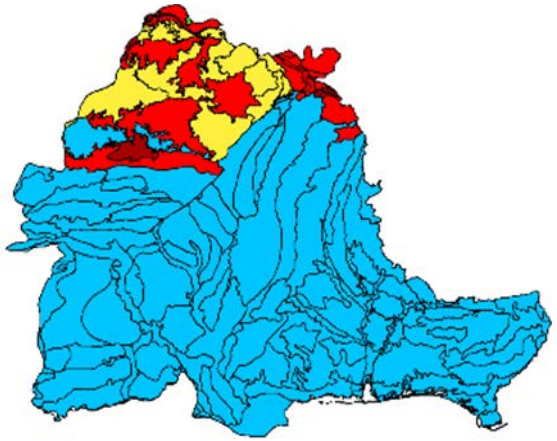
White oak



Management facilitates change

Shortleaf pine year 2100

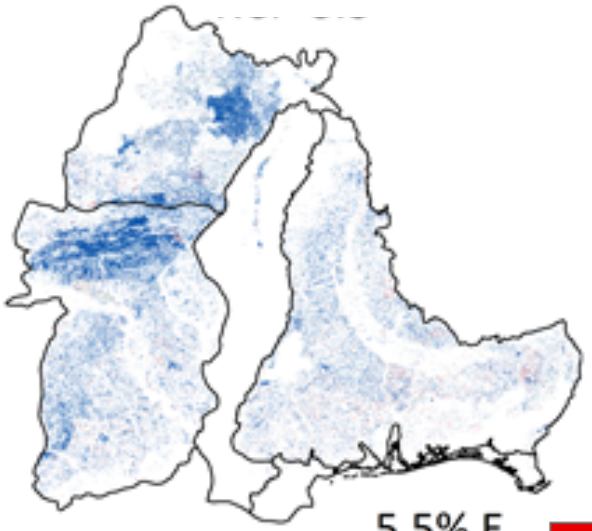
LINKAGES:
Habitat potential



Extirpated
Small Increase
Large Decrease
Large Increase
Small Decrease
Colonization

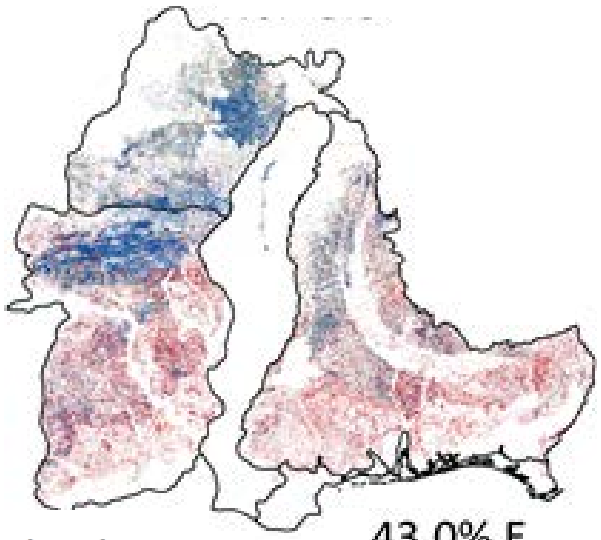
LANDIS:

No management **With management**



5.5% E
1.0% C
93.5% P

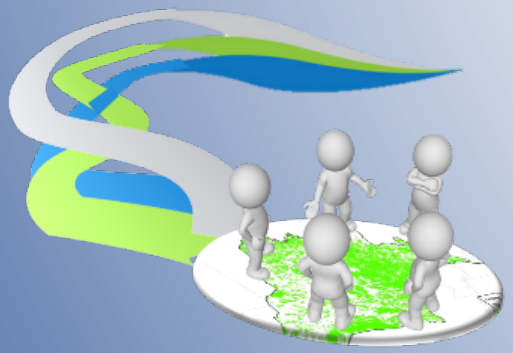
Extinction
Colonization
Persistence



43.0% E
9.8% C
47.2% P

Guiding Regional Conservation Planning under Climate Change

Integrating dynamic landscape population models with structured decision making



Thomas Bonnot, *University of Missouri, Northeast Climate Science Center*

Frank Thompson, *Northern Research Station, USFS*

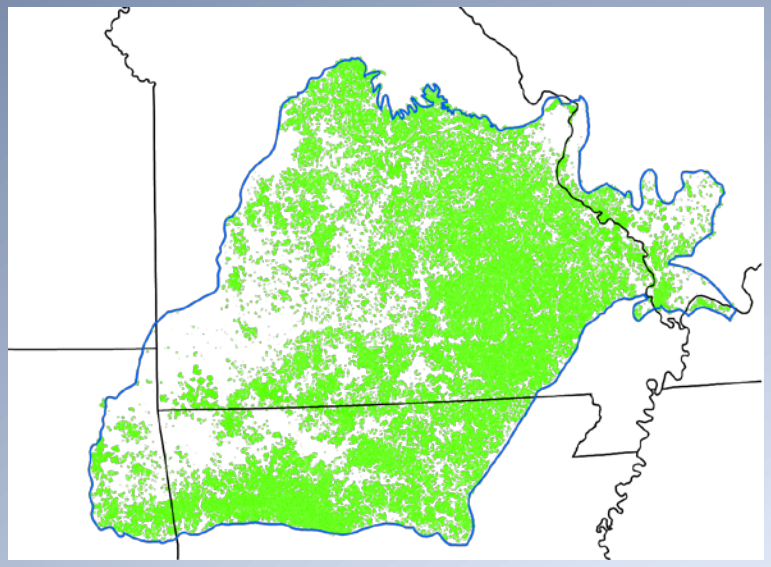
Josh Millspaugh, *University of Missouri*

GCPO

NE CSC Northeast Climate Science Center

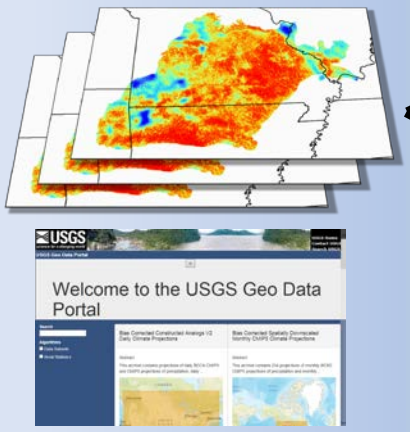
Ozark Highlands Team

D. Todd Jones-Farrand	GCPO
Kristine Evans	GCPO
Phillip Hanberry	MORAP
Allison Fowler	AR
Mark Howery	OK
Jane Fitzgerald	CHJV
Larry Heggemann	CHJV
Shea Hammond	USFWS
Esther Stroh	USGS
Nate Muenks	MO

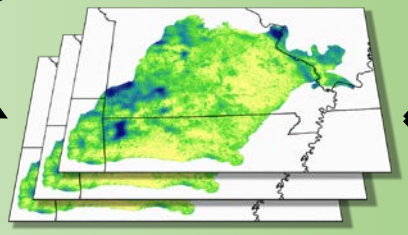


Dynamic Landscape Metapopulation Models

Climate Model



Landscape Model



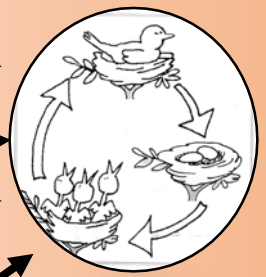
LANDIS

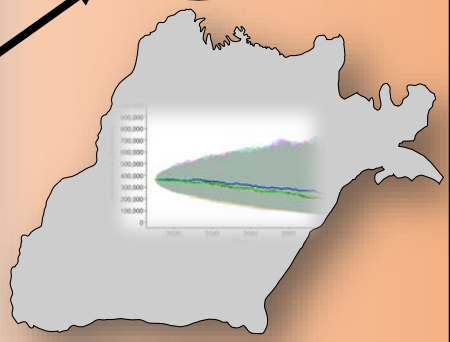
LINKAGES

Habitat Model

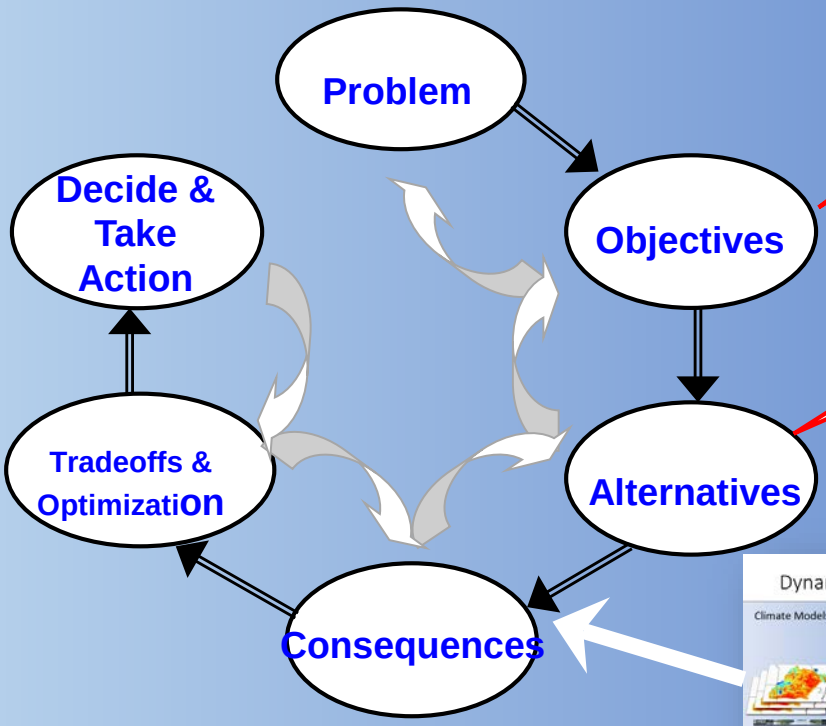
- Reproduction
- Survival
- Abundance
- Dispersal

Population Model



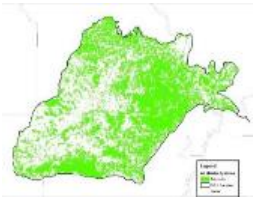


Structured Decision Making



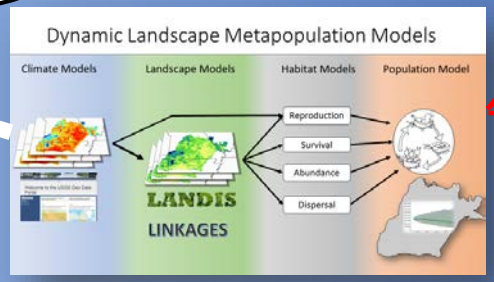
Species Risk
- Species 1?
- Species 2?
- Species 3?

Conservation
- What?
- When?
- Where?



Climate Change
- Climate 1?
- Climate 2?
- Climate 3?

Urbanization



Objectives: Focal Species

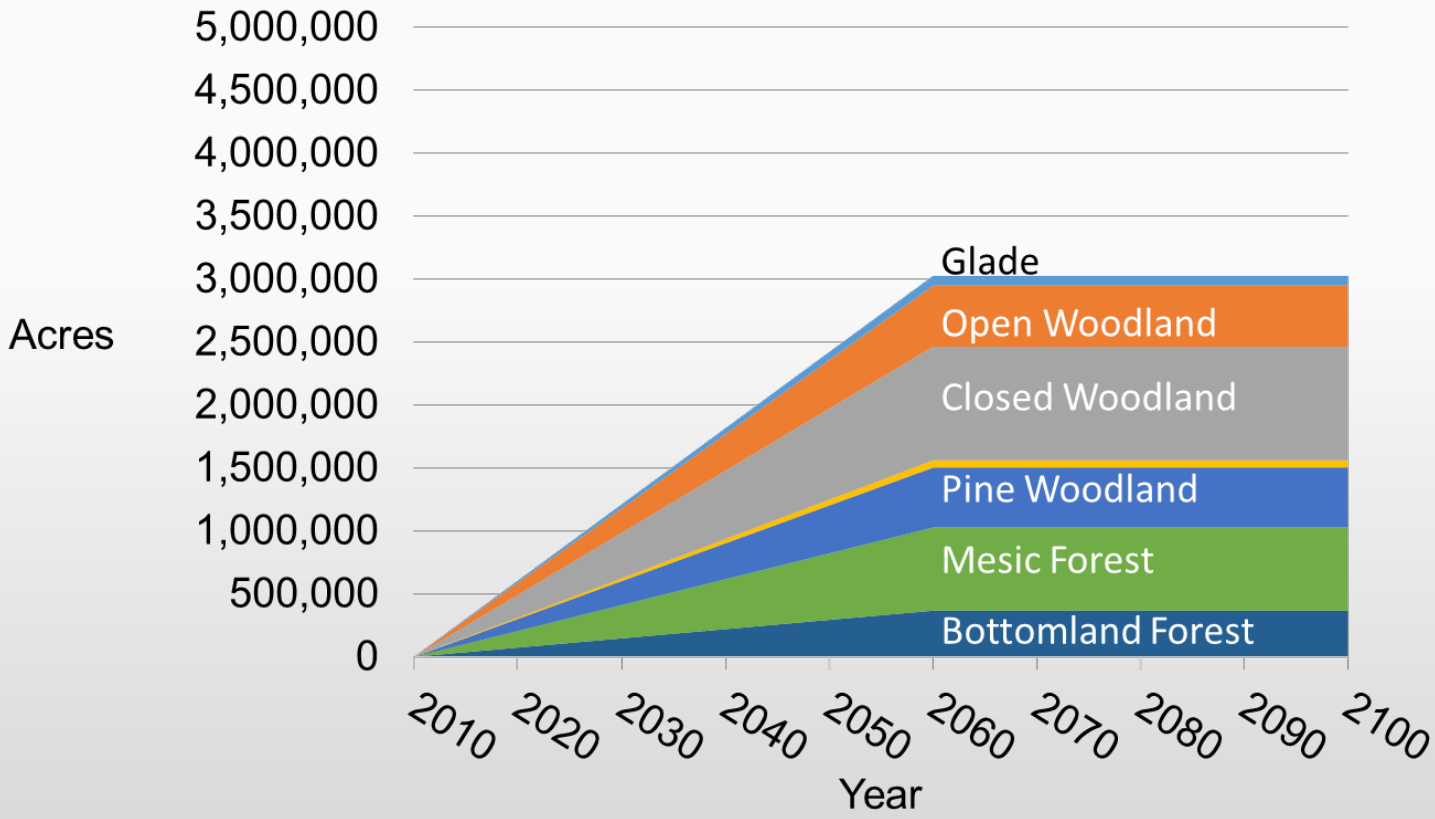
Forest

Glade, Open or Closed-woodland

Pine Woodland

Floodplain

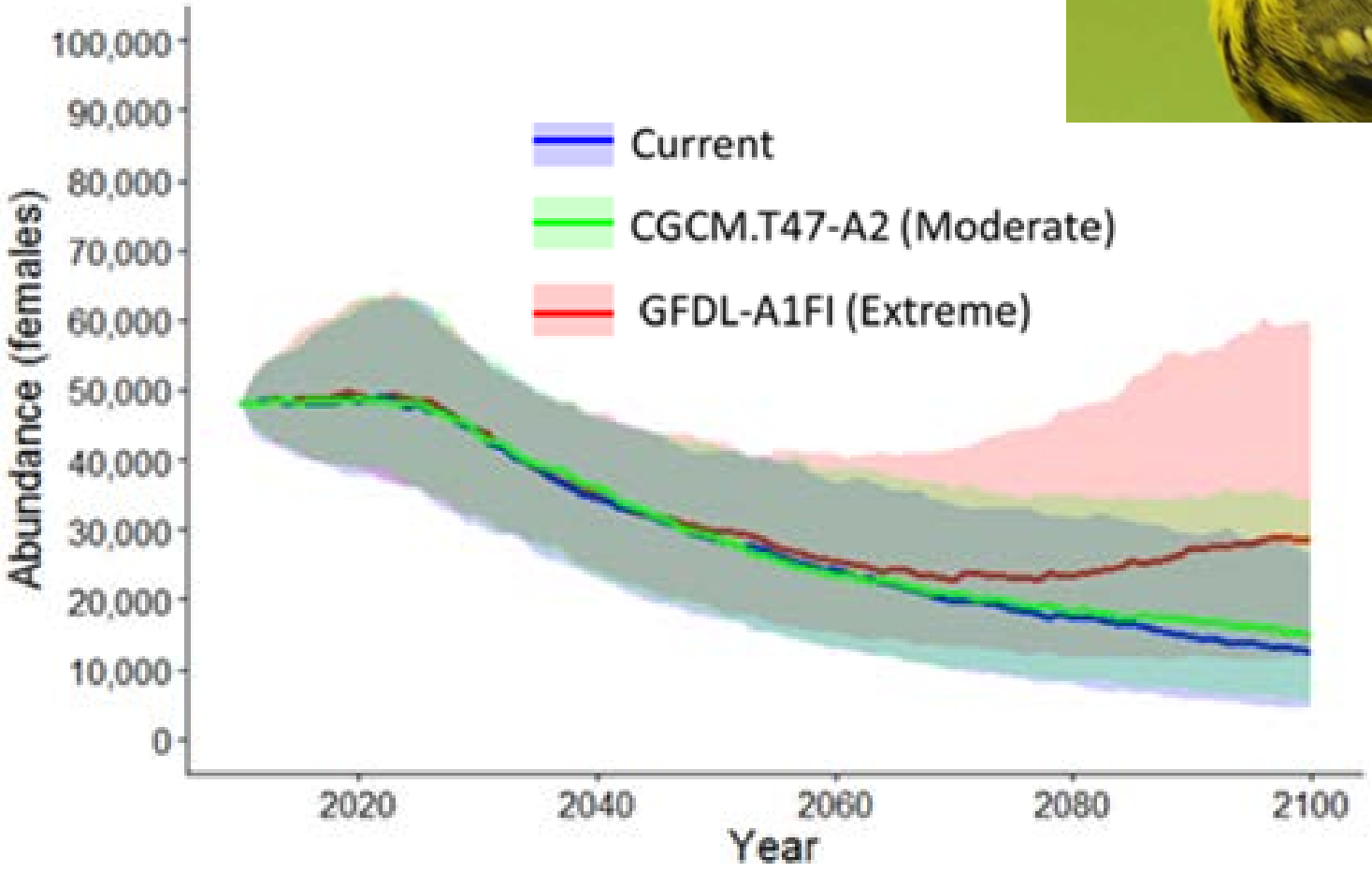
Alternatives: Restoration Scenarios



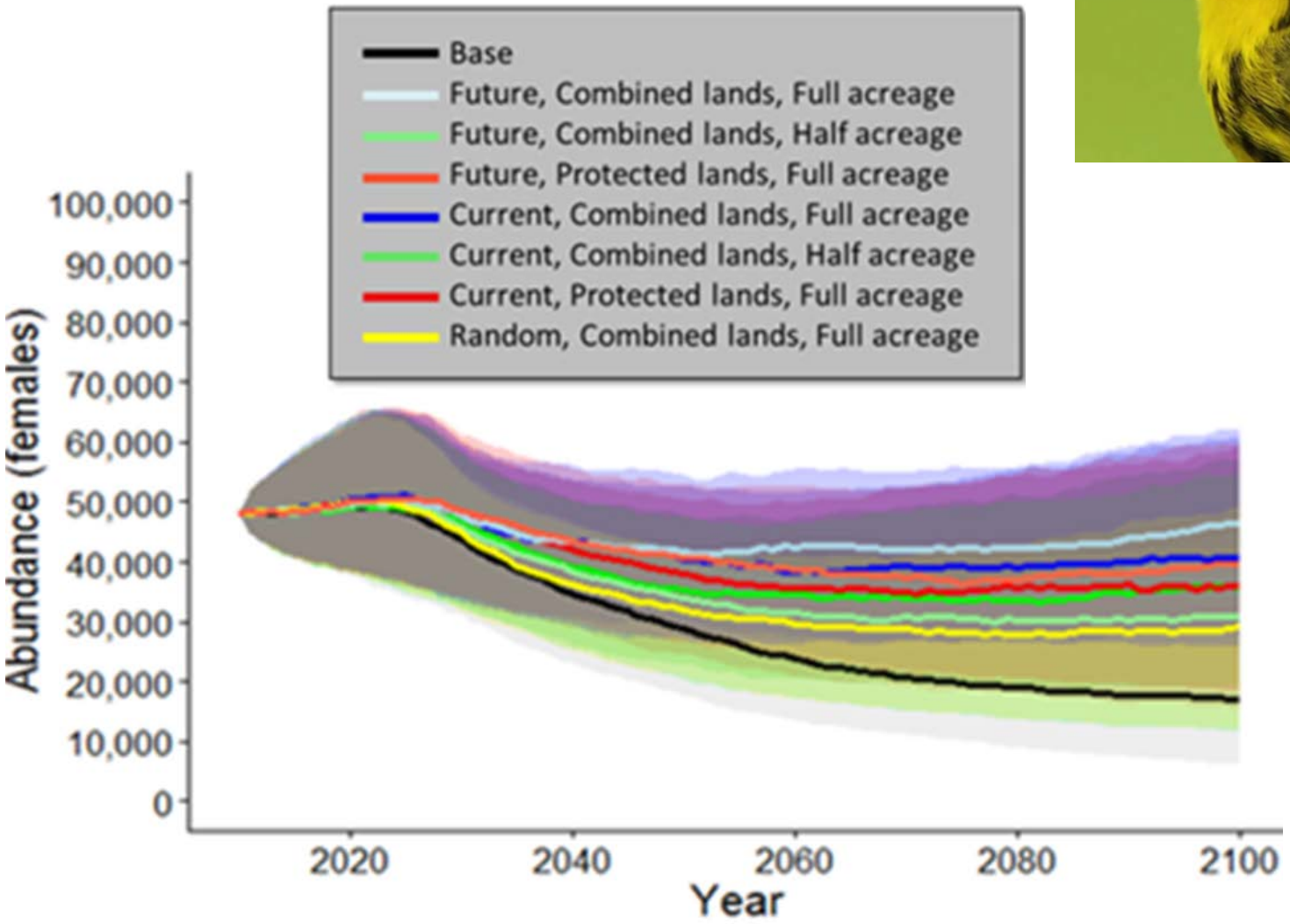
Spatial Parameters

- Amount= 0, 50, or 100%
- Prioritization= Random, Current, or Future conditions
- Ownership= Protected, Private, Protected+Private

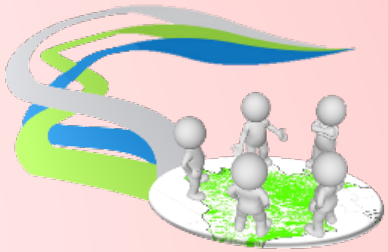
Prairie warbler response by climate scenario

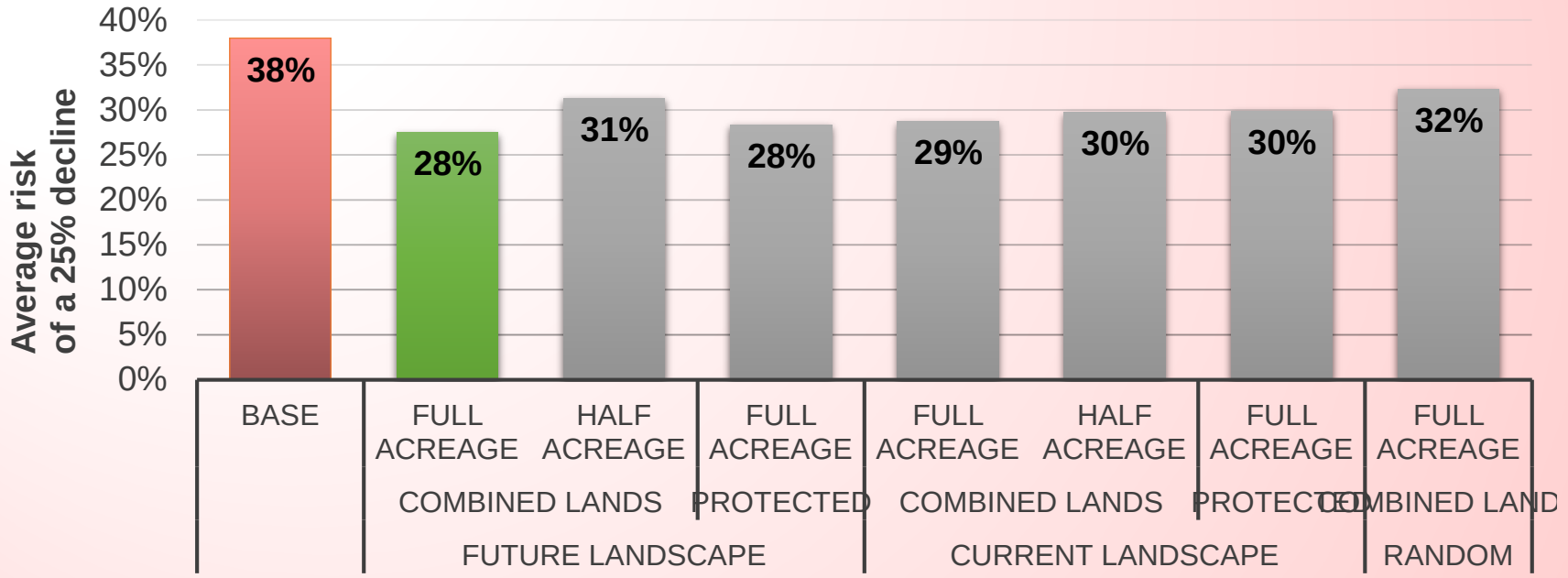


Prairie warbler response by restoration scenario



Decision: Pooled risk across species and climate projections





Summary

- Landscape and regional context matters
  - constrains available management options
  - constrains species demographics and potential population responses
- Climate context matters
  - direct and indirect effects of climate change will have positive and negative effects on populations
- Management actions may be more important in the near term, but in the long term climate change may profoundly affect habitat
- Landscape Conservation Design provides a toolbox that enables us to account for these factors and plan how to restore wildlife populations


LANDSCAPE CONSERVATION COOPERATIVES
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE
CFLR Program
NBCI
National Bobwhite Conservation Initiative
Conservation partnerships now enable us to plan conservation at sufficiently large scales – beyond the reach or resources of any one organization – that we can design landscapes to restore populations.


The ongoing challenge is to implement enough management in the right places to carry through with these designs and achieve our objectives.