Global Change and Birds: Patterns and Predictions

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Overview

1. Life history traits of birds relevant to global change
2. Observed evidence for bird response to global change
3. Projected future influence of global change on birds
4. What can foresters do?
5. Why it matters

Why be concerned about climate change and birds?

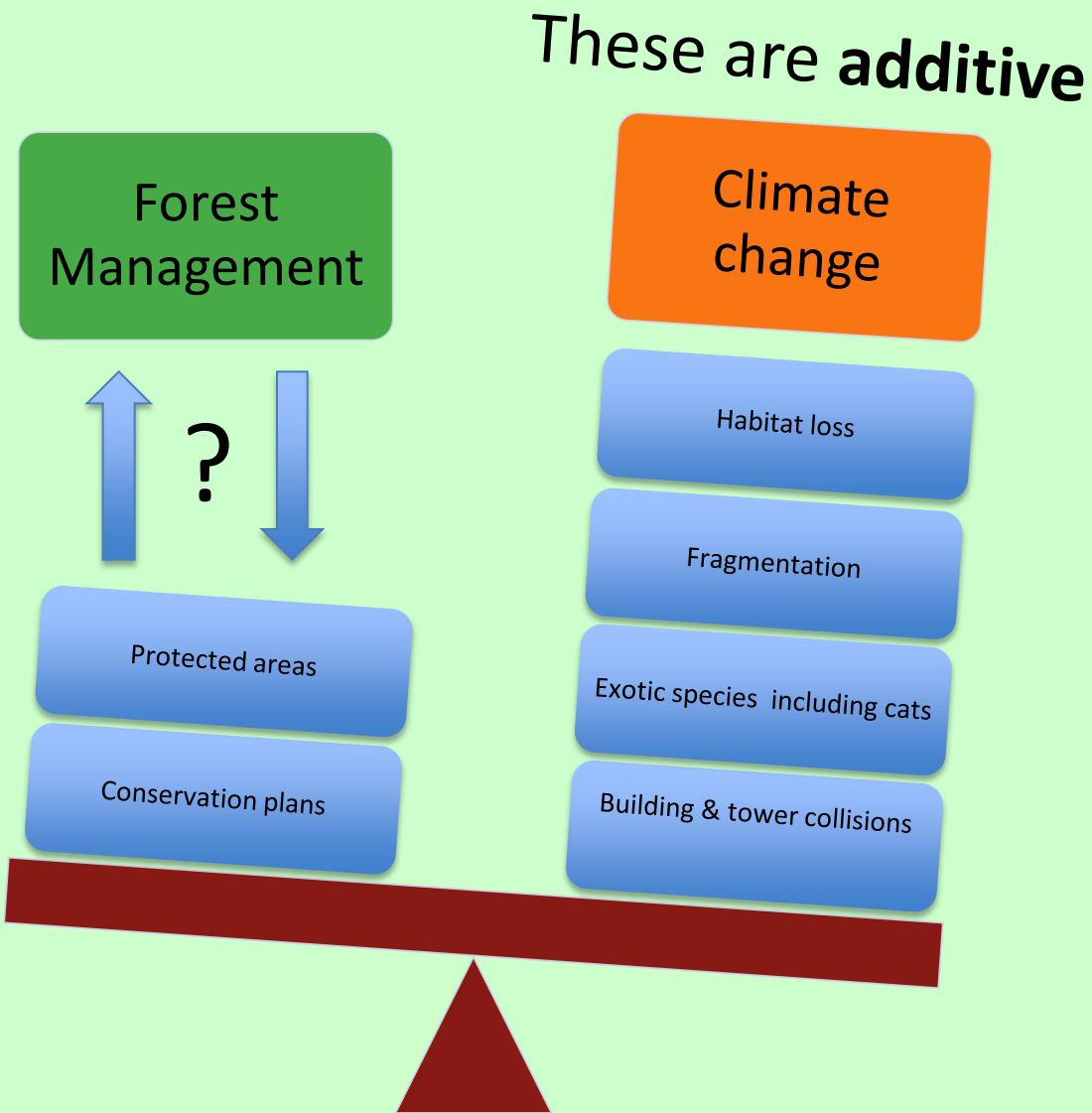
- Ecological Services
  - Spruce budworm, gypsy moth, pine beetle
    - Bird suppress background populations and outbreaks
- Reshuffled bird communities and interacting species have *highly unpredictable* consequences.

- Economic/Aesthetic – In 1996, people spend $1.4 billion on wildlife watching and feeding (primarily birds) in U.S.
- Endangered Species
  - Not all species can simply move, esp. in fragmented landscape

Avian Life history and global change

1. Highly mobile
2. Most temperate birds are migratory
3. Well understood habitat associations related to forest composition and structure.
4. Relatively easy to monitor
5. Long term (half-century) data exists on distribution and population change

Relevant global change processes



Where can climate warming impact bird annual cycle?

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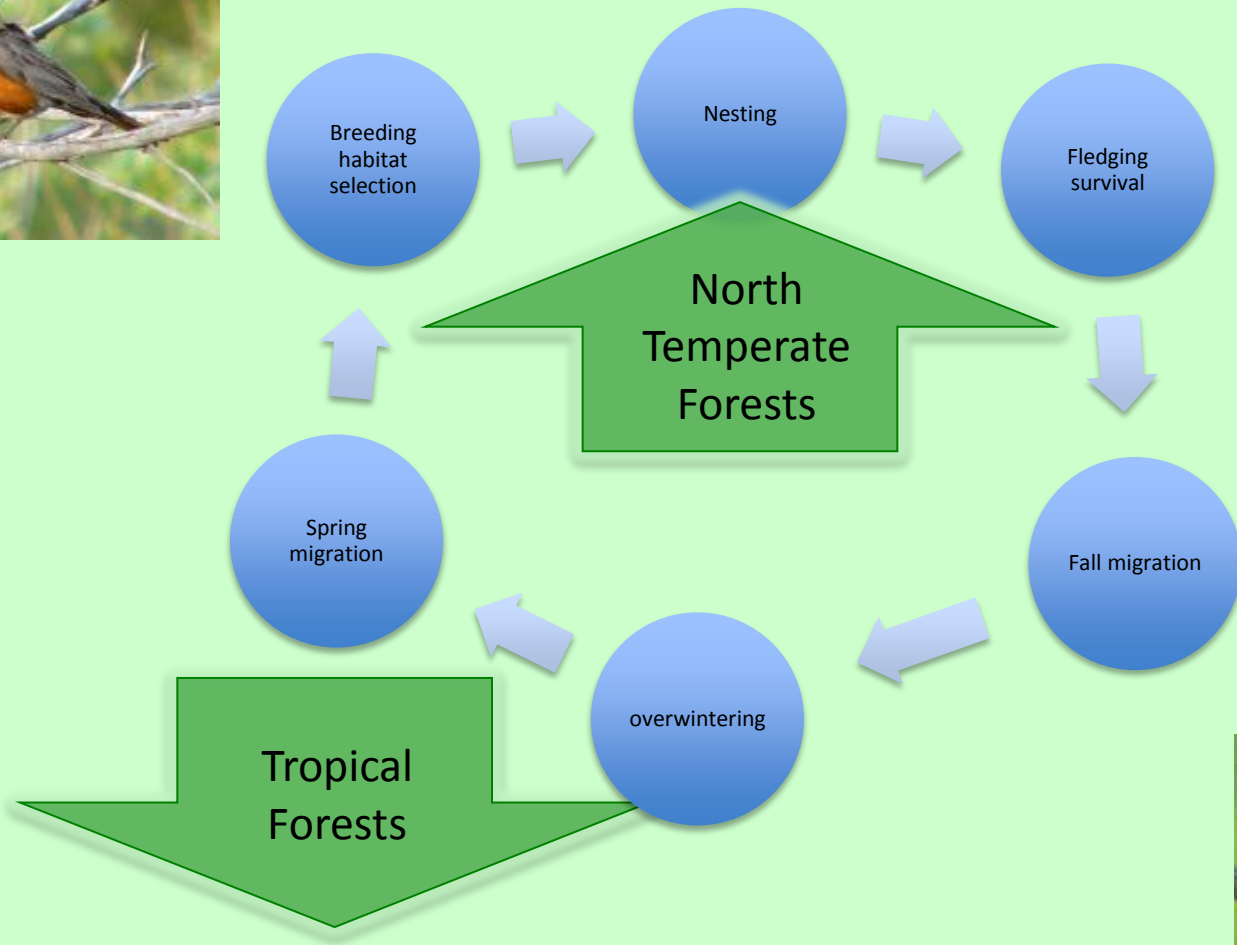
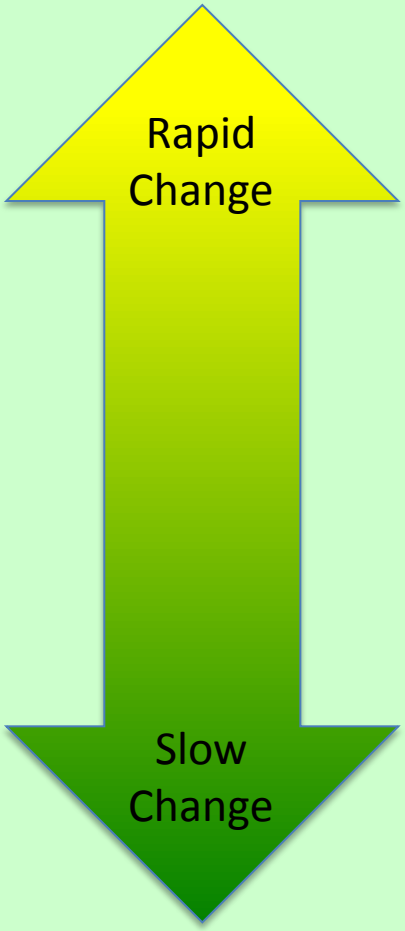


Sources of Climate Change Impacts on Birds

1. Changes in plant and arthropod phenology

2. Changes in prey and predator populations

3. Changes in forest composition and structure



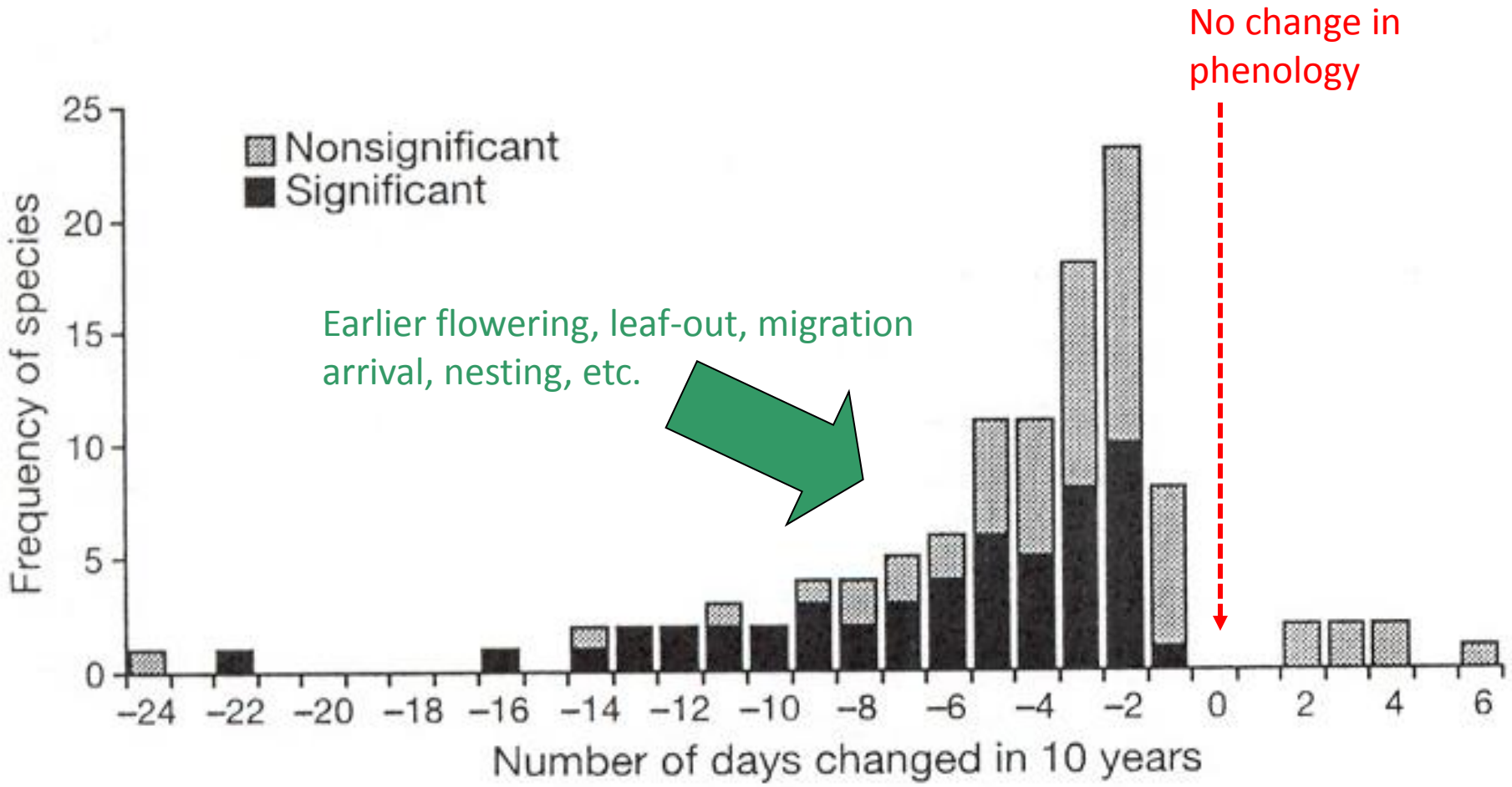
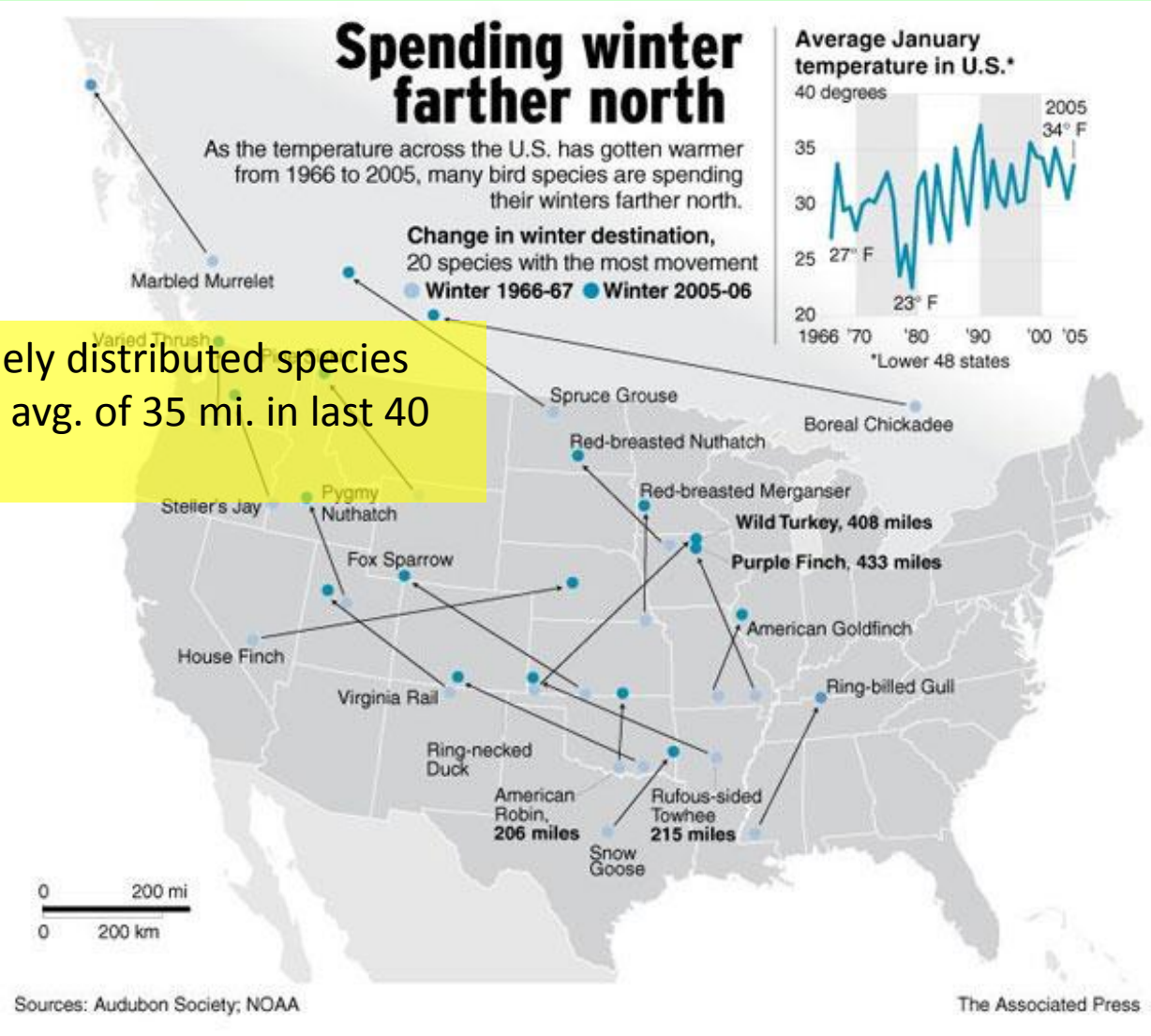


Figure 1 Frequency distribution of species and groups of species (see text) with a temperature-related trait changing by number of days in 10 years. No data were tabulated for species showing zero days changing in ten years (see Methods).

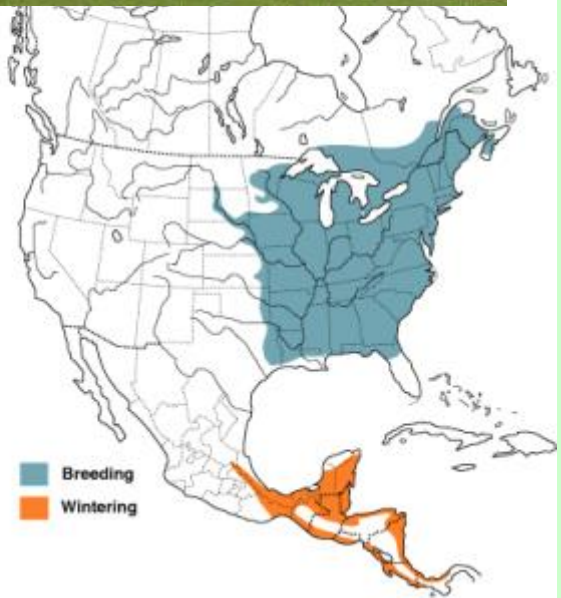
From: Root et al. 2 Jan. 2003, Nature - 143 studies

The center of the wintering grounds has shifted northward

60% of 305 widely distributed species have shifted an avg. of 35 mi. in last 40 years



1. Changes in plant and arthropod phenology



Peak Bird Arrival, April 25

Former peak of nestling hatch and arthropod abundance, June 3

1980

Controlled by Photoperiod

2000

Potential Asynchrony

Controlled by Photoperiod

New peak nestling hatch season (25 May)

New peak arthropod abundance (15 May

April 1 **May 1** **June 1**

Both and Visser 2001, *Nature*

2. Changes in predator populations

Nesting success is among the most important demographic variables influencing species population stability, growth or decline.

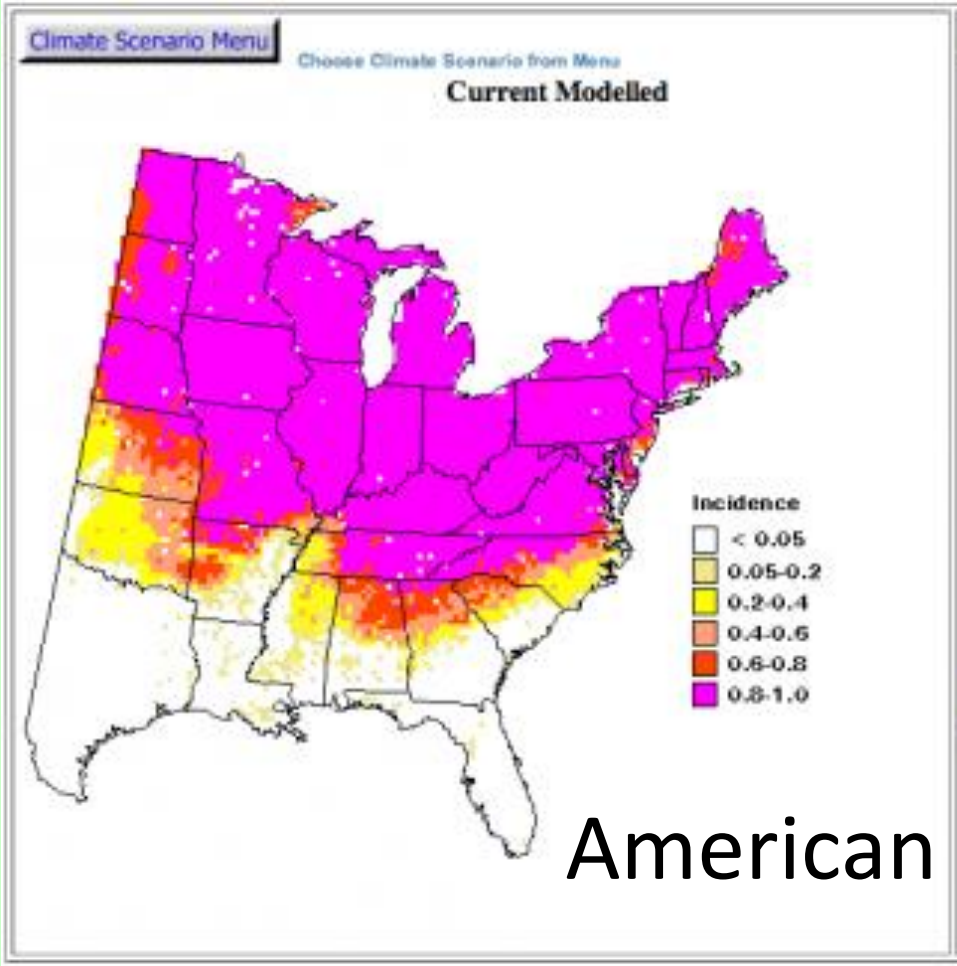
Forest breeding birds are subjected to a diversity of mammalian, avian and reptilian predators.

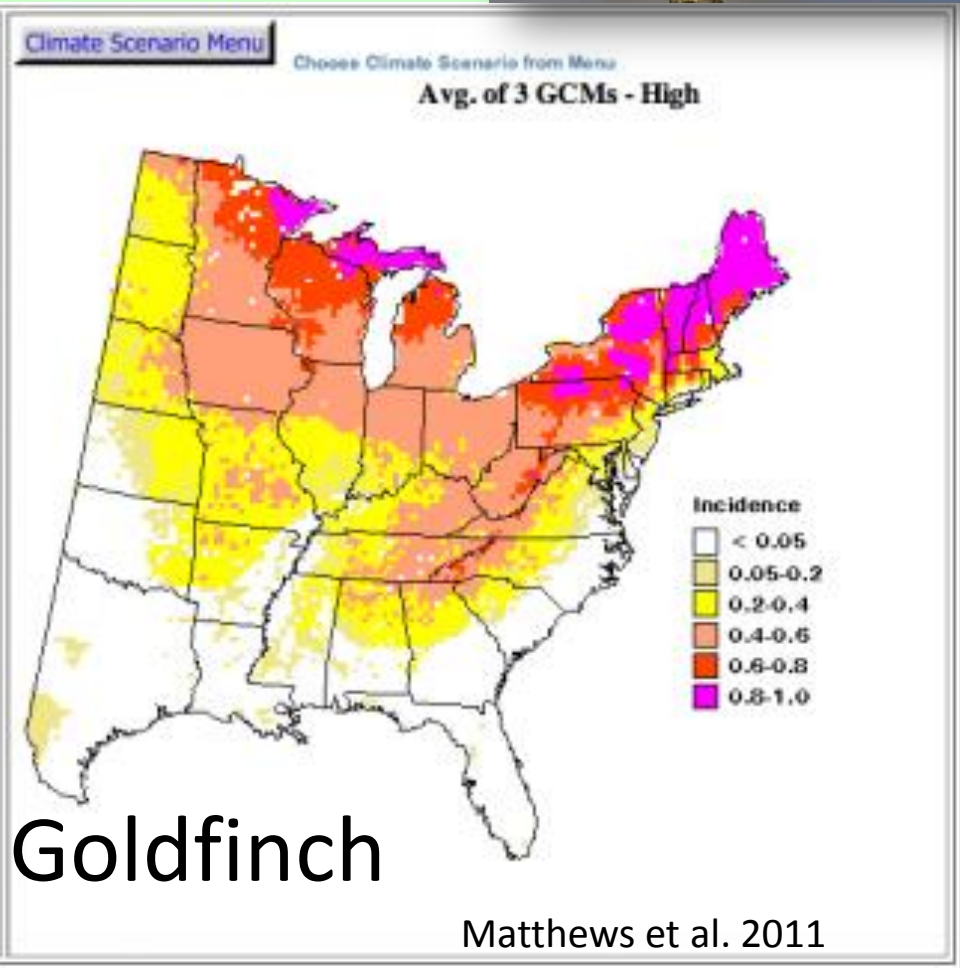
Mammals: Raccoon, fisher, marten, weasels, opossum, squirrel spp. chipmunk spp., feral cat, shrew spp., etc.

Birds: Corvids, hawks, owls (at least 2 dozen spp.)

Reptiles: snakes

3. Changes in forest composition and structure

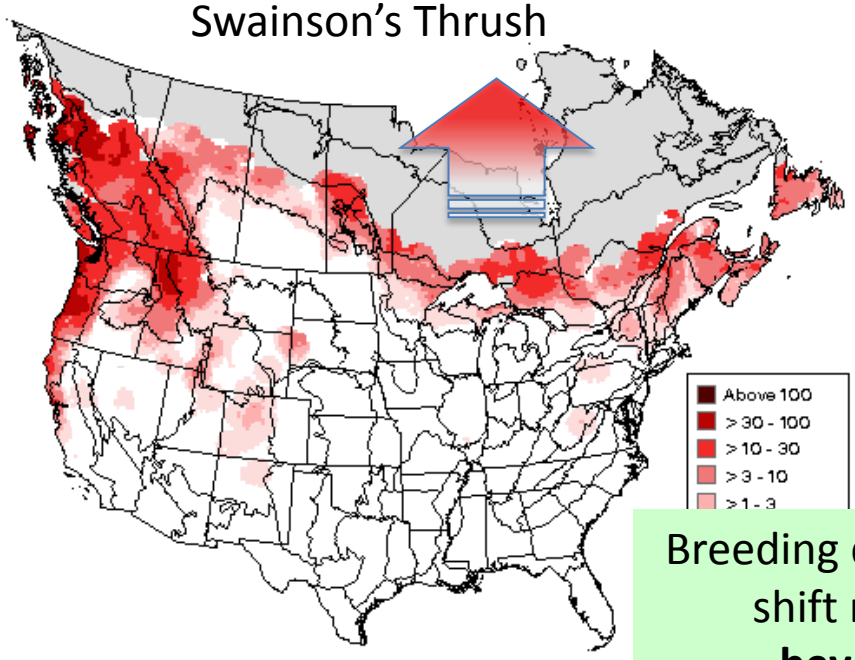




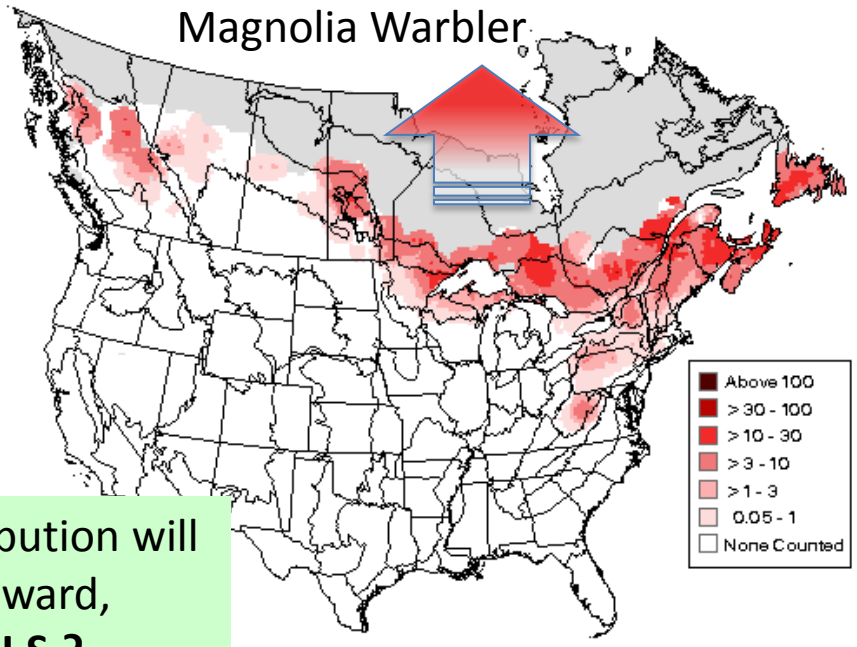
American Goldfinch

Matthews et al. 2011

Swainson's Thrush

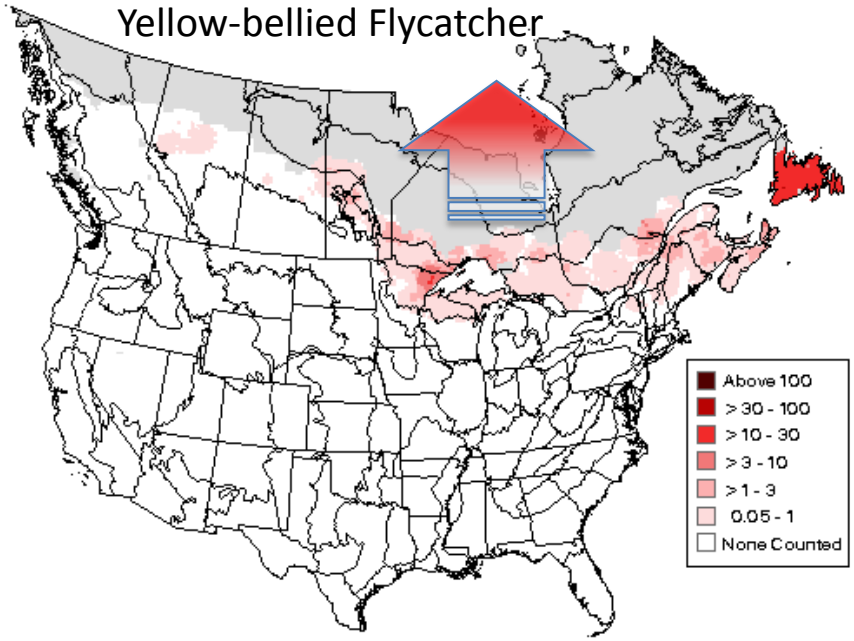


Magnolia Warbler

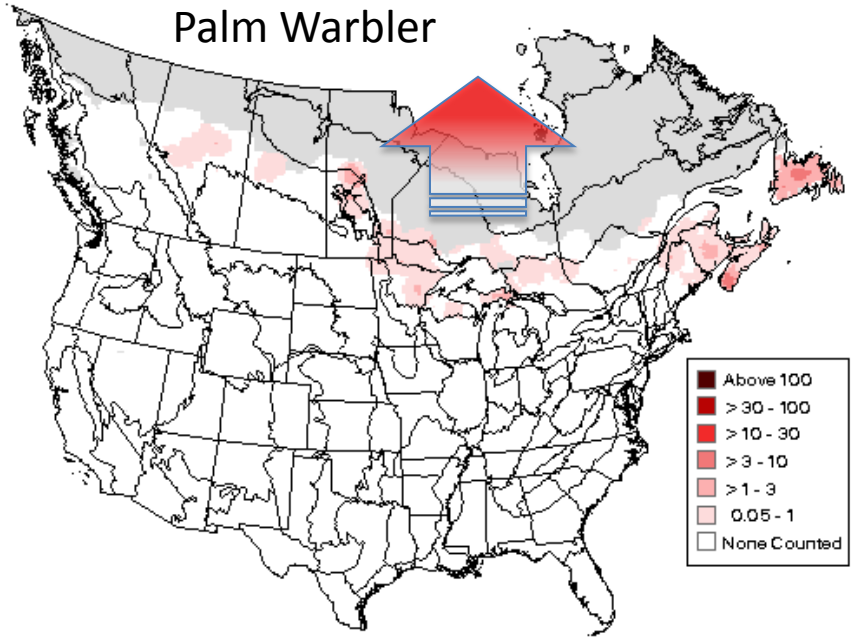


Breeding distribution will shift northward, **beyond U.S.?**

Yellow-bellied Flycatcher

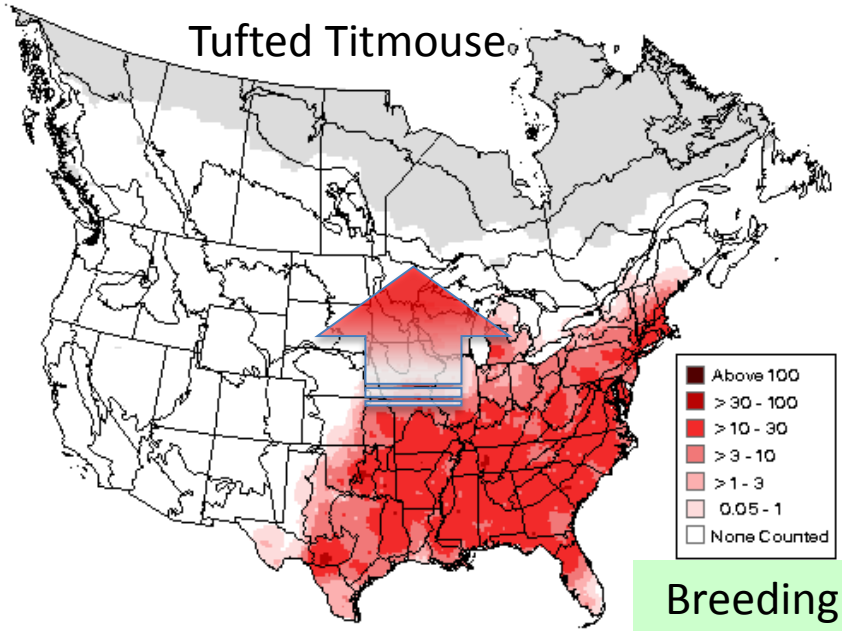


Palm Warbler

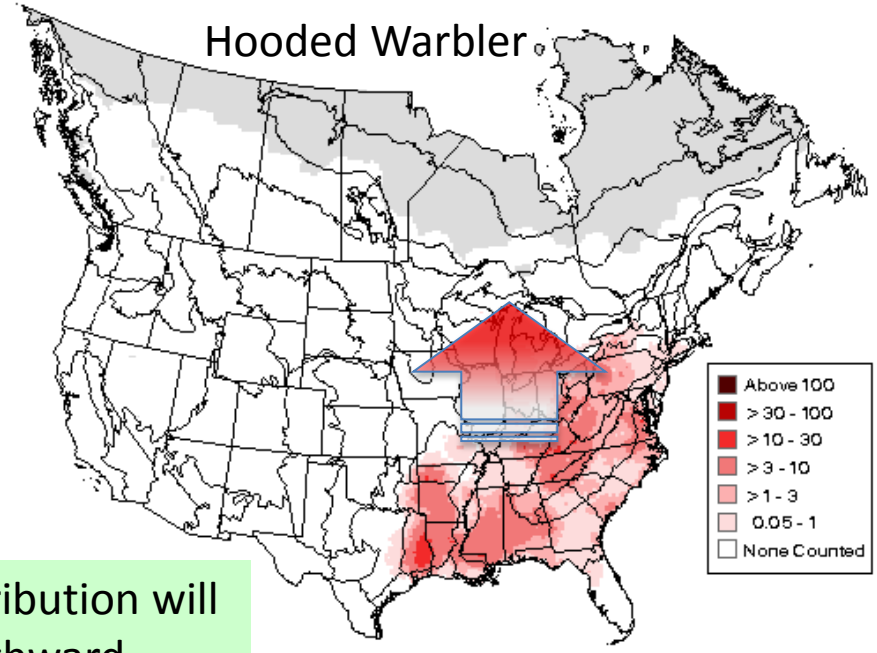


Breeding Bird Survey, USGS, 2006-2011

Tufted Titmouse

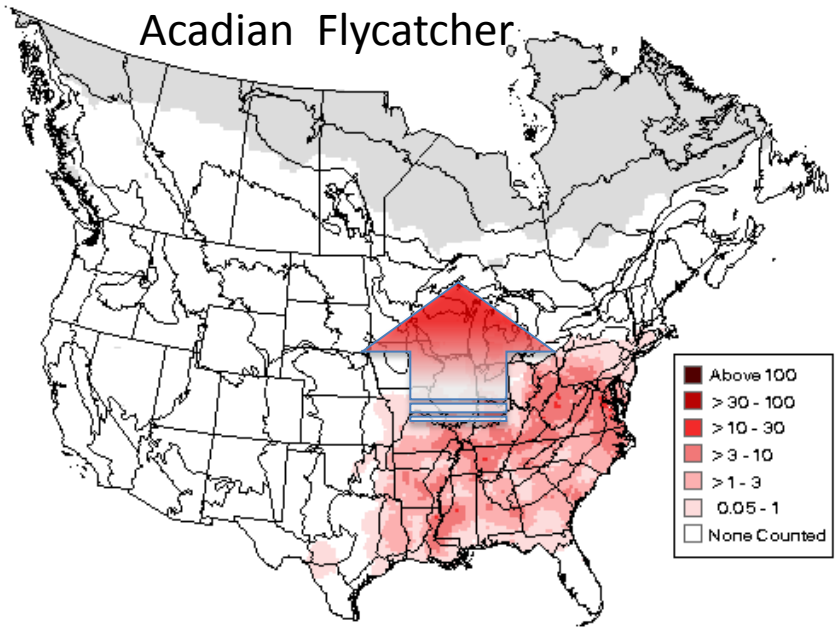


Hooded Warbler

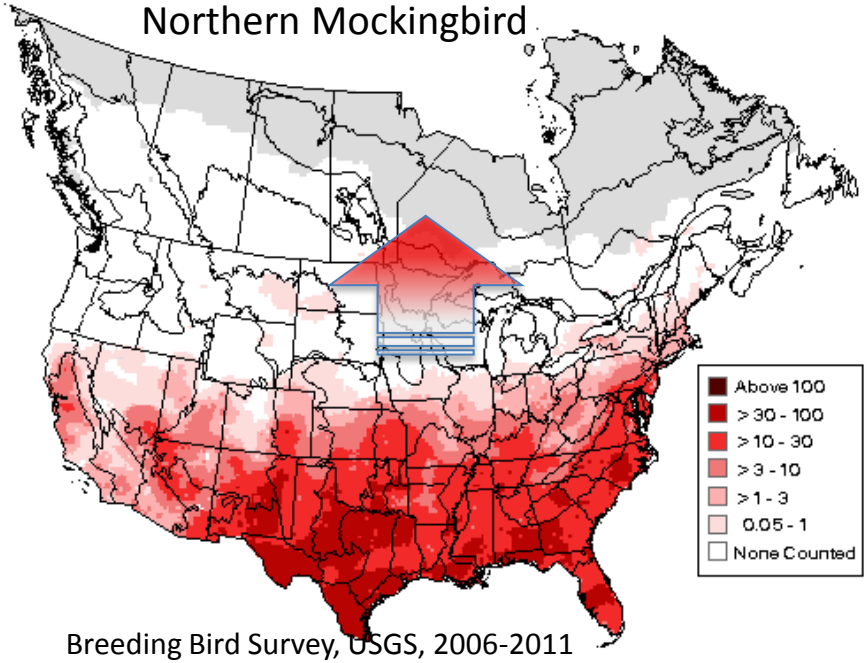


Breeding distribution will shift northward

Acadian Flycatcher

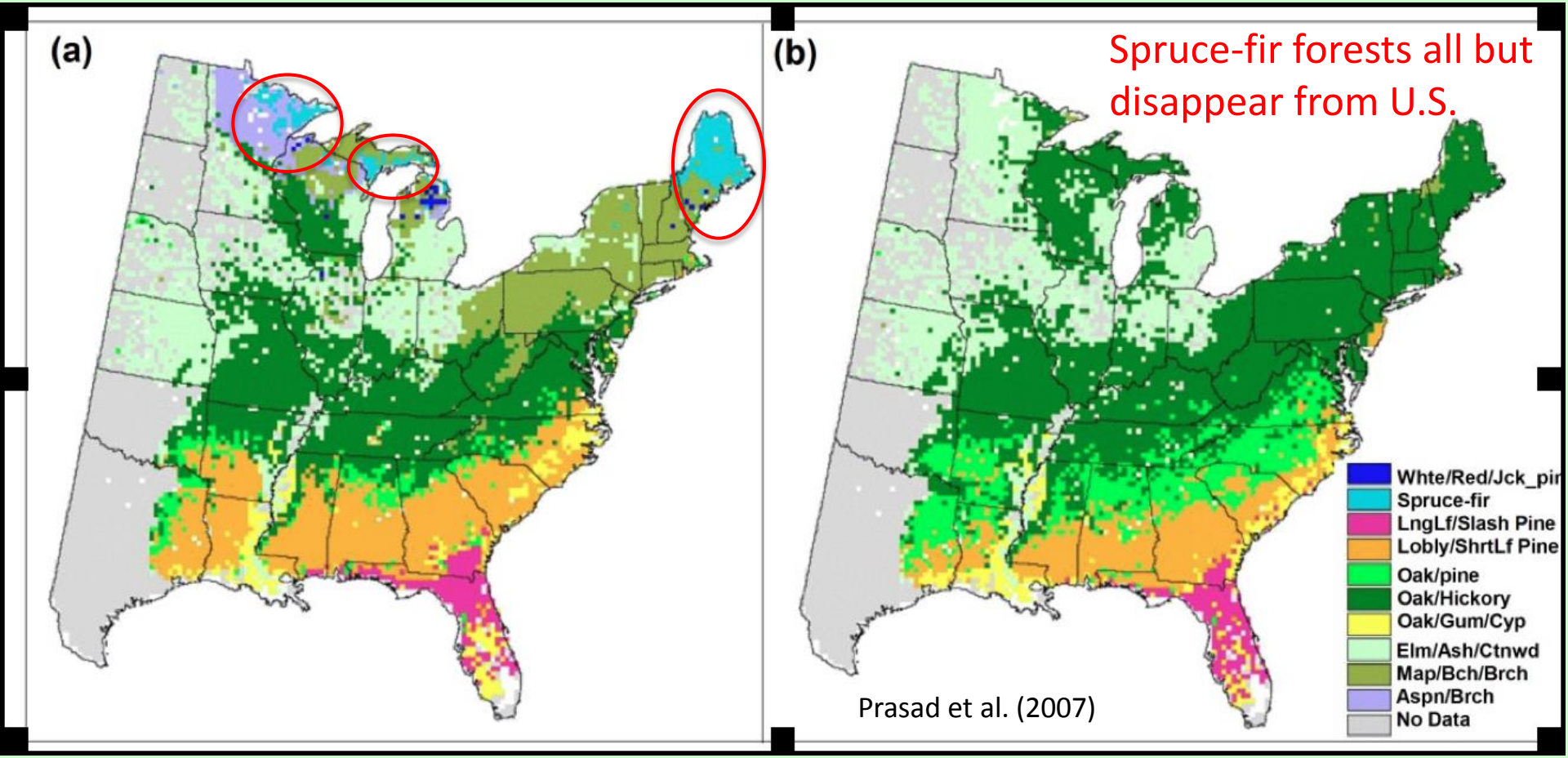


Northern Mockingbird



Breeding Bird Survey, USGS, 2006-2011

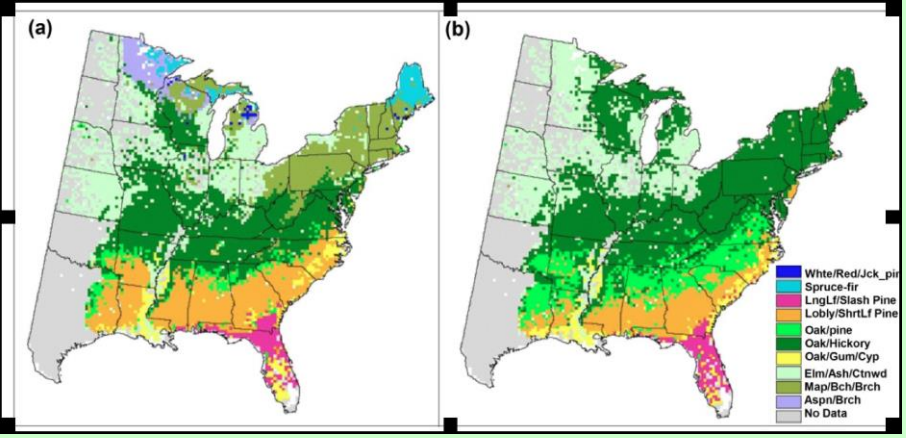
3. Changes in forest composition and structure



Current and Projected distribution of eastern forest types (GCM High Emissions Scenario)

Does not account for potential refugia

Spruce-fir birds



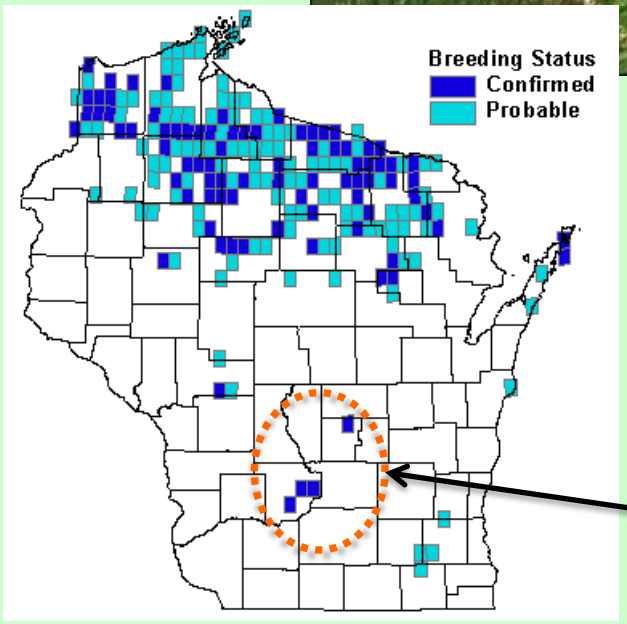
- Yellow-bellied Flycatcher
- Swainson's Thrush
- Magnolia Warbler
- Blackpoll Warbler
- Palm Warbler

How did birds deal with the last major climate change?

Relict habitats retain northern plant and some animal communities

Remnant Habitats **can support small populations of species and increase local native species richness**

- Today, ***Conifer relics*** support spatially isolated populations of:
  - Blackburnian Warbler
  - Black-throated Green Warbler
  - Yellow-rumped Warbler
  - Magnolia Warbler
  - Northern Parula
  - Hermit Thrush
  - Winter Wren
  - Blue-headed Vireo



http://www.geo.msu.edu/geogmich/white-red-pine.html

Spruce-fir stands

MICHIGAN

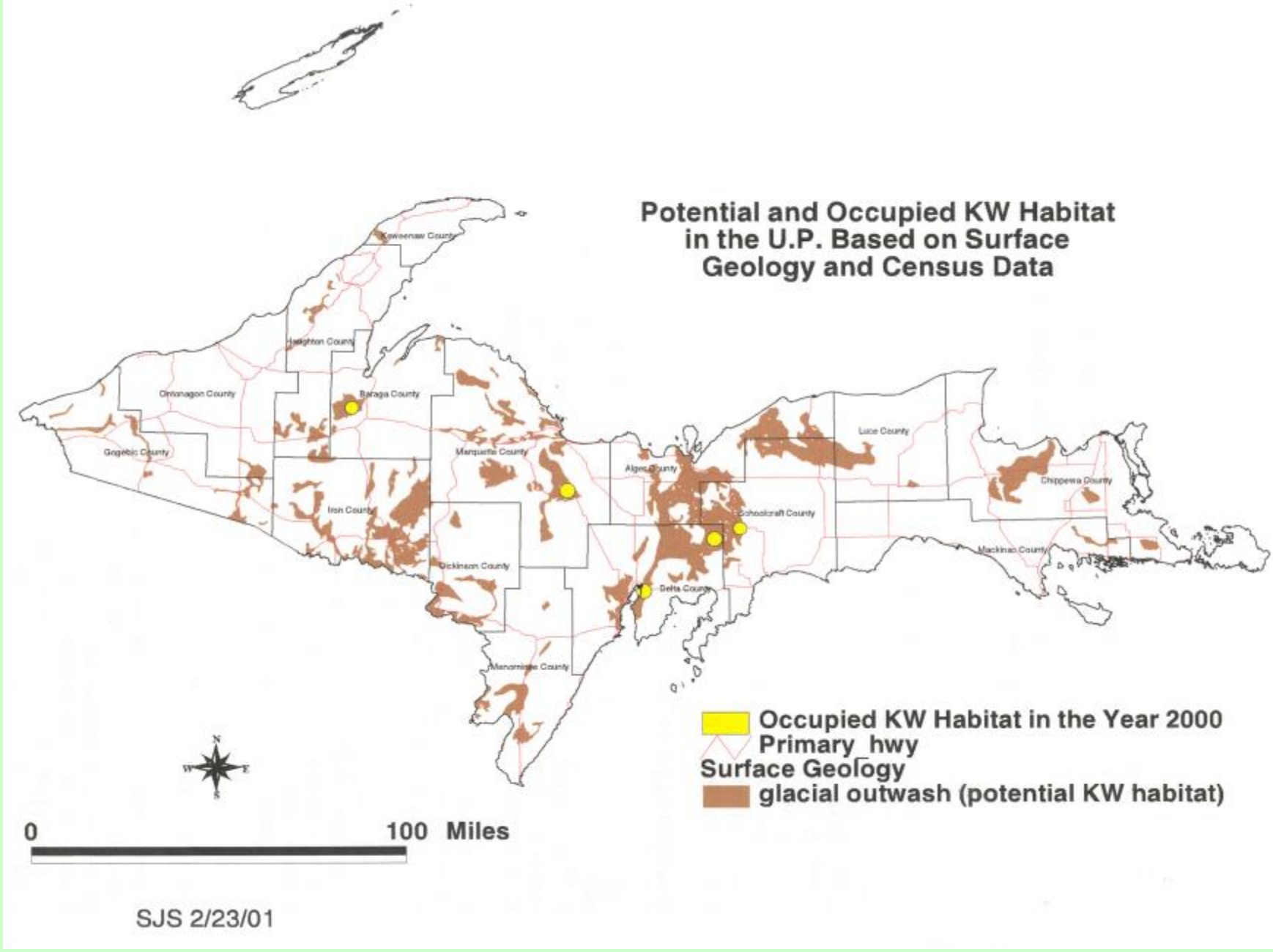
LEGEND
COUNTY BOUNDARY
STATE BOUNDARY

SCALE
MILES

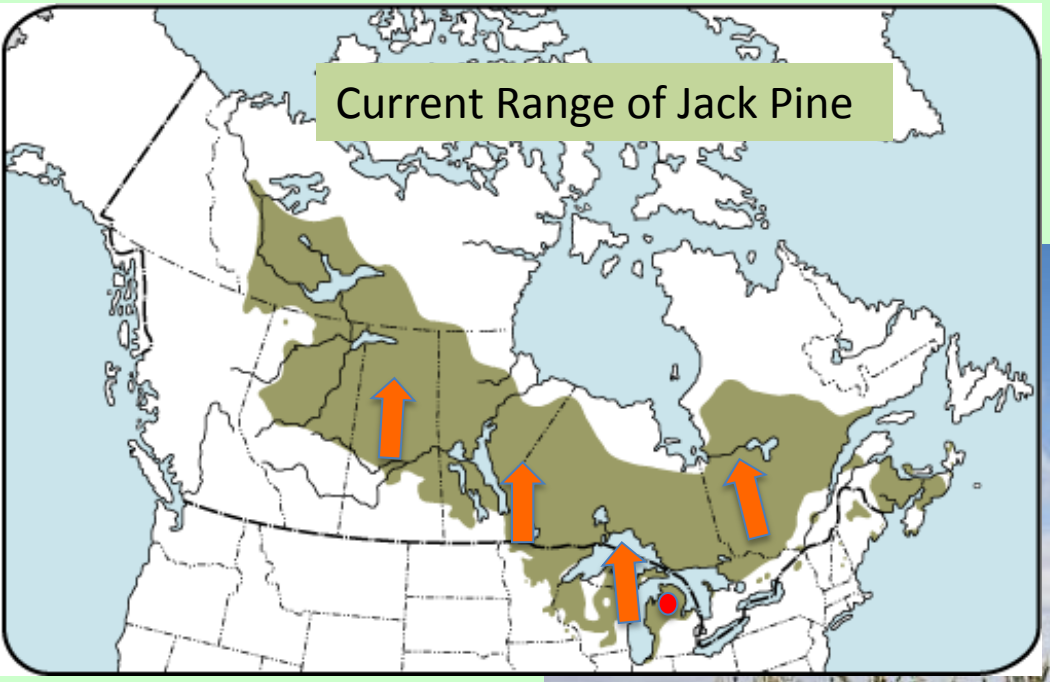
FOREST
1 DECIDUOUS OAK, HICKORY, ASH ELM, BLACK WALNUT
CONIFEROUS
WHITE, RED JACK PINE
SPRUCE, FIR
2 MIXED BIRCH, BEECH, MAPLE, HEMLOCK
GRASSLAND

Spruce-fir stands are found in patches across the landscape.

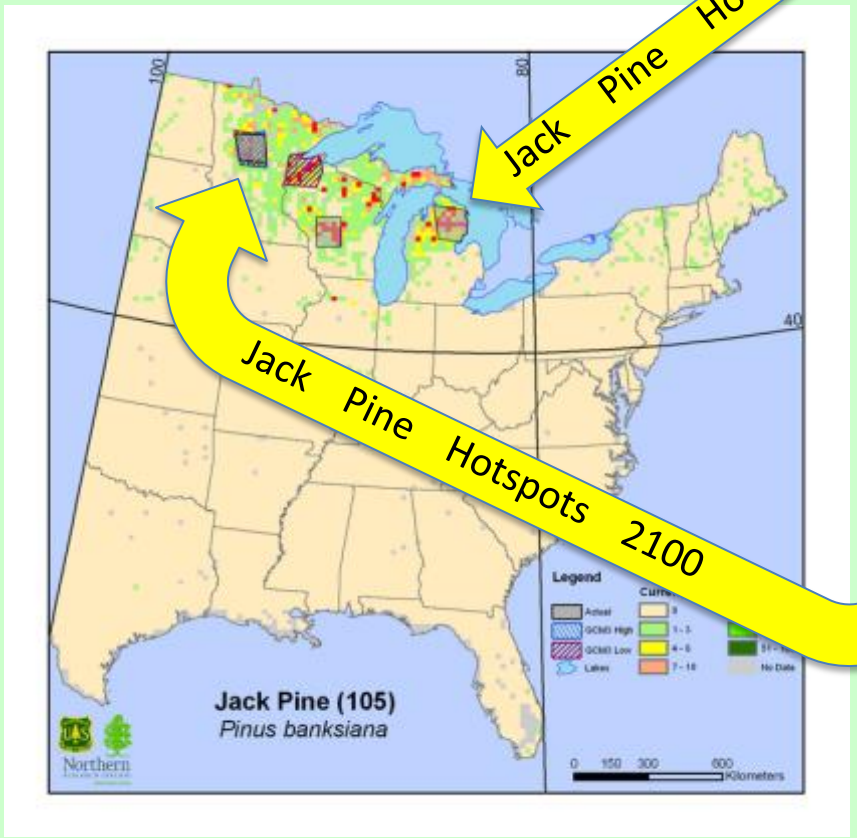
Foresters are uniquely qualified to identify and manage to sustain such stands.


Potential and Occupied KW Habitat in the U.P. Based on Surface Geology and Census Data
Houghton County
Ontonagon County
Baraga County
Gogebic County
Marquette County
Iron County
Alger County
Luce County
Schoolcraft County
Chippewa County
Mackinac County
Dickinson County
Delta County
Menominee County
Occupied KW Habitat in the Year 2000
Primary_hwy
Surface Geology
glacial outwash (potential KW habitat)
0
100 Miles
SJS 2/23/01

Endangered Species

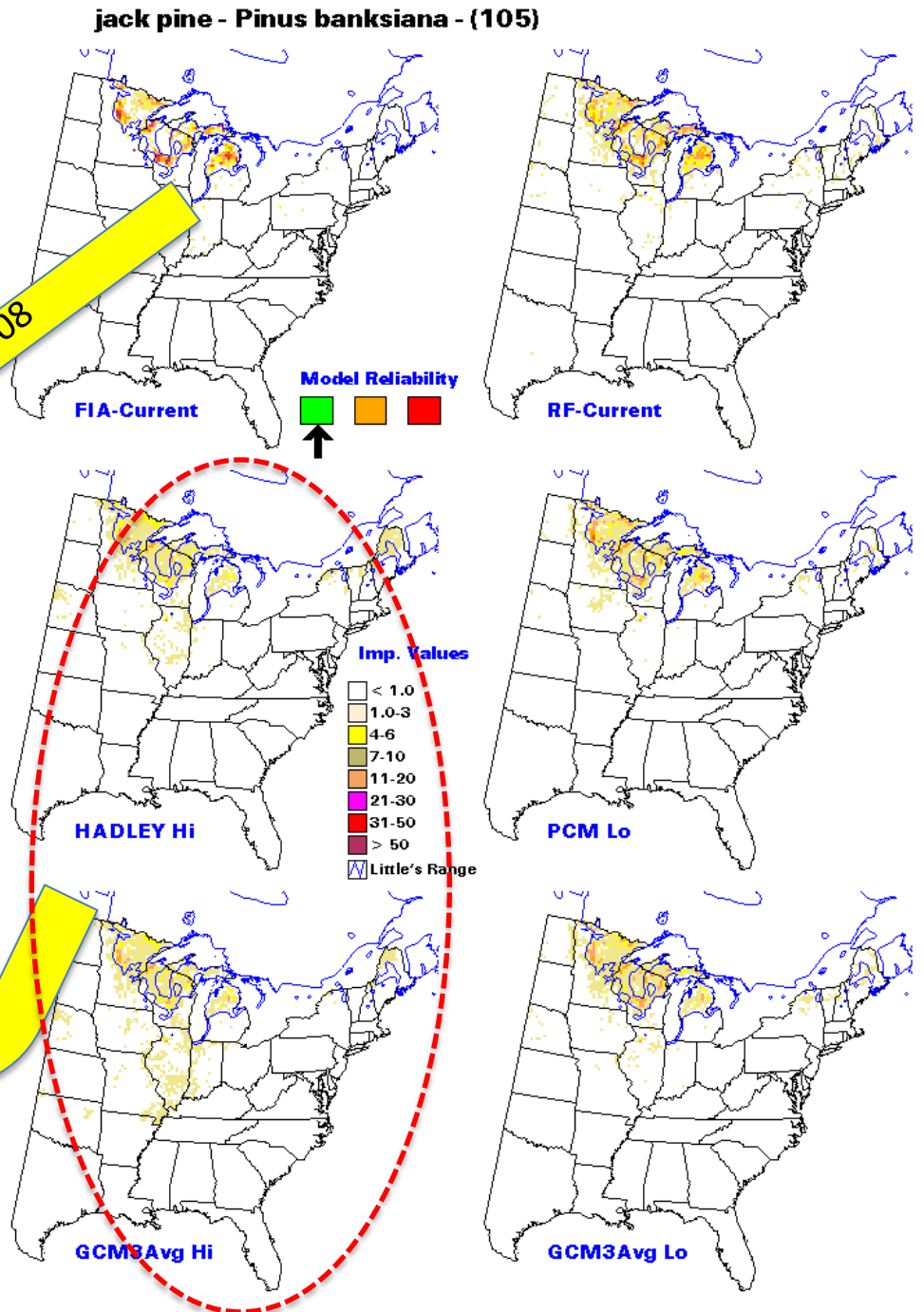


Modeled future habitat suitability



Jack Pine Hotspots 2008

Jack Pine Hotspots 2100



Climate change and birds, in summary:

- Birds have proven to be useful sentinel species for other forms of global change
- Diverse, ubiquitous, charismatic, historic data
- Will be winners and losers
- Need to better understand species-specific response
- Can act now to identify likely refugia sites

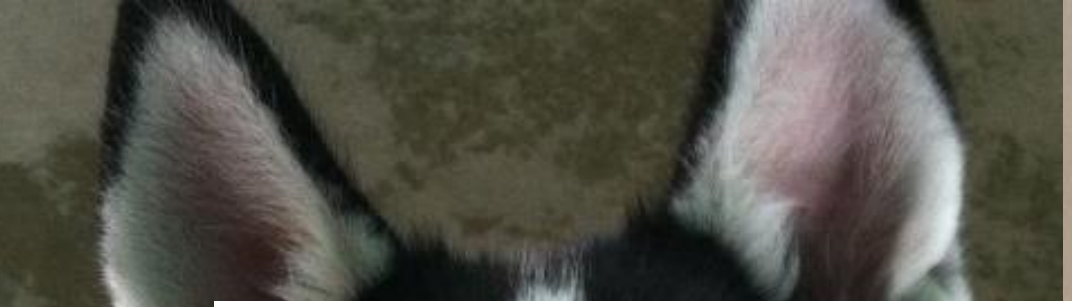
Why be concerned about climate change and birds?

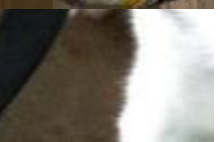
- Ecological Services
  - Spruce budworm, gypsy moth, pine beetle
    - Bird suppress background populations and outbreaks
- Reshuffled bird communities and interacting

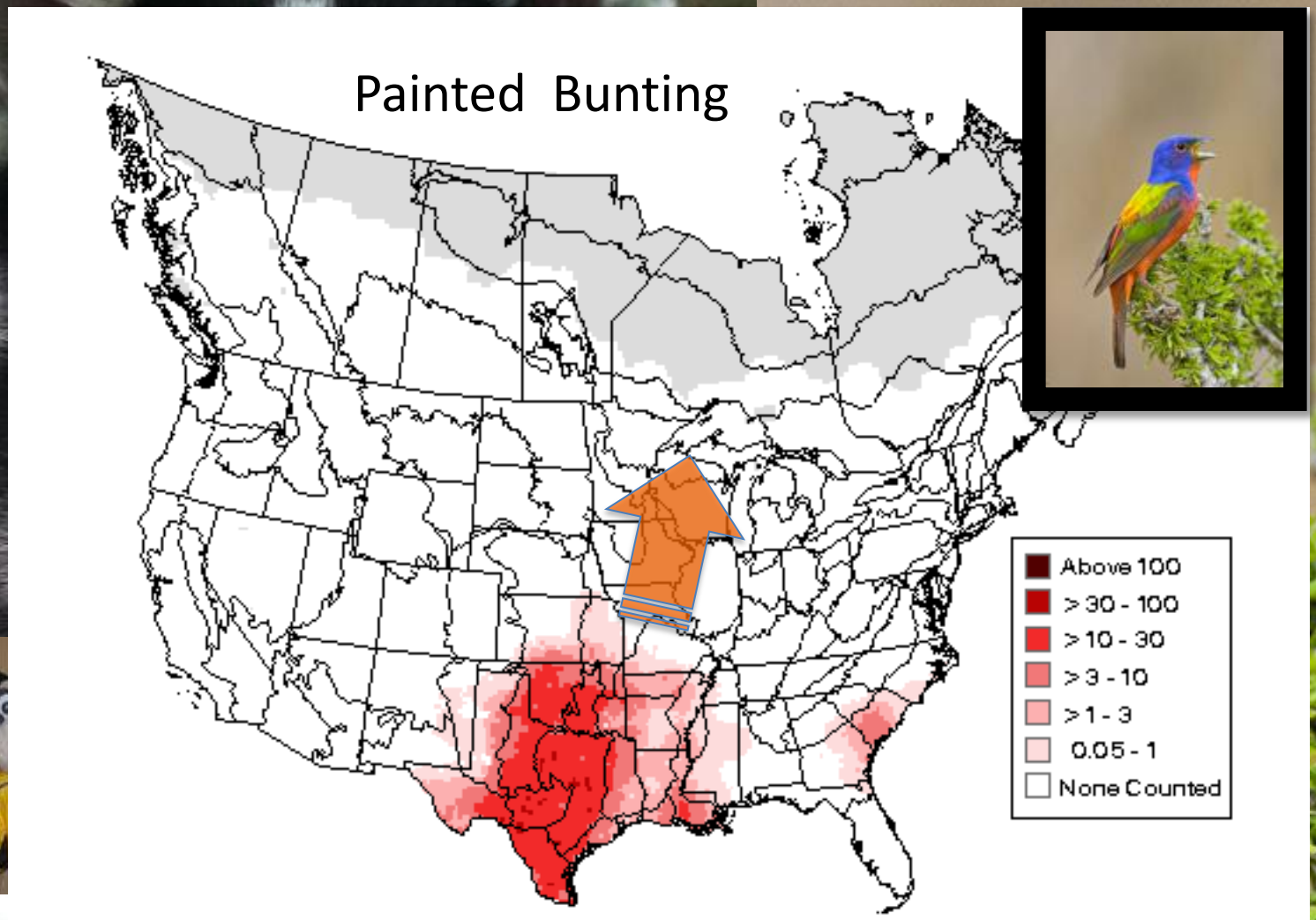
Forest managers and ecologists are uniquely qualified to identify potential refugia to sustain landscape level bird species richness.

- Endangered Species
  - Not all species can simply move, esp. in fragmented landscape

Alternative mascots?



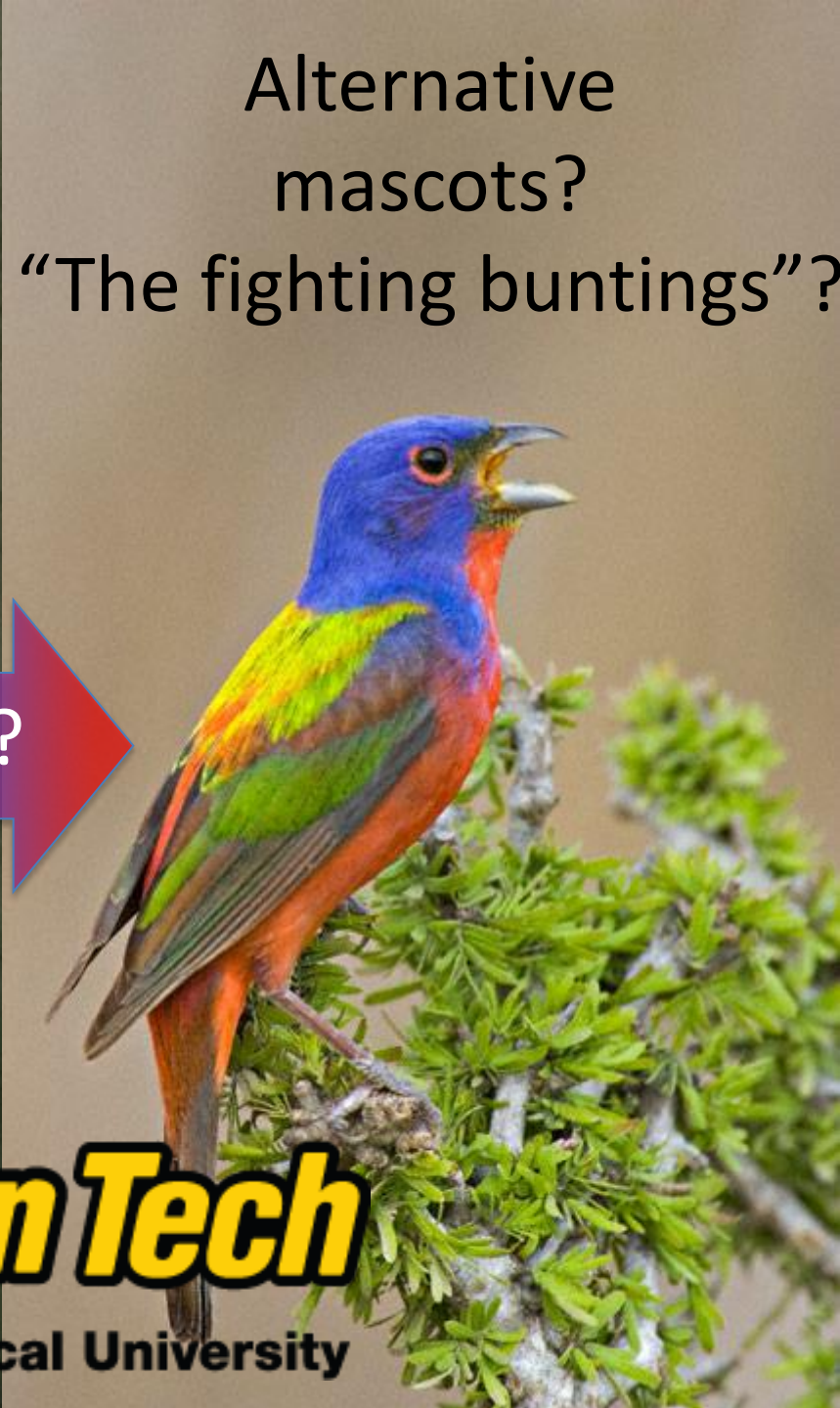




Alternative mascots?

“The fighting buntings”?

?



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2. Changes in predator populations

Nesting success is among the most important