Anthropocene

Citizen science as an essential tool for studying the impacts of climate change on birds

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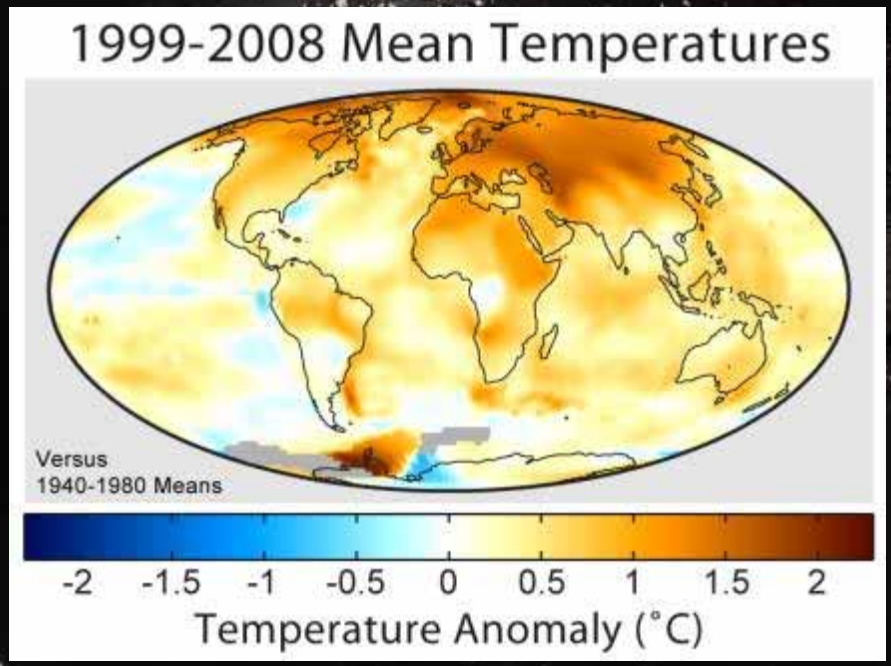
World population
> 7,000,000,000

More than 40%
in farmland

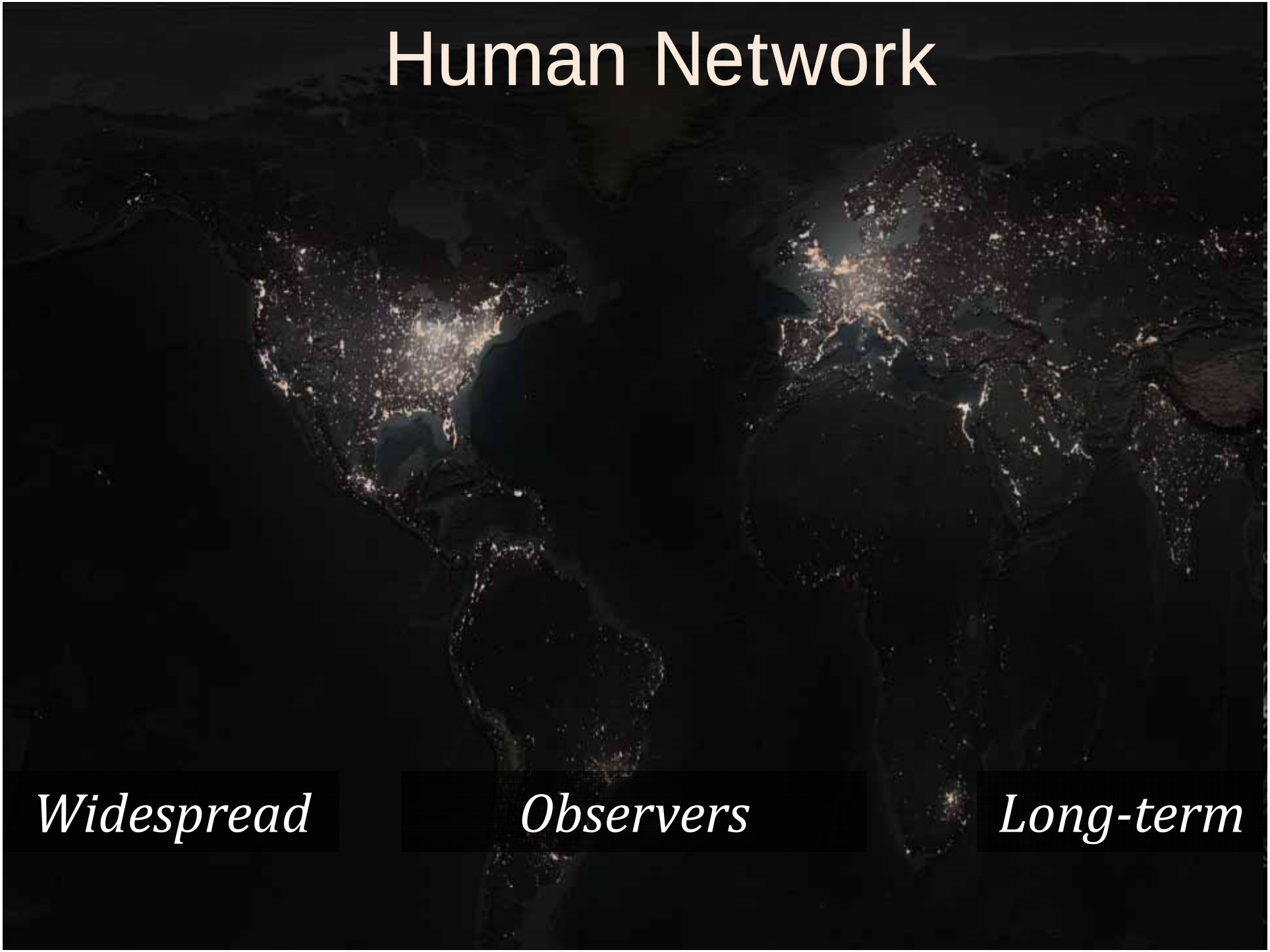
Half of population
live in cities

Modern Climate Change

- Rising temperature
- Altered precipitation
- Milder winters
- Earlier springs
- Extreme weather



Human Network



Dawn of Citizen Science

Scientist/ Volunteer

Volunteer

Scientist/ Volunteer

Question → Data → Analysis → Publish

Birds

Numerous

Identifiable

Diverse

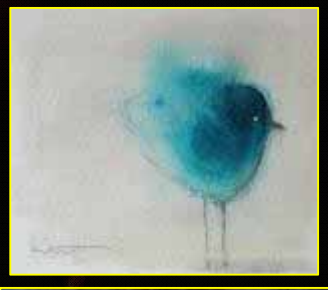
Birds

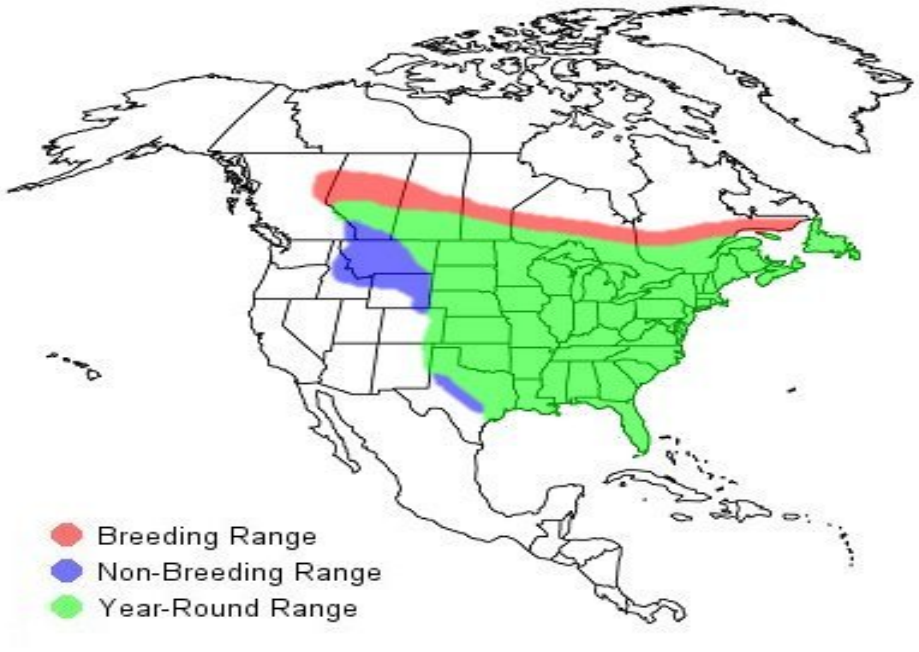
Numerous

Identifiable

Diverse

Culture




Breeding Range
Non-Breeding Range
Year-Round Range

Climate Change and Birds

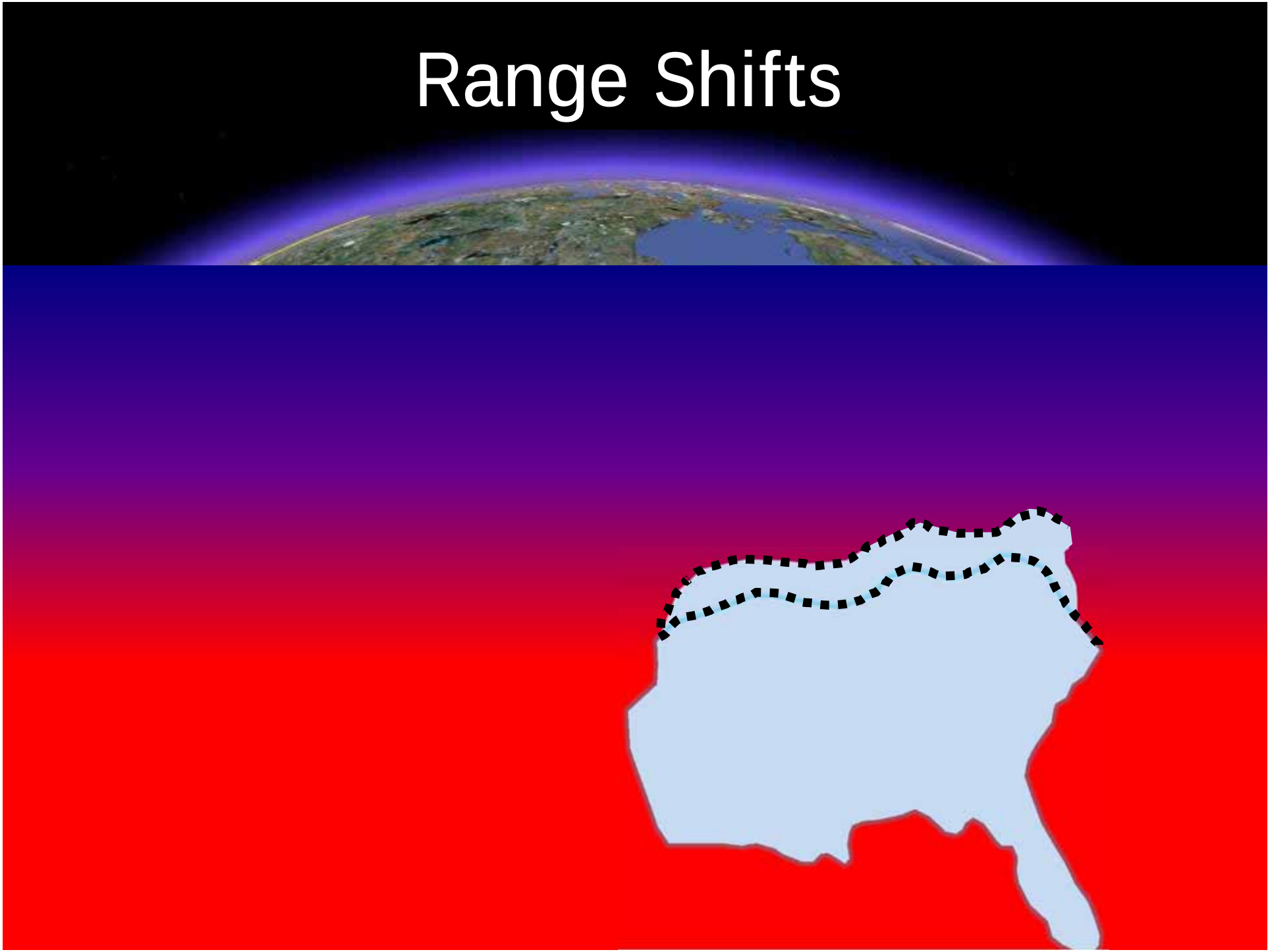
Range shifts

Changes in migration

Communities

Extreme events

Range Shifts



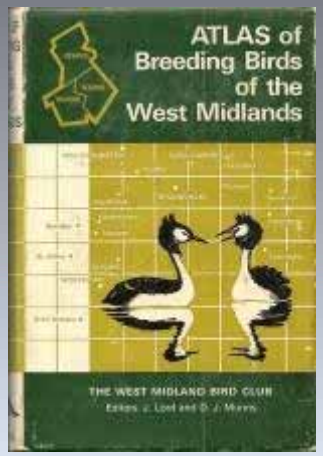
Bird Atlases

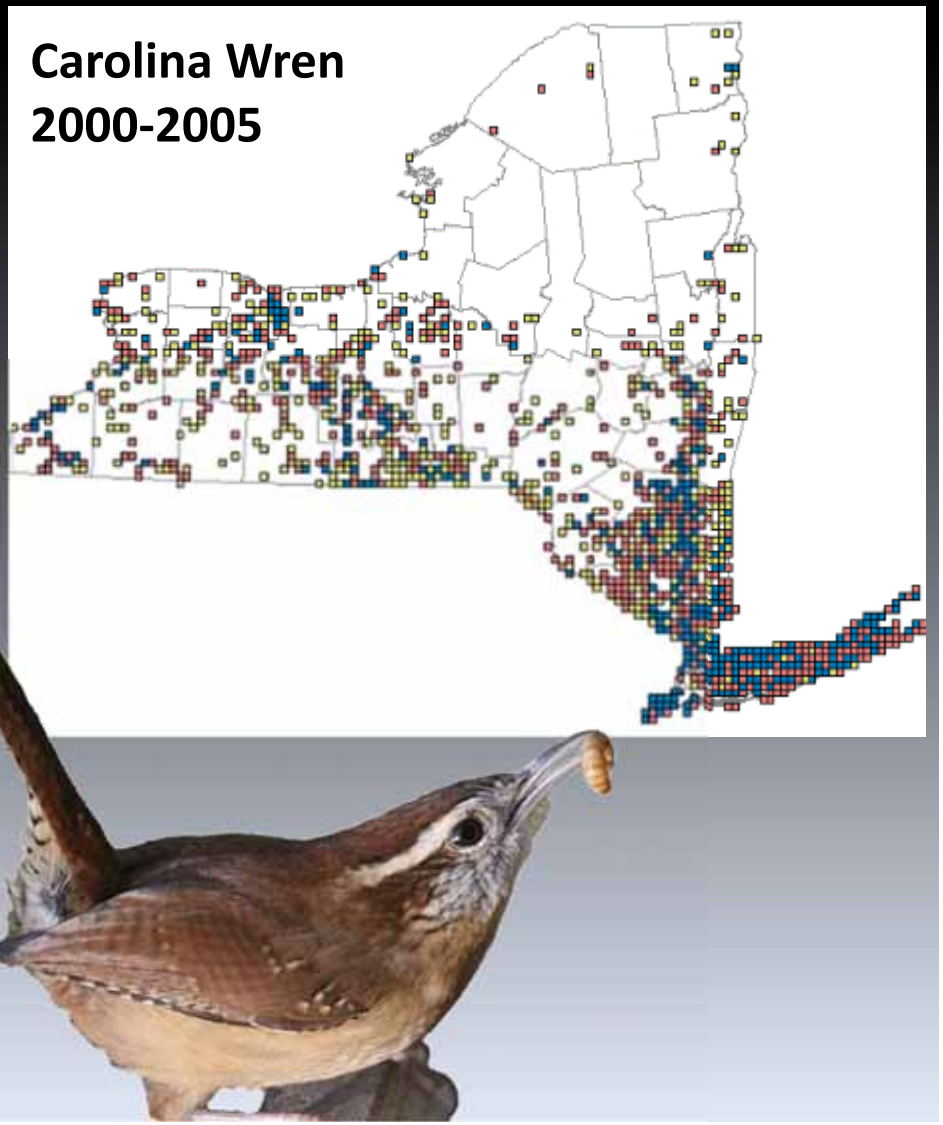
First atlases of 1960s

400 atlases

Local to continental

Over 68% are repeat





Global Patterns

Sources: Thomas and Lennon 1999, Brommer 2004, Hitch and Leberg 2007, Zuckerberg et al. 2009

Audubon's Christmas Bird Count

December 25, 1900
- Participants: 27
- Counts: 25
- Birds reported: ~19,000
- Number of species: 90


J. Fishers

114th Annual CBC
- Participants: 71,659
- Counts: 2,480
- Birds reported: 66,243,371
- Number of species: 2,403

Audubon

Winter Bird Ranges

Northern boundaries

Northward range shifts


Howard


S. Ramirez

Audubon

Sources: Root 1998, La Sorte and Thompson 2007

North American Breeding Bird Survey

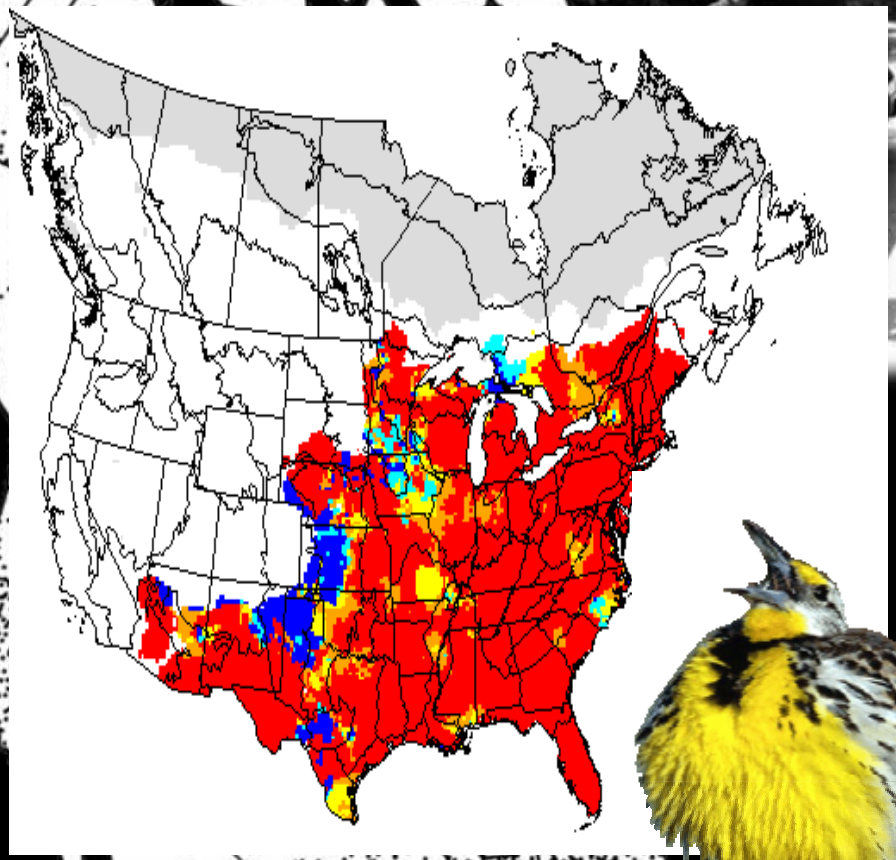
Began in 1966

Annual road-side counts

40 km long , 50 stops

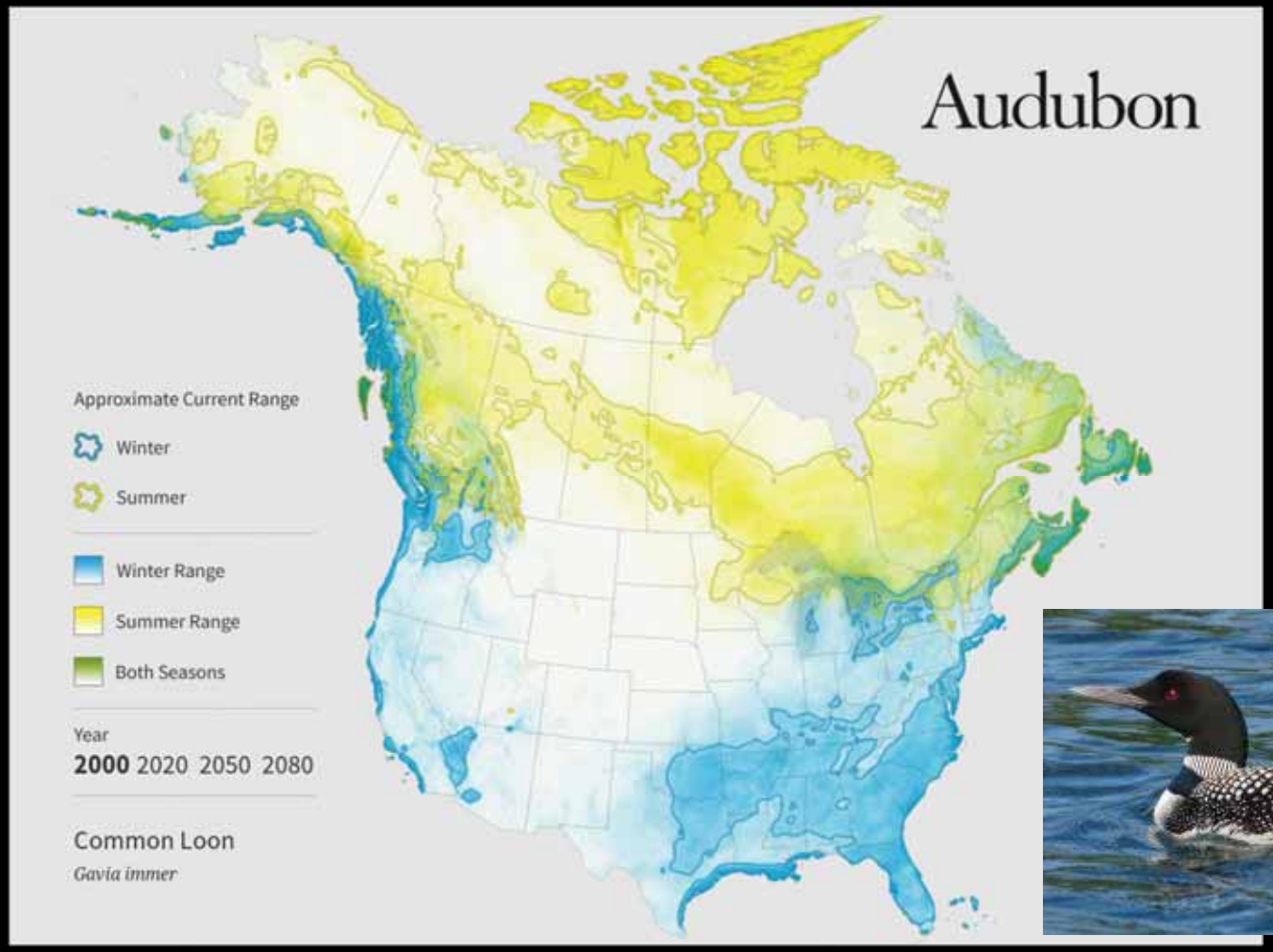
Over 3,000 surveys

Population trends



USGS
Patuxent Wildlife Research Center

Future Climatic Suitability

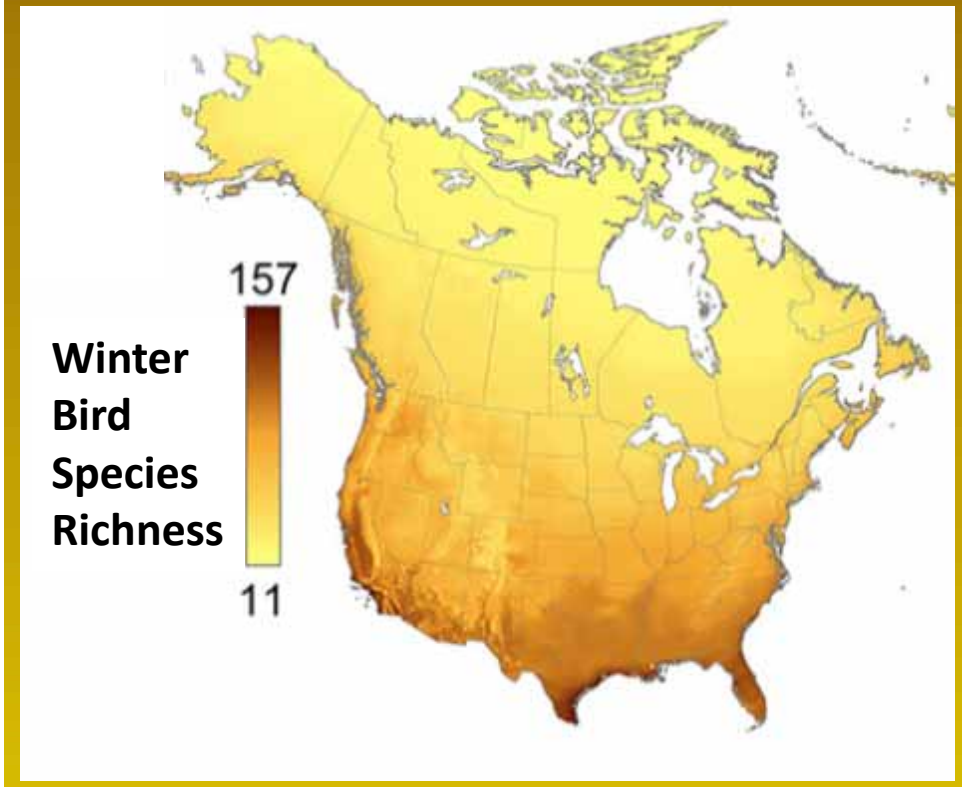


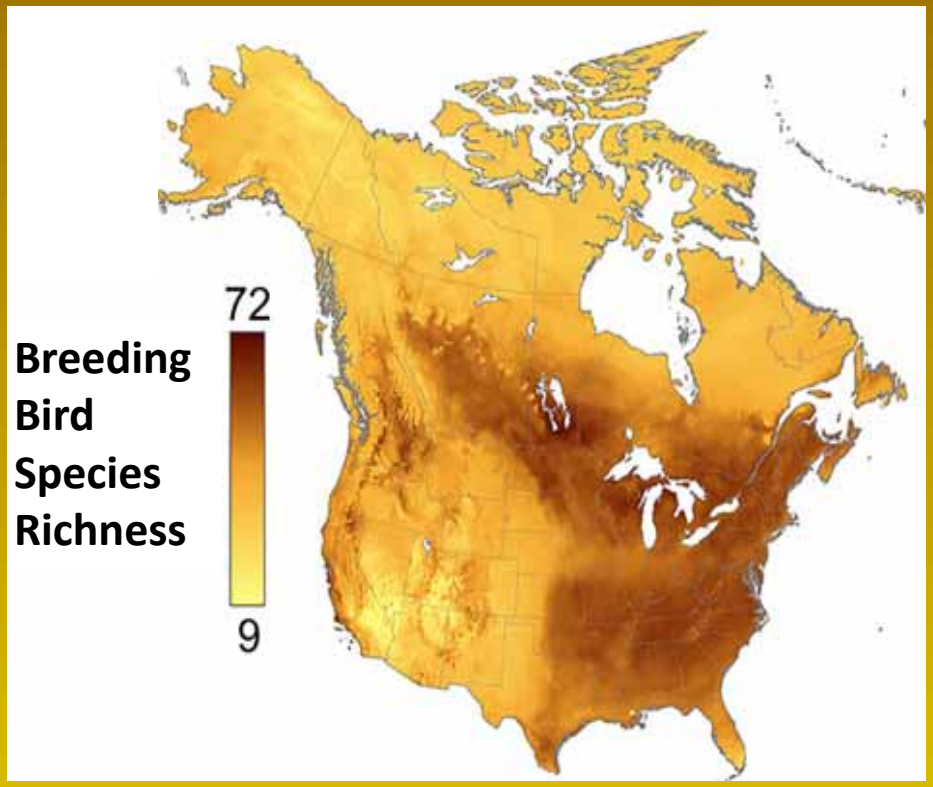

John Picken

300 species will lose more than half their climate space by late century

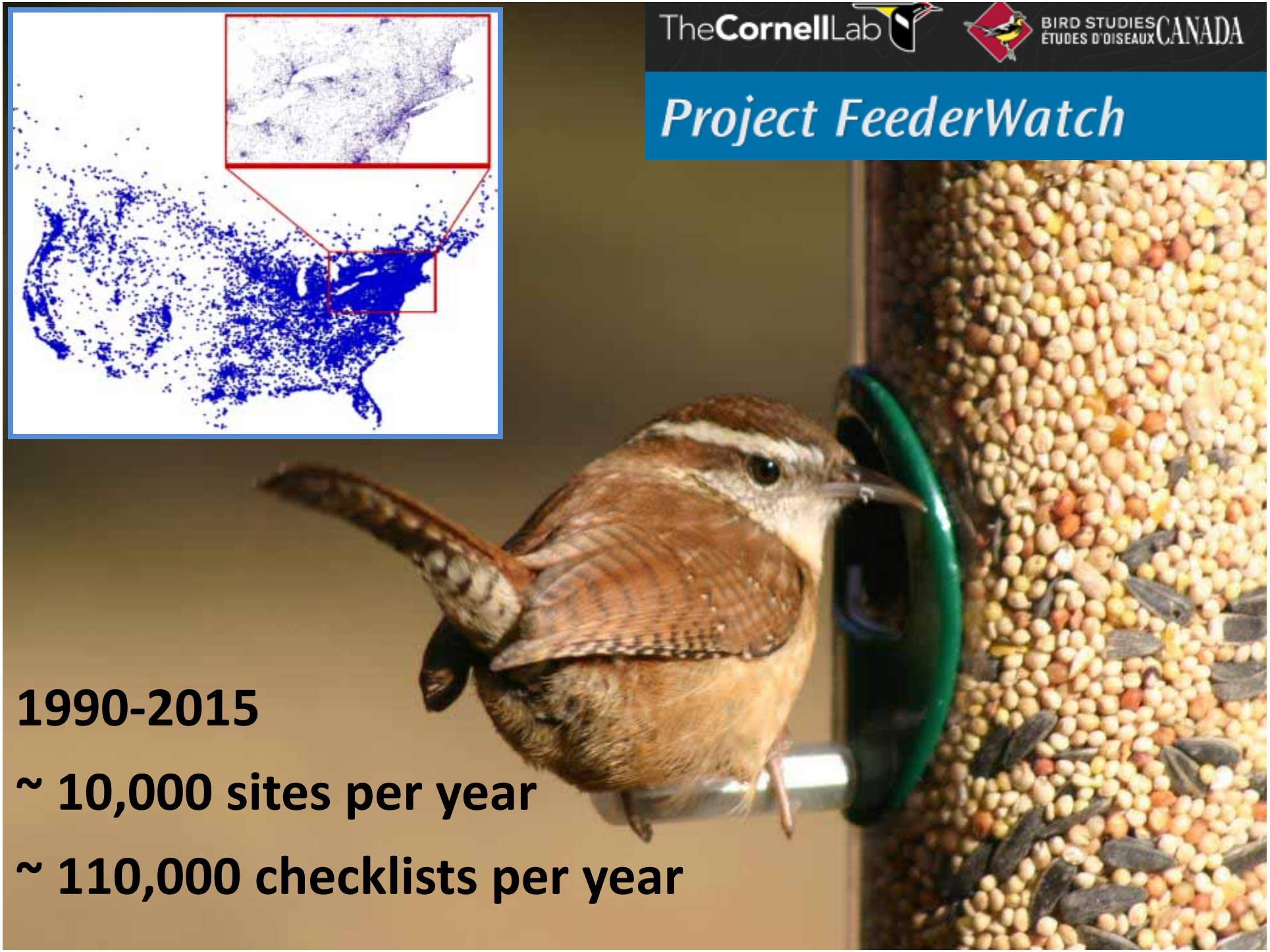
Source: Langham et al. 2015

Future Climatic Suitability





Source: Distler et al. 2015


TheCornellLab
BIRD STUDIES CANADA
ÉTUDES D'OISEAUX
Project FeederWatch
1990-2015
~ 10,000 sites per year
~ 110,000 checklists per year


Southeast









Mid-Atlantic
















Great Lakes

Reshuffling of bird communities

Warm-adapted birds
Smaller-bodied
Southerly
Increasing

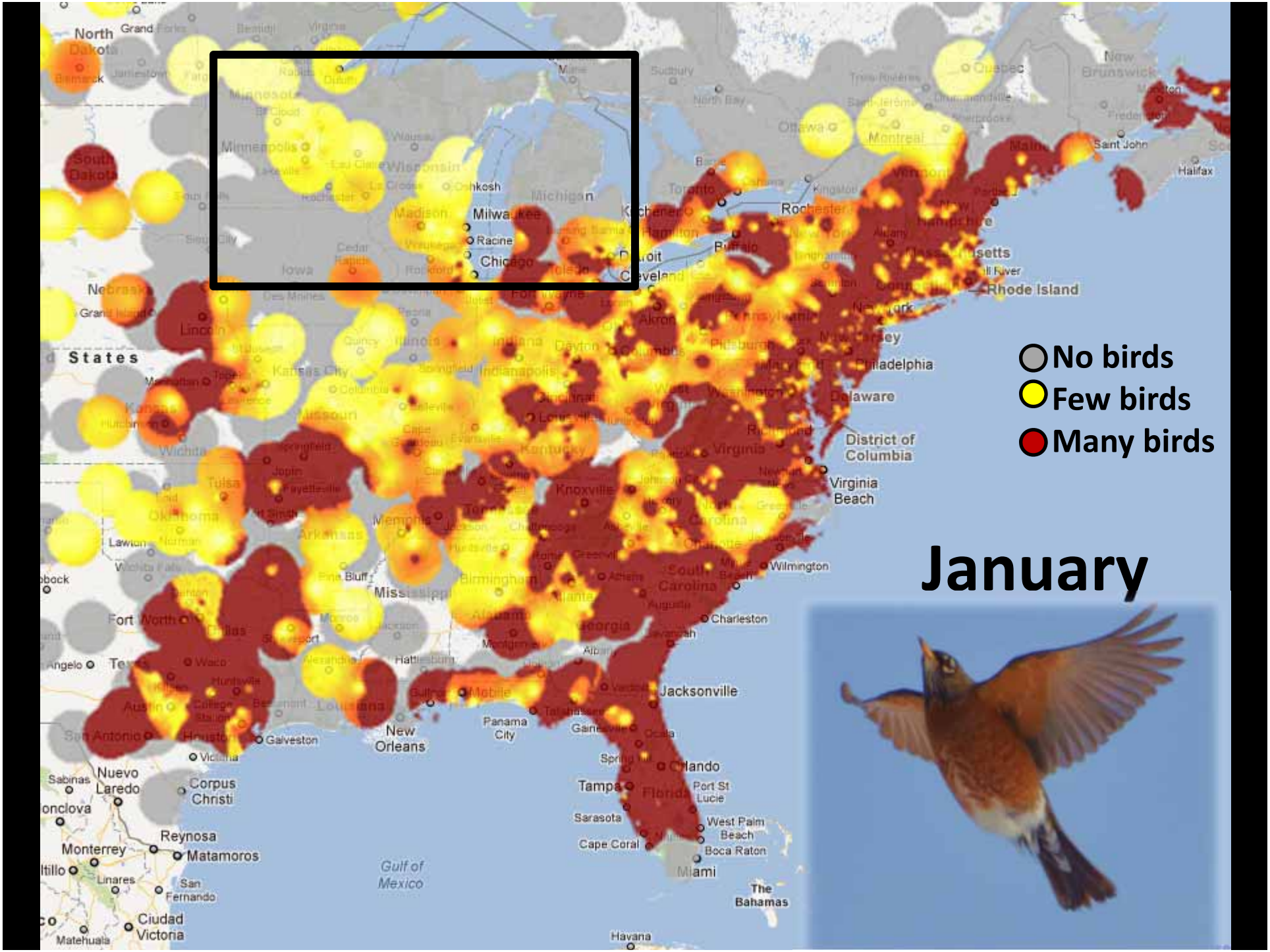
Sources: Princé and Zuckerberg 2015

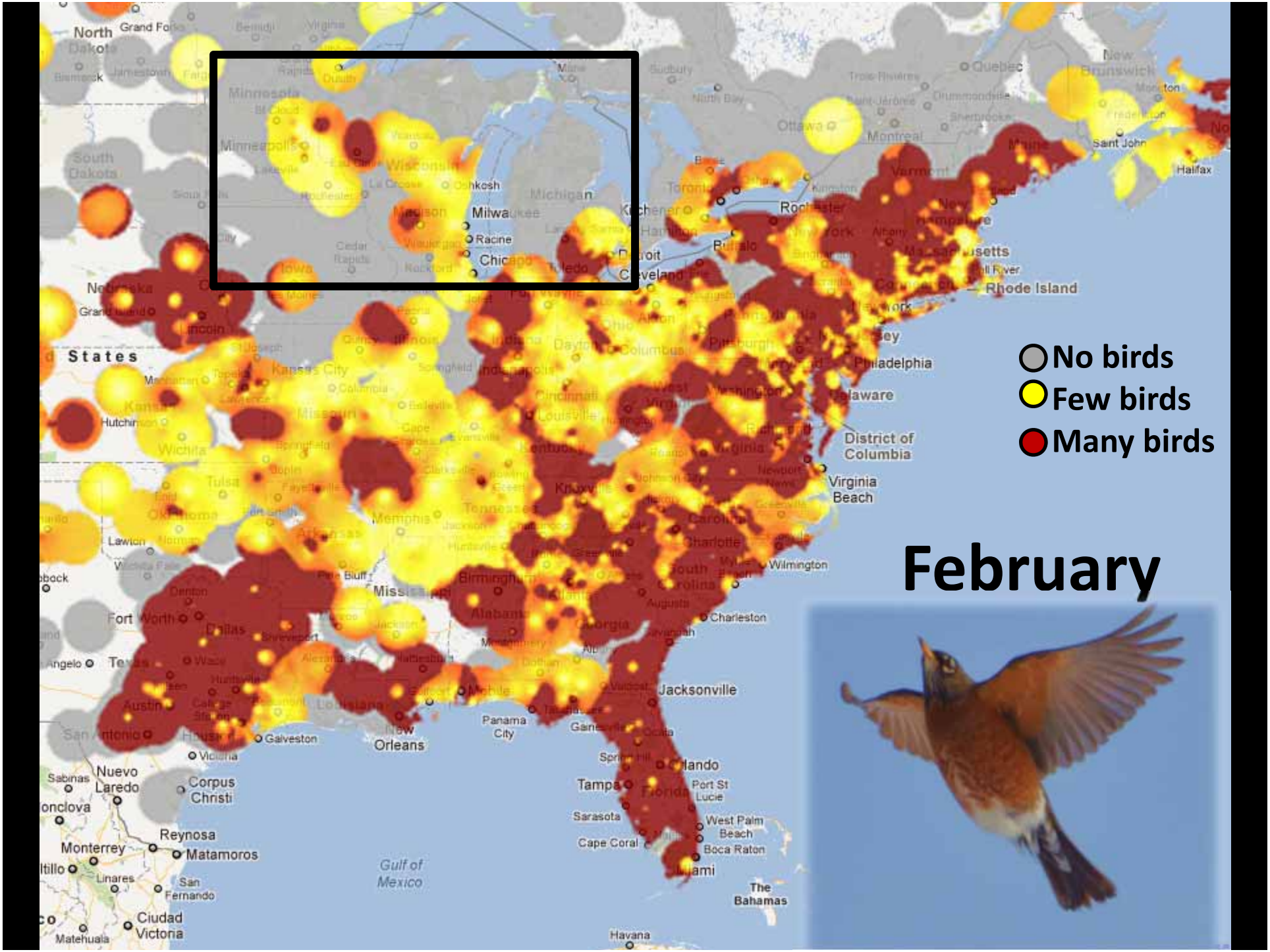
Range Shifts

More than half of observed animal range boundaries have already shown a response to modern climate change

Sources: Thomas et al. 2010

Spring Migration


No birds
Few birds
Many birds
January
Minneapolis
Milwaukee
Racine
Chicago
Rhode Island
Philadelphia
Delaware
District of Columbia
Virginia Beach
Wilmington
Charleston
Jacksonville
Orlando
Tampa
Port St Lucie
West Palm Beach
Boca Raton
Miami
The Bahamas
Cape Coral
Sarasota
New Orleans
Panama City
Galveston
Houston
Corpus Christi
Nuevo Laredo
Reynosa
Matamoros
Monterrey
Ciudad Victoria
Gulf of Mexico
Havana
Kansas City
Indianapolis
Knoxville
Memphis
Birmingham
Fort Worth
Wichita
Lincoln
Omaha
Des Moines
Chicago
Detroit
Cleveland
Buffalo
Rochester
Toronto
Ottawa
Montreal
Quebec
Saint John
Halifax


No birds
Few birds
Many birds
February
Gulf of Mexico
Minneapolis
Milwaukee
Chicago
Cleveland
Buffalo
Rochester
Toronto
Ottawa
Montreal
Quebec
Saint John
Halifax
Rhode Island
Philadelphia
Delaware
District of Columbia
Virginia Beach
Wilmington
Charleston
Jacksonville
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The Bahamas
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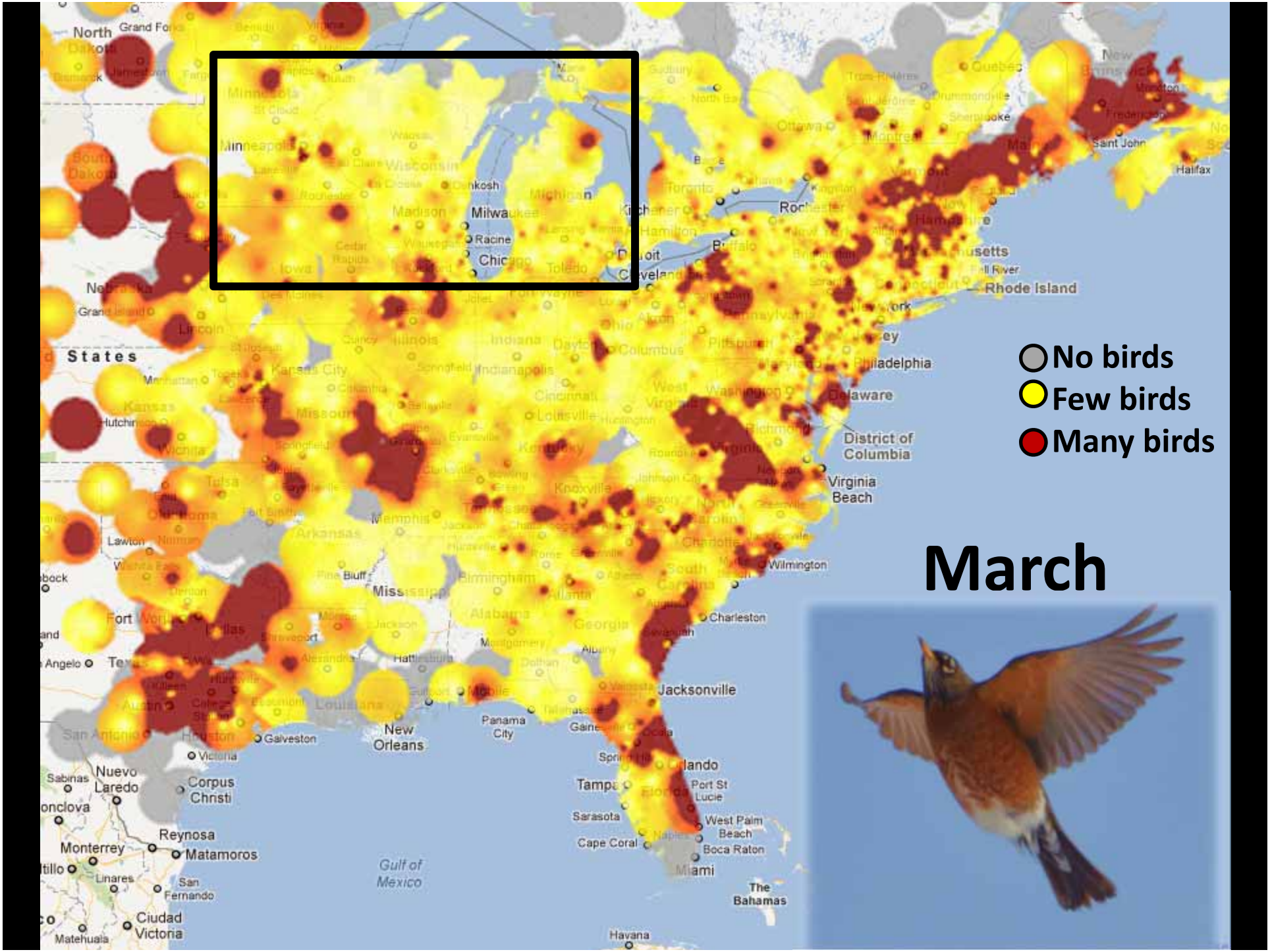
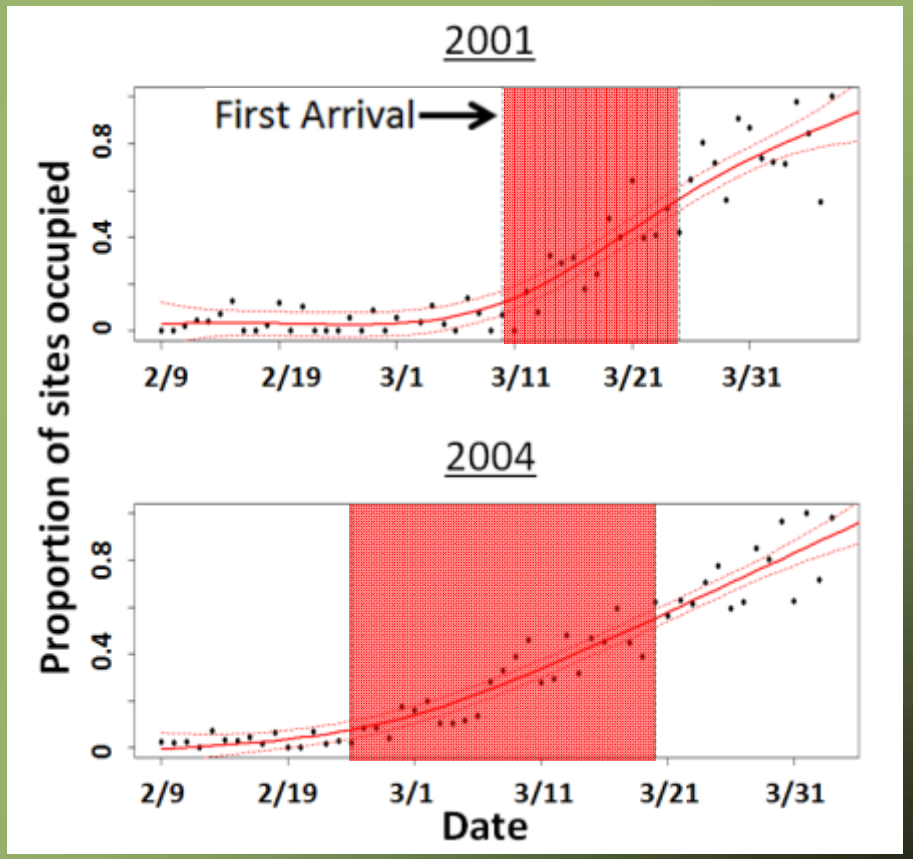
Panama City
New Orleans
Galveston
Houston
Dallas
Fort Worth
Austin
San Antonio
Corpus Christi
Laredo
Nuevo Laredo
Reynosa
Matamoros
Monterrey
Ciudad Victoria
Kansas City
Omaha
Lincoln
Wichita
Tulsa
Memphis
Nashville
Louisville
Cincinnati
Columbus
Pittsburgh
Indianapolis
Chicago
Milwaukee
Madison
Minneapolis
North Dakota
South Dakota
Nebraska
Iowa
Michigan
Wisconsin
Minnesota
States


No birds
Few birds
Many birds
March
Gulf of Mexico
Milwaukee
Chicago
Racine
Jacksonville
New Orleans
Tampa
Miami
Rhode Island
Delaware
District of Columbia
Virginia Beach
Wilmington
Charleston
Havana
The Bahamas

Earlier Spring Arrival

Spring arrival

Short-distance migrants



Sources: Zuckerberg et al. 2015

Earlier Nesting

Dating back to 1960s

Thousands of nest record cards

Earlier nesting

215

NORTH AMERICAN NEST RECORD CARD PROGRAM

SPECIES WOOD THRUSH

NAME OF OBSERVER WILLIAM H. HOOVER

IN COLUMN B, CHECK IF NEST UNDER CONSTRUCTION OR GIVE NUMBER OF EGGS OR YOUNG AT VISIT.

YEAR 1966

LOCALITY 4mi N.W of Capon Bridge

COUNTY HAMPSHIRE

STATE W. VA.

SITE

DATE	B	EGGS	YOUNG	COMMENTS
June 21		3		
June 22		2	1	
June 23		2	1	Young twice the size than at birth
June 25		1	2	notable difference in size of young
June 26		1	2	
June 27		1	2	
July 4				All birds left nest one egg remaining

HEIGHT ABOVE GROUND (IN FEET) 10

HABITAT Low, dense trees on top of small ridge

RETURN TO LABORATORY OF ORNITHOLOGY, CORNELL UNIVERSITY, ITHACA, NEW YORK 14850

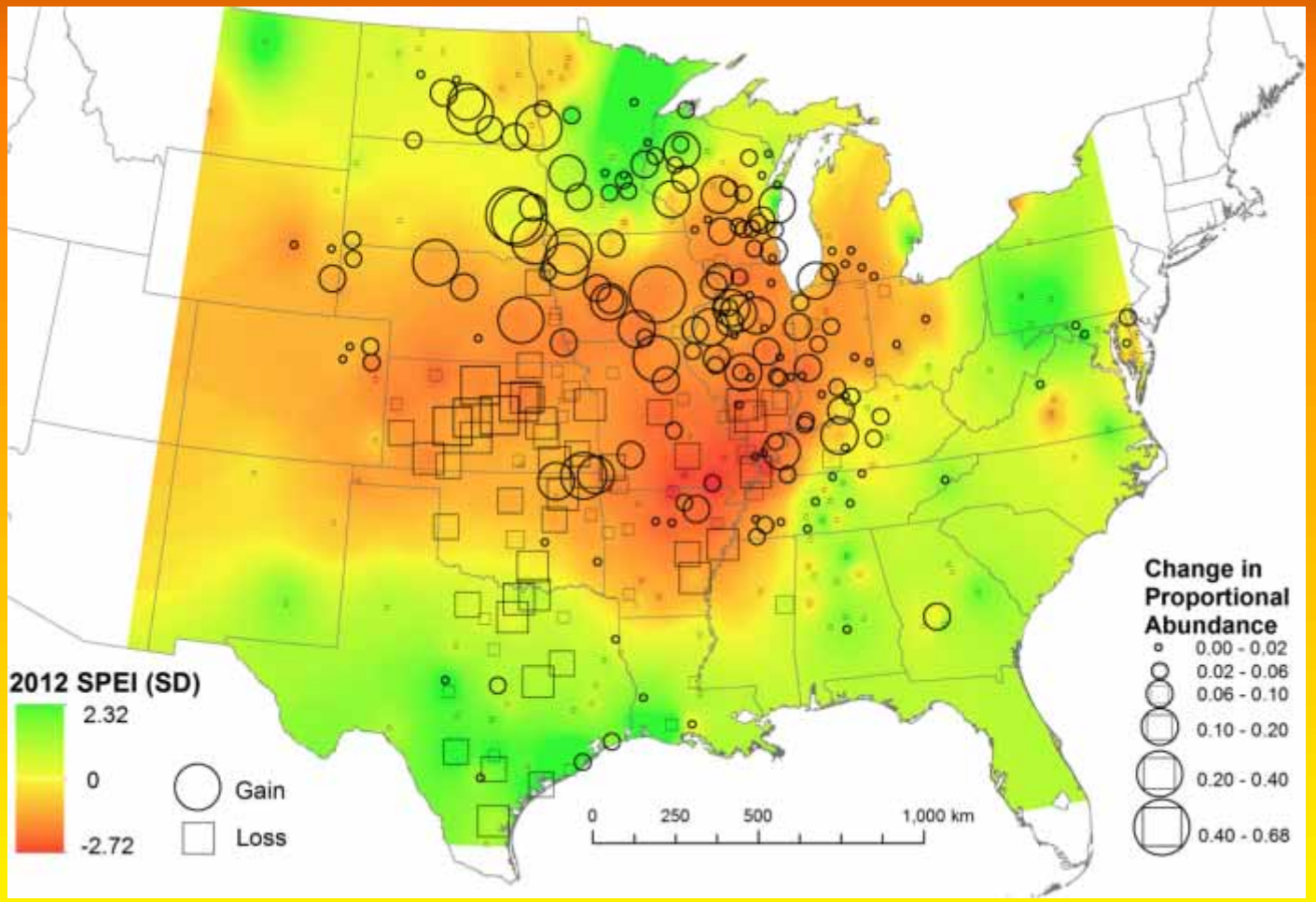
(ADDITIONAL REMARKS ON OTHER SIDE)

Sources: Dunn and Winkler 1999

Extreme Weather Events

Drought "pushes" birds to range edges

McNeal



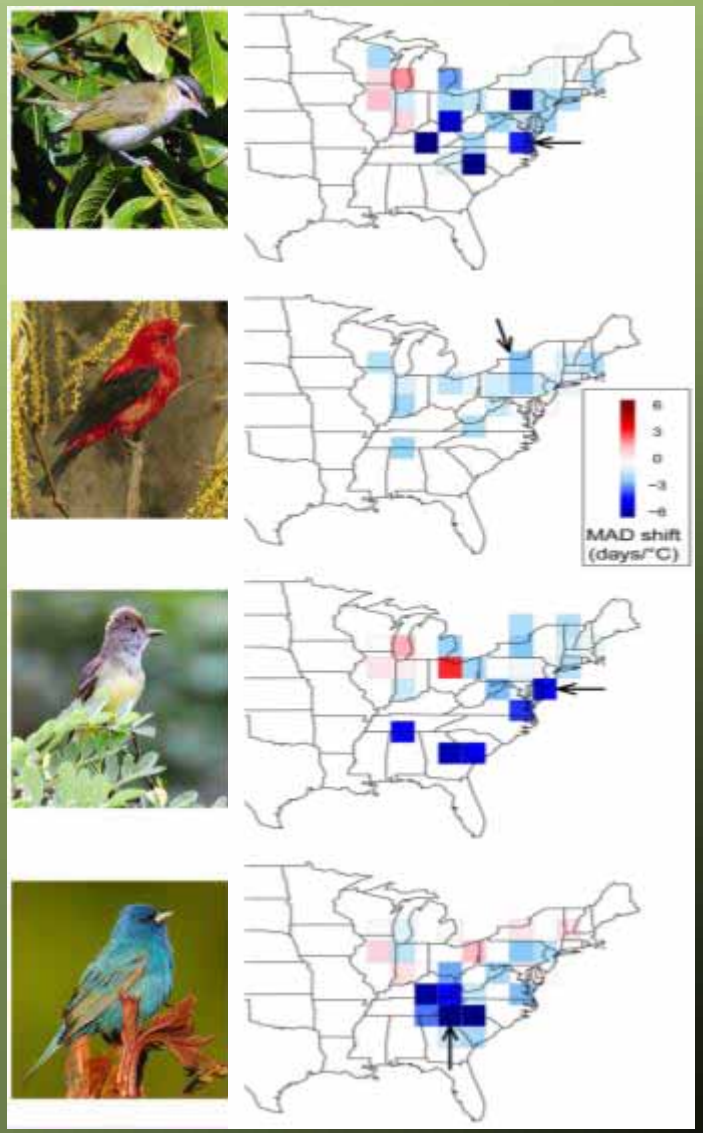
Sources: Bateman et al. 2015


TheCornellLab of Ornithology
25,000,000
observations per month
eBird


January 4

Geography of Early Arrival

- Arrival a day earlier every degree of warming
- Earlier arrival at southerly latitudes
- More sensitive in less seasonal environments



Sources: Hurlbert and Liang 2012

Climate Change and Birds

Range shifts

Changes in migration

Communities

Extreme events

Climate Change and Birds

Science at broad scales

Long-term monitoring

Scientific knowledge

"Invisible" effort

Sources: Cooper et al. 2015

Future of Citizen Science

Mobile applications and crowdsourcing
Global citizen-science community
Fusion of disciplines

Anthropocene • Citizen Science

Rene Prochelle, FeederWatcher,
23 years
Over 200 checklists

A window to nature
Value
Engagement
Education
Communication

An era born of out of necessity

Become a citizen scientist!

CitizenScience.org
DataONE.org
CitSci.org

Citizen scientists

Christmas Bird Count (Audubon)
North America Breeding Bird Survey (USGS)
Project FeederWatch (Cornell Lab of Ornithology and Bird Studies Canada)

Lab Members (past and present)

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