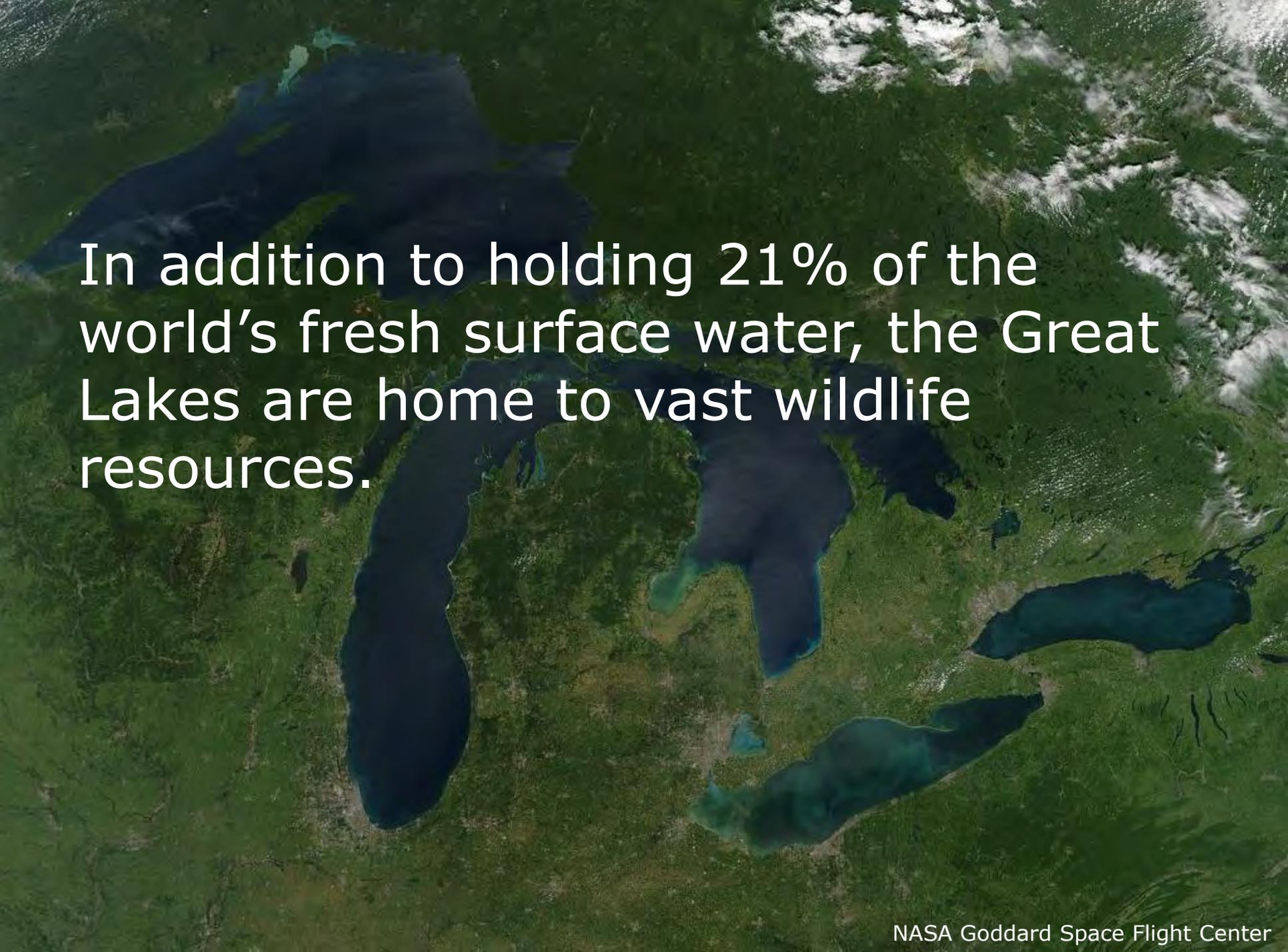


Mapping airspace use to inform conservation decisions along the Great Lakes

June 24, 2019

Elizabeth Rigby, Presenter
Kevin Heist
Nathan Rathbun
Michael Wells

A satellite image of the Great Lakes region in North America, showing the five large lakes (Superior, Michigan, Huron, Erie, and Ontario) and the surrounding land and water. The lakes are dark blue, and the surrounding land is green with some brown patches. The text is overlaid on the image in white.

In addition to holding 21% of the world's fresh surface water, the Great Lakes are home to vast wildlife resources.

A satellite image of the Great Lakes basin in North America, showing the five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) and the surrounding land and water. The lakes are dark blue, and the surrounding land is green. The image is taken from a high angle, showing the entire basin and parts of the surrounding continent.

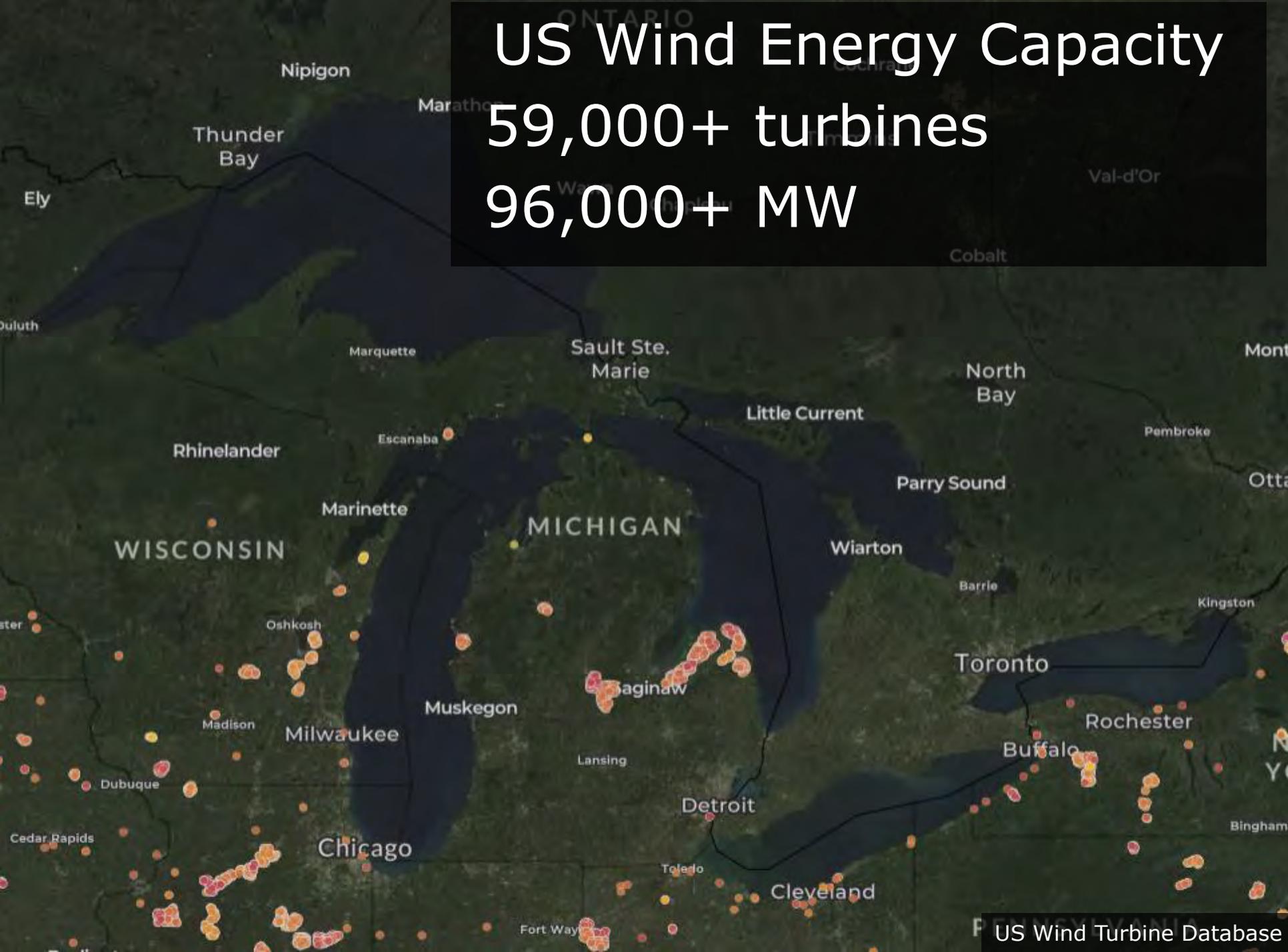
Millions of birds migrate through the Great Lakes basin each year.

Bats also migrate shorter distances through the basin.

US Wind Energy Capacity

59,000+ turbines

96,000+ MW



How can we avoid and minimize negative impacts?

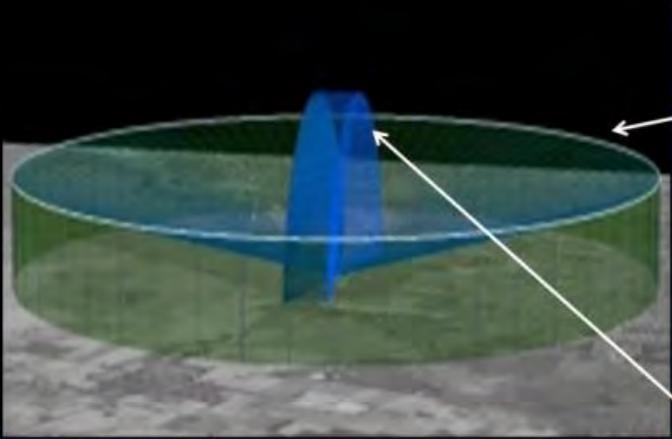
Where are conservation opportunities?





Studying Migration

- Challenge: most migrants move nocturnally
- Solution: radar can track migrants

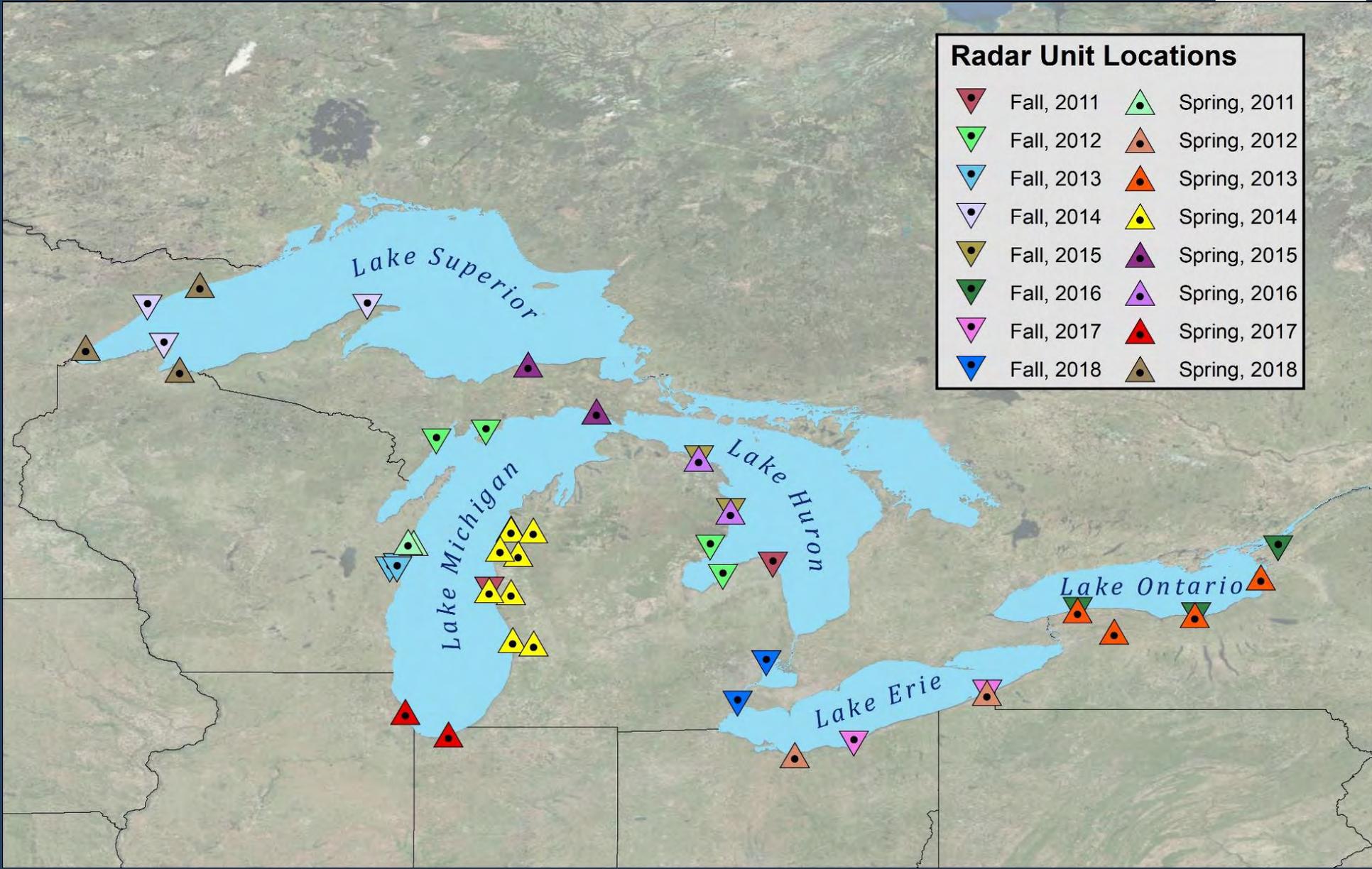


Horizontal Radar

Avian Radar Unit

Vertical Radar

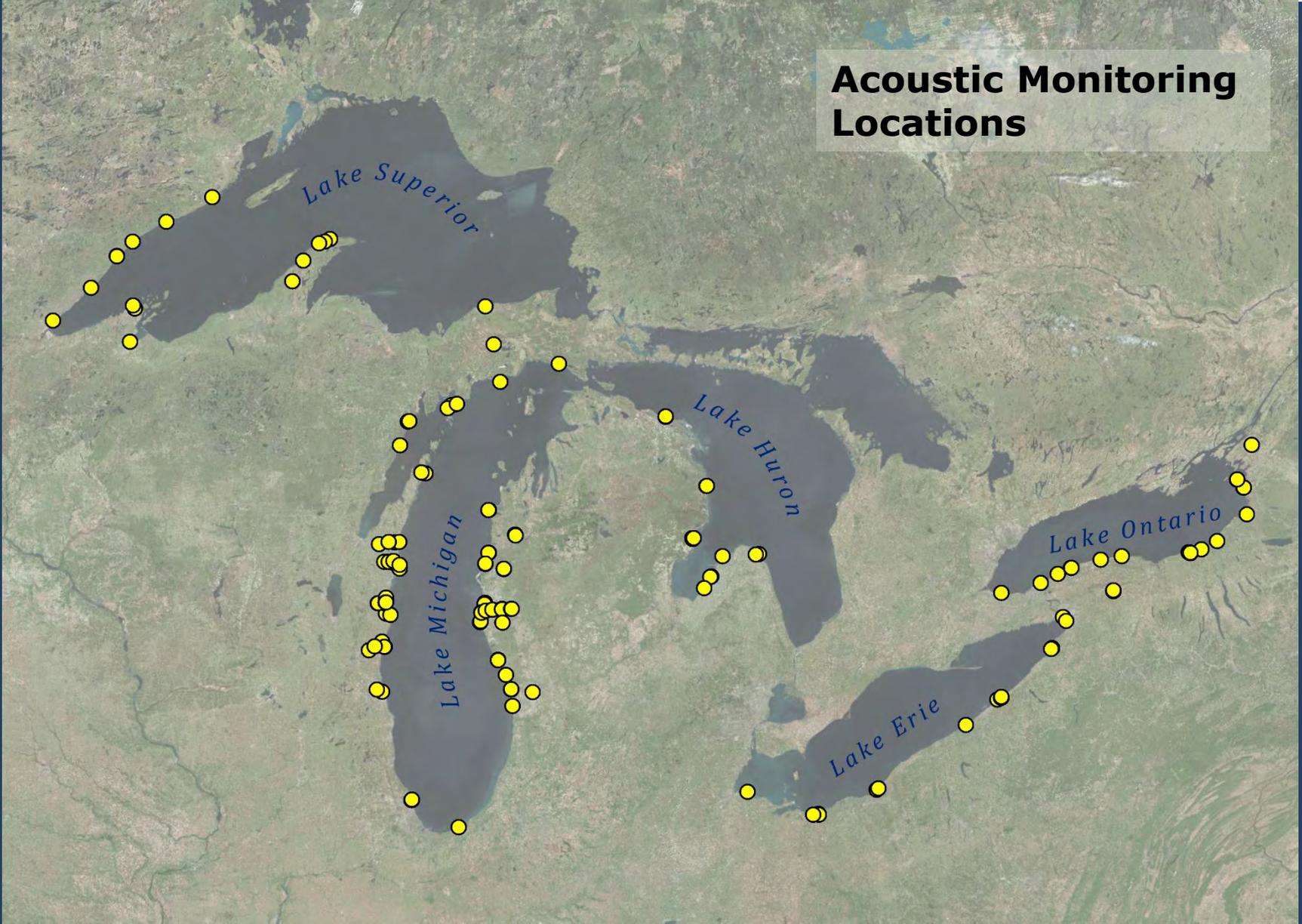




Radar Unit Locations

	Fall, 2011		Spring, 2011
	Fall, 2012		Spring, 2012
	Fall, 2013		Spring, 2013
	Fall, 2014		Spring, 2014
	Fall, 2015		Spring, 2015
	Fall, 2016		Spring, 2016
	Fall, 2017		Spring, 2017
	Fall, 2018		Spring, 2018

Acoustic Monitoring Locations





U.S. Fish & Wildlife Service

Great Lakes Avian Radar Technical Report Huron and Oceana Counties, MI

Biological Technical Publication
BTP-R011-2015



U.S. Fish & Wildlife Service

Great Lakes Avian Radar Technical Report Niagara, Genesee, Wayne and Jefferson Counties, New York

Spring 2013 Season



U.S. Fish & Wildlife Service, Region 3



U.S. Fish & Wildlife Service

Great Lakes Avian Radar Technical Report Lake Erie Shoreline: Erie County, Ohio and Erie County, Pennsylvania

Spring 2012



U.S. Fish & Wildlife Service, Region 2
Funding Provided by the Great Lakes Restoration Initiative



U.S. Fish & Wildlife Service

Great Lakes Avian Radar Technical Report Lake County, MN Bayfield County, WI Keweenaw County, MI

Fall Season 2014
Biological Technical Publication
BTP-R010-2017



U.S. Fish & Wildlife Service, Region 3
Funding Provided by the Great Lakes Restoration Initiative

www.fws.gov/radar



Great Lakes Avian Radar Technical Report Lake Huron Shoreline: Presque Isle County and Alcona County, MI Fall 2015, and Spring 2016



U.S. Fish and Wildlife Service, Region 3
Funding Provided by Great Lakes Restoration Initiative



Great Lakes Avian Radar Technical Report Lake Ontario Shoreline: Jefferson, Wayne, and Niagara Counties, New York Fall 2016



U.S. Fish and Wildlife Service, Region 3
Funding Provided by Great Lakes Restoration Initiative

Comparing shoreline and inland migration using avian radar

4 ABSTRACT
5 Millions of flying migrants encircle the Great Lakes on their long-distance journey each
6 spring and fall, but quantitative data regarding how they traverse the region are limited.
7 Shorelines are known areas of migrant concentrations due to the ecological barrier effect, but
8 details on the magnitude of this concentration and the flight behaviors causing it are largely
9 unknown. Mobile avian radar can provide a unique view of how birds and bats move across
10 landscapes by tracking thousands of individual migrants moving through a sample volume that
11 extends multiple kilometers in radius. During the spring of 2014 we used this avian radar unit
12 to compare migration patterns at shoreline and inland sites along the eastern shore of Lake
13 Michigan. The radar views showed between inland and shoreline sites over the course of four
14 trial periods spanning the migration season. We found that shoreline activity was significantly
15 higher than activity at inland sites (shoreline to inland activity ratio was 1.17), especially during
16 the hour of dawn. The difference in migration traffic was largest during the peak migration
17 timeframe from late April to early June. We also found that while a large proportion of migrants
18 moved westward throughout the night, migrants at shoreline (but not inland) locations shifted
19 their flight orientation back toward the east at dawn, remaining to show from over seas. This
20 confluence of migrants along the shoreline helps explain the high numbers migrants often
21 observed there, and we estimated a migrant accumulation rate of 130 migrants per hour per
22 square mile region of coastal upland at dawn. Our findings stress the importance of
23 conserving shoreline riparian habitat for migrating birds and bats, and maintaining a higher level of
24 caution when assessing the potential impacts of development in coastal areas.

25 INTRODUCTION
26 Many species of birds and bats experience strong selective pressure during migration (Sibley and
27 Holmes 2002, Fleming and Eby 2001, Newton 2004) and the need for conservation during their
28 life-cycle phase is clear (Hans 2000, Robinson and Matthews 2001, Klusman et al. 2014, Mann
29 et al. 2015). Identifying migration routes, habitat used, and causes of stress or mortality during
30 this phase is as important as understanding the requirements of quality breeding and wintering
31 grounds (Emer and Hannon 1993, Fishberg et al. 2010). Nonetheless, much remains to be known
32 about how migrating birds and bats connect distant habitats.
33 Technological advances and improved modeling techniques are beginning to close this
34 information gap by identifying common-level patterns of movement as well as areas where

Elevated bat activity near an ecological barrier and implications for wind energy development

8 Kevin W. Hunt^{1,*}, Douglas H. Johnson^{2,1}, Jeffrey Gosse³, Daniel Nisbet^{4,6}, Anna C. Peterson⁵,
9 Jim Perry¹, and David Larsen⁷

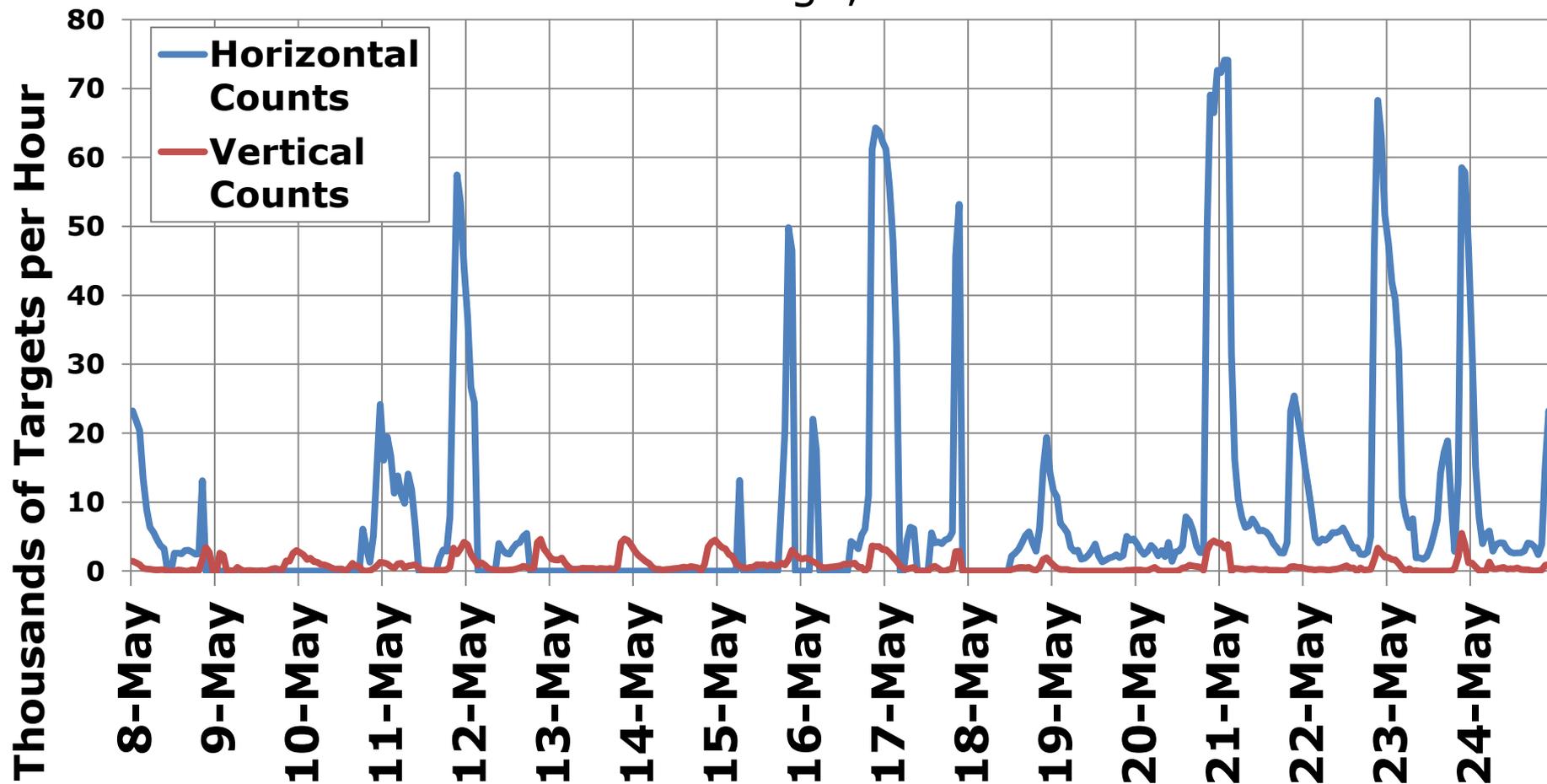
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29 United States of America

30 Disclaimer: The findings and conclusions in this article are those of the authors and do not
31 necessarily represent the views of the U.S. Fish and Wildlife Service. The mention of trade
32 names or products does not constitute an endorsement or approval of the quality or value of
33 such names or products by the U.S. Fish and Wildlife Service.



Magnitude of Migration

Chicago, IL





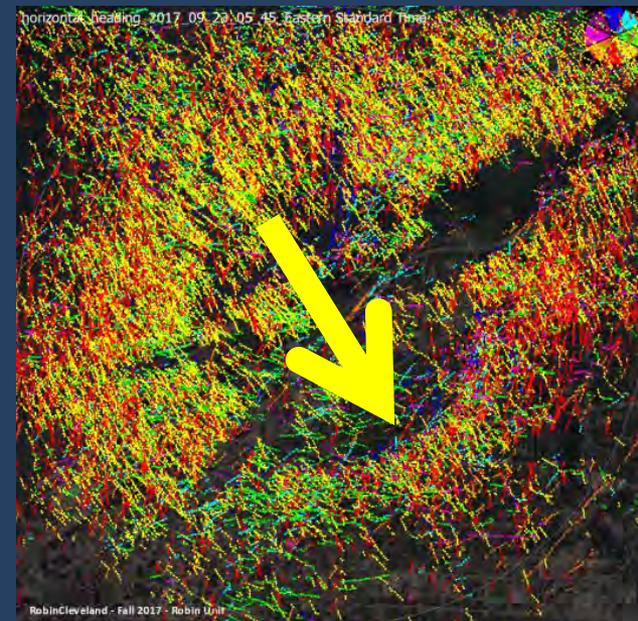
Direction of Flight



Day



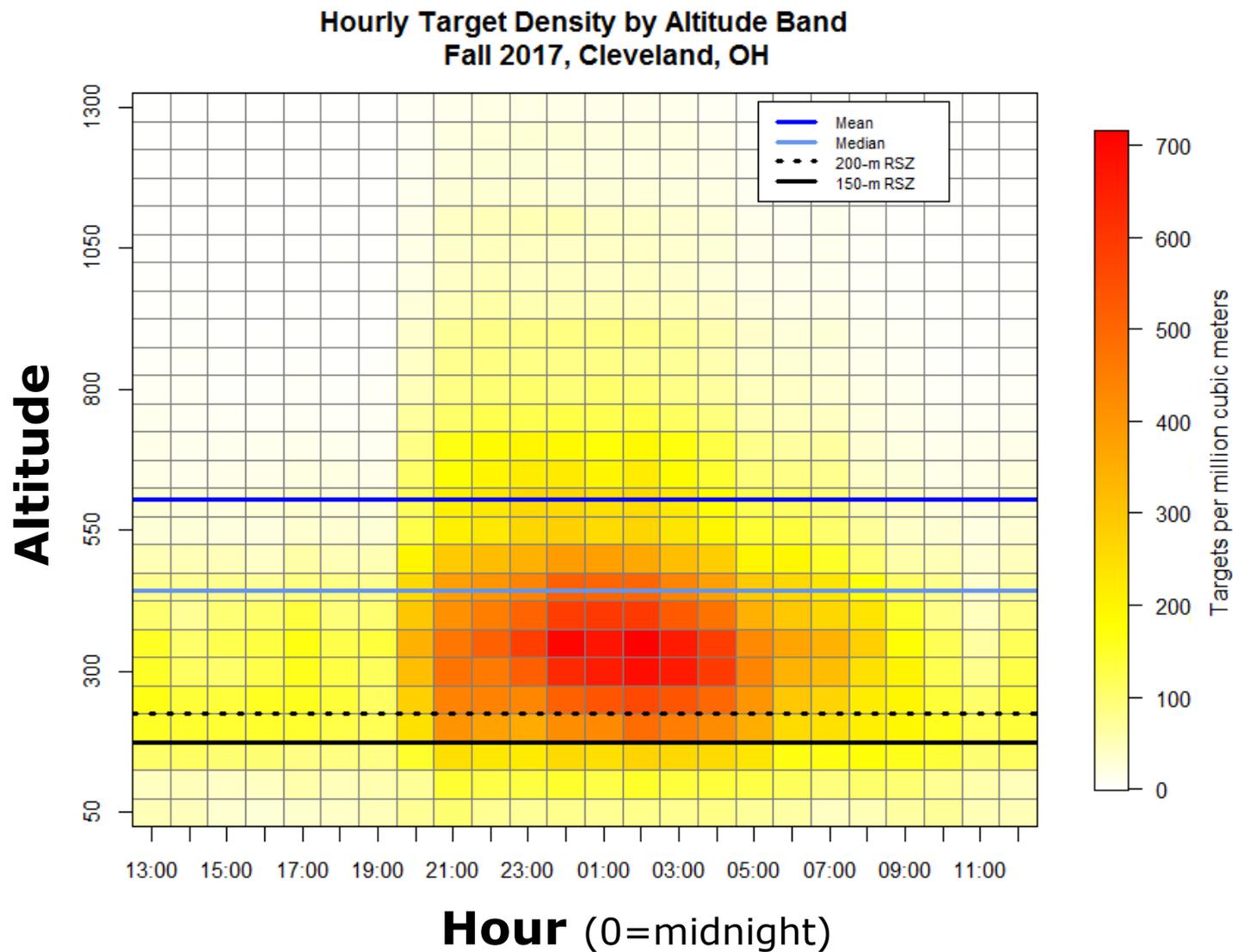
Night



Dawn



Altitude of Flight



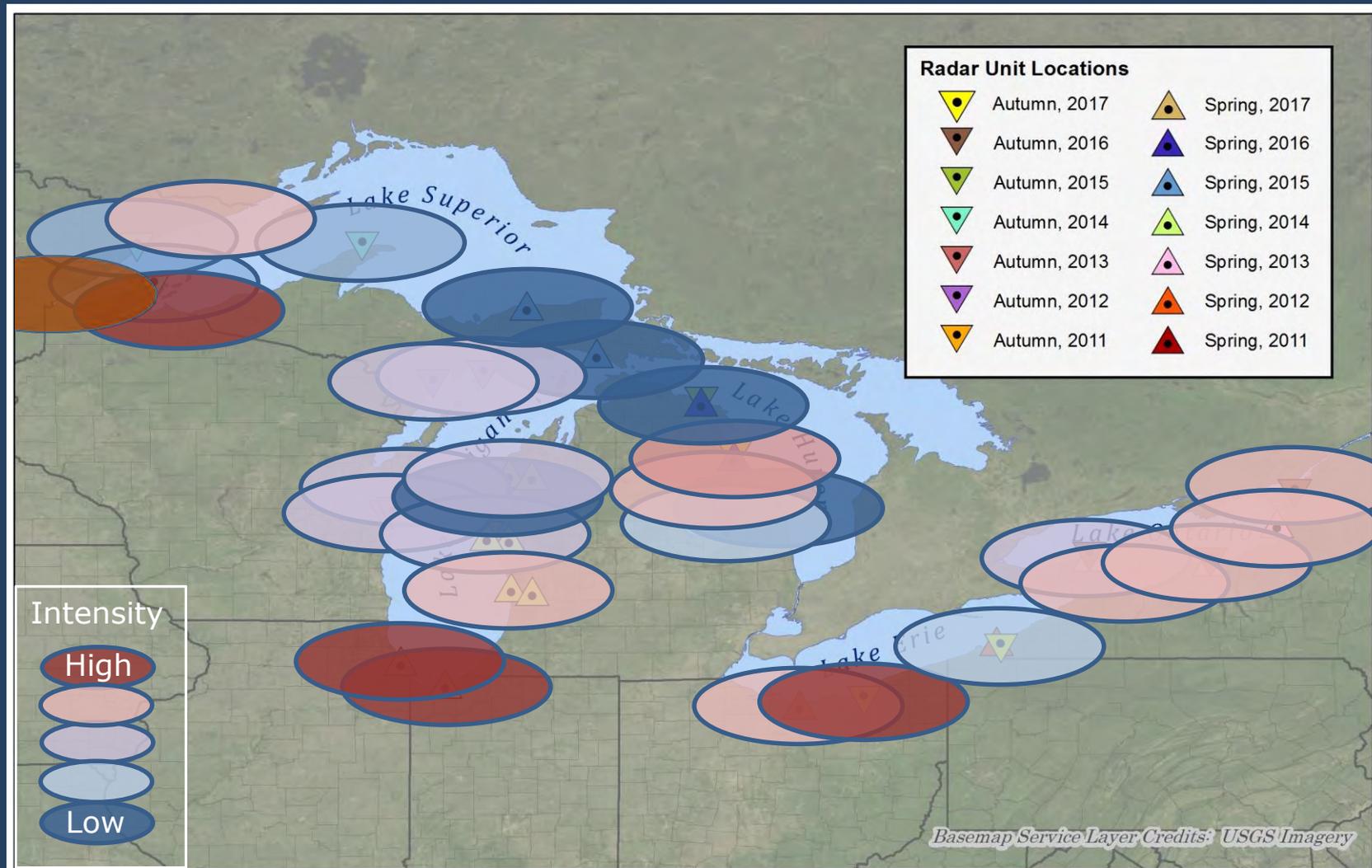


Avian Radar Project

- Transitioning from a site-specific focus to providing region-wide information
- Creating a Decision Support Tool (DST) to inform conservation decisions
 - Radar data
 - Bat acoustic data
 - Partner data



Radar Data (birds & bats)

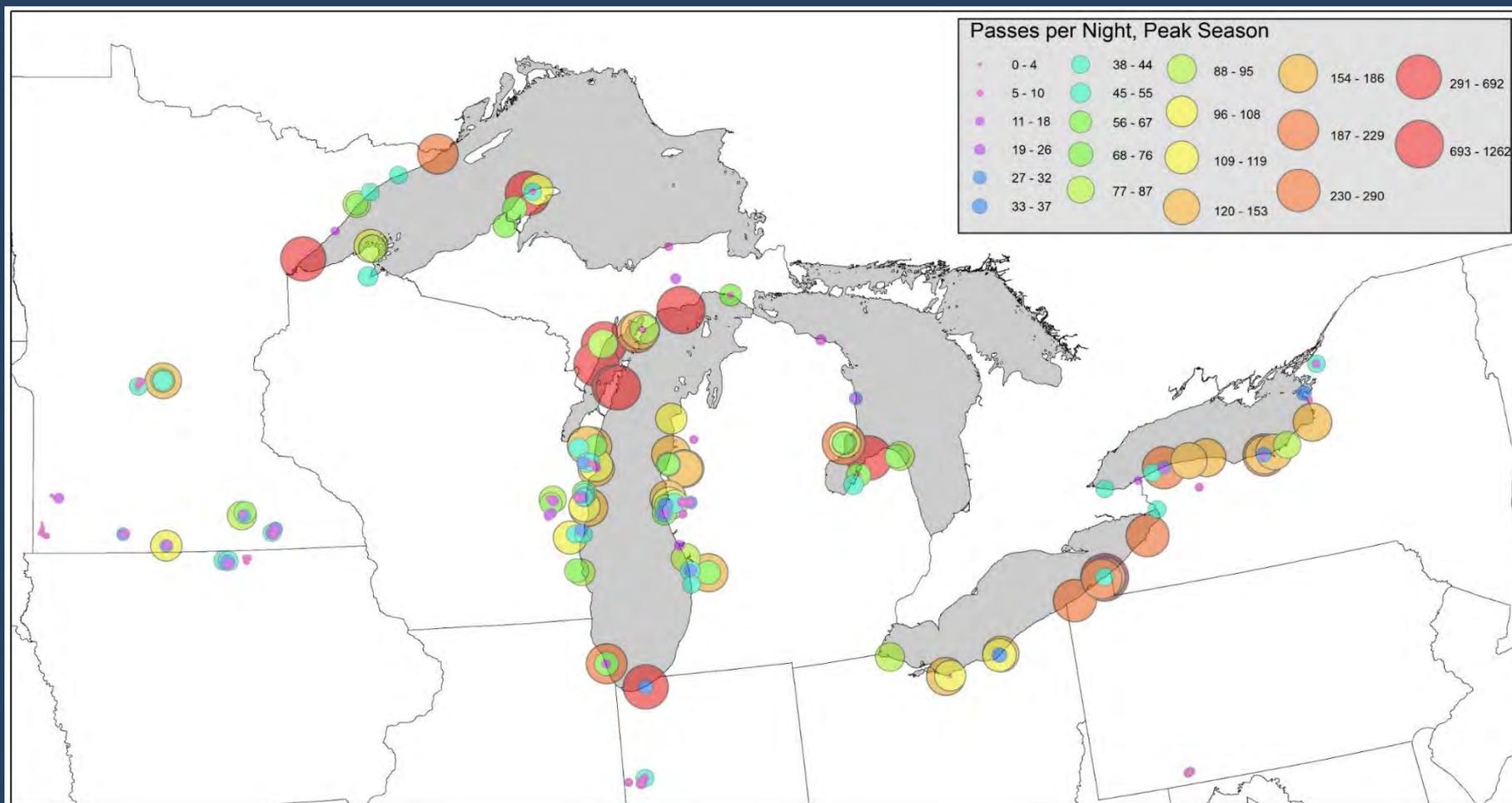






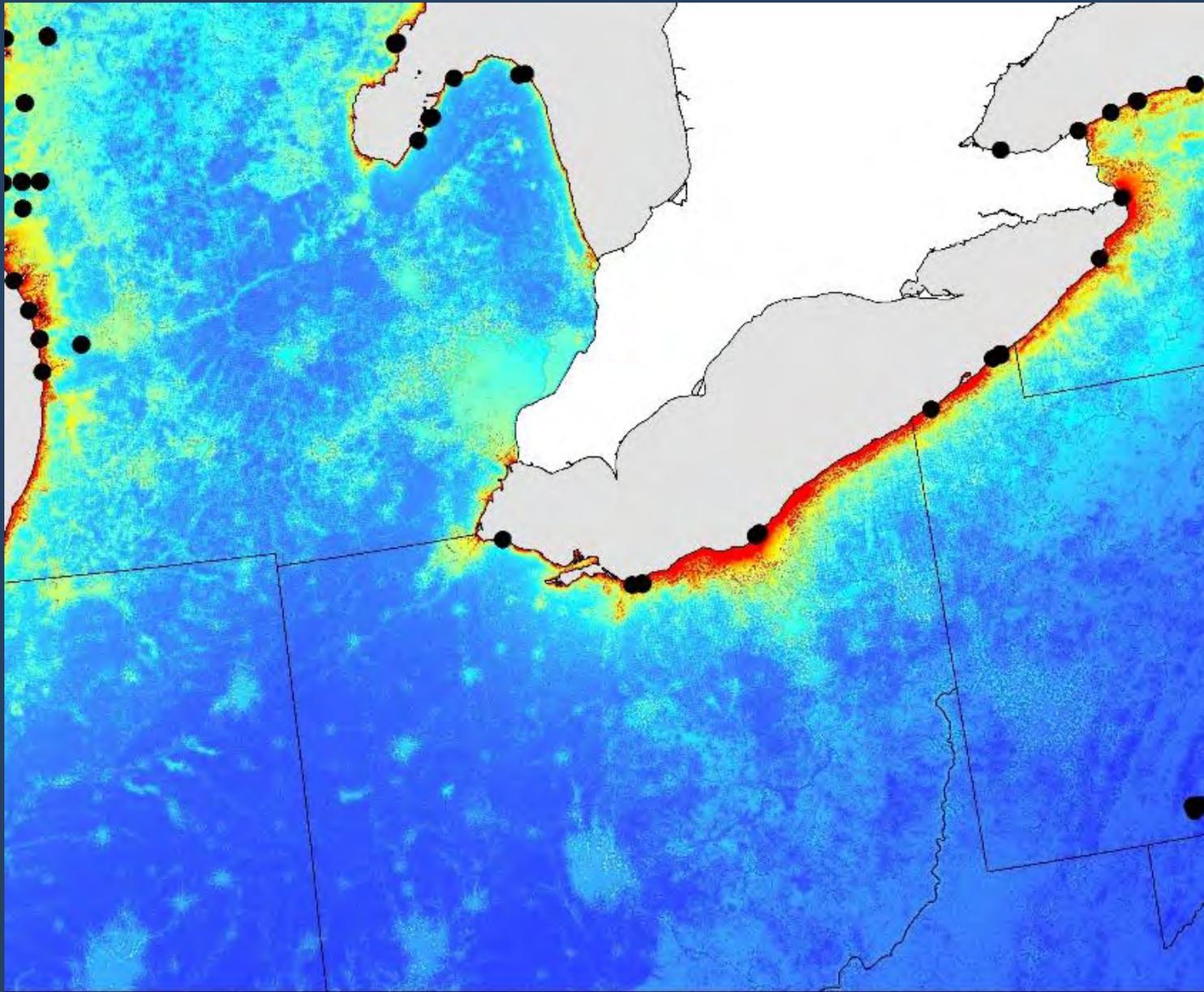
Bat Data

Bat acoustic recording locations, 2010 – 2018





Bat Model



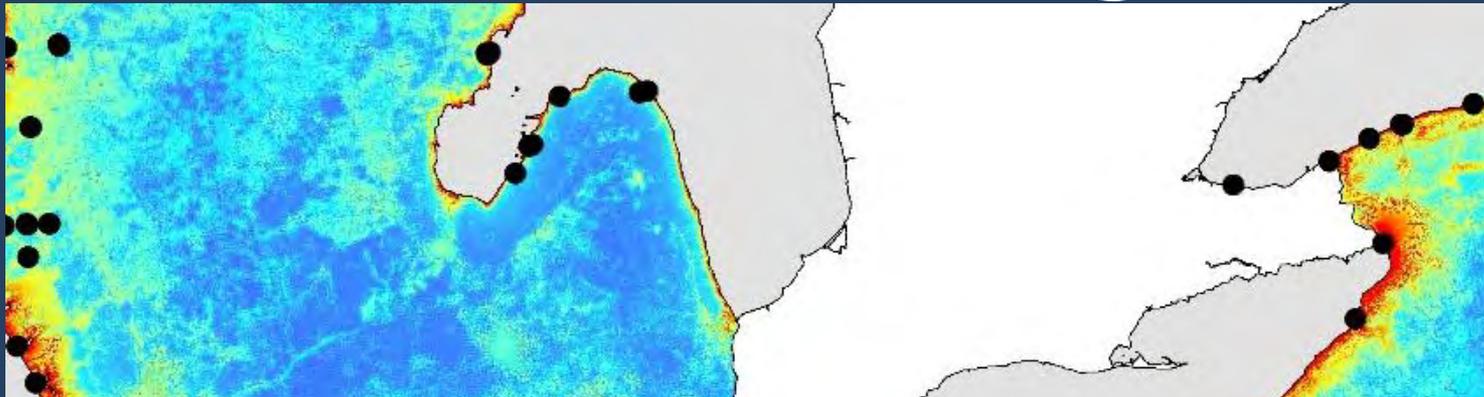


Avian Radar Project

- Developing partnerships with decision makers to inform DST
 - Intra- and inter-agency partners
 - State and local governments
 - Tribes
 - NGOs
- Incorporate partner data and current decision tools



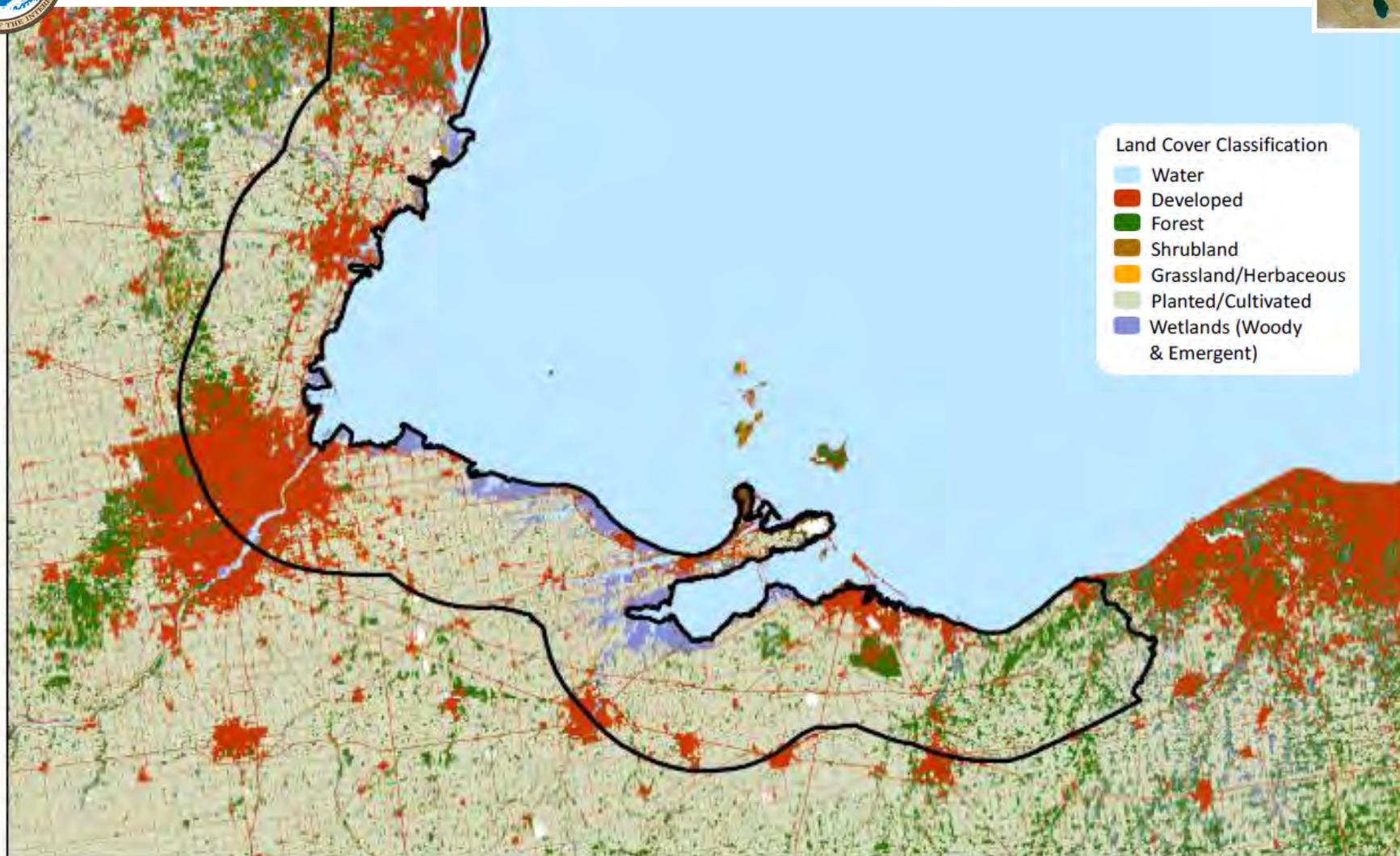
FWS Coastal Program



Western Lake Erie/Lake St. Clair Focus Area

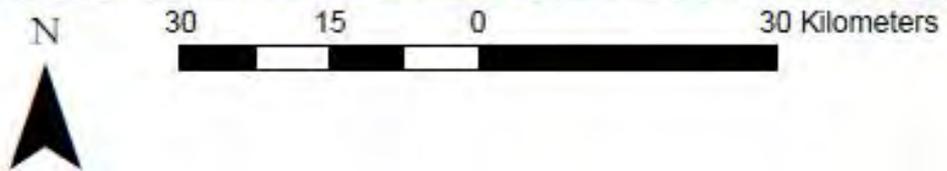


Figure 7. Western Lake Erie/Lake St. Clair focus area.



Land Cover Classification

- Water
- Developed
- Forest
- Shrubland
- Grassland/Herbaceous
- Planted/Cultivated
- Wetlands (Woody & Emergent)





Next Steps

Iterative process for development and revision

DST version 1.0 available to partners in late 2019

DST Version 2.0 available to public late 2020

Questions

A satellite image of the Great Lakes region in North America. The lakes are shown in dark blue, contrasting with the green landmass. The word "Questions" is written in large white font across the top center of the image.