



Mapping airspace use to inform conservation decisions along the Great Lakes

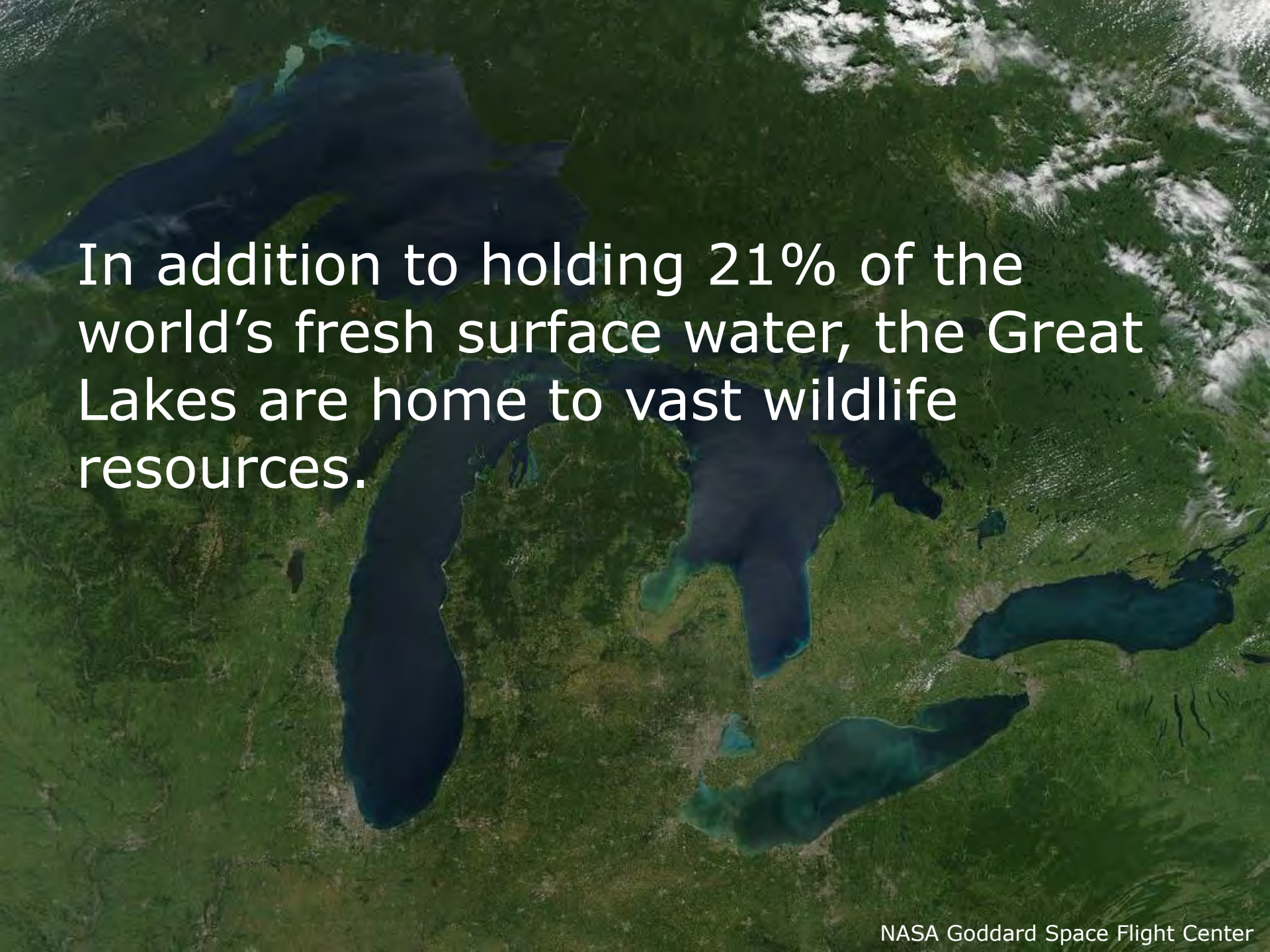
June 24, 2019

Elizabeth Rigby, Presenter

Kevin Heist

Nathan Rathbun

Michael Wells

A satellite image of the Great Lakes region in North America. The five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) are visible as large, dark blue bodies of water. The surrounding land is covered in green vegetation, with some white clouds visible in the upper right corner. The text is overlaid on the left side of the image.

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

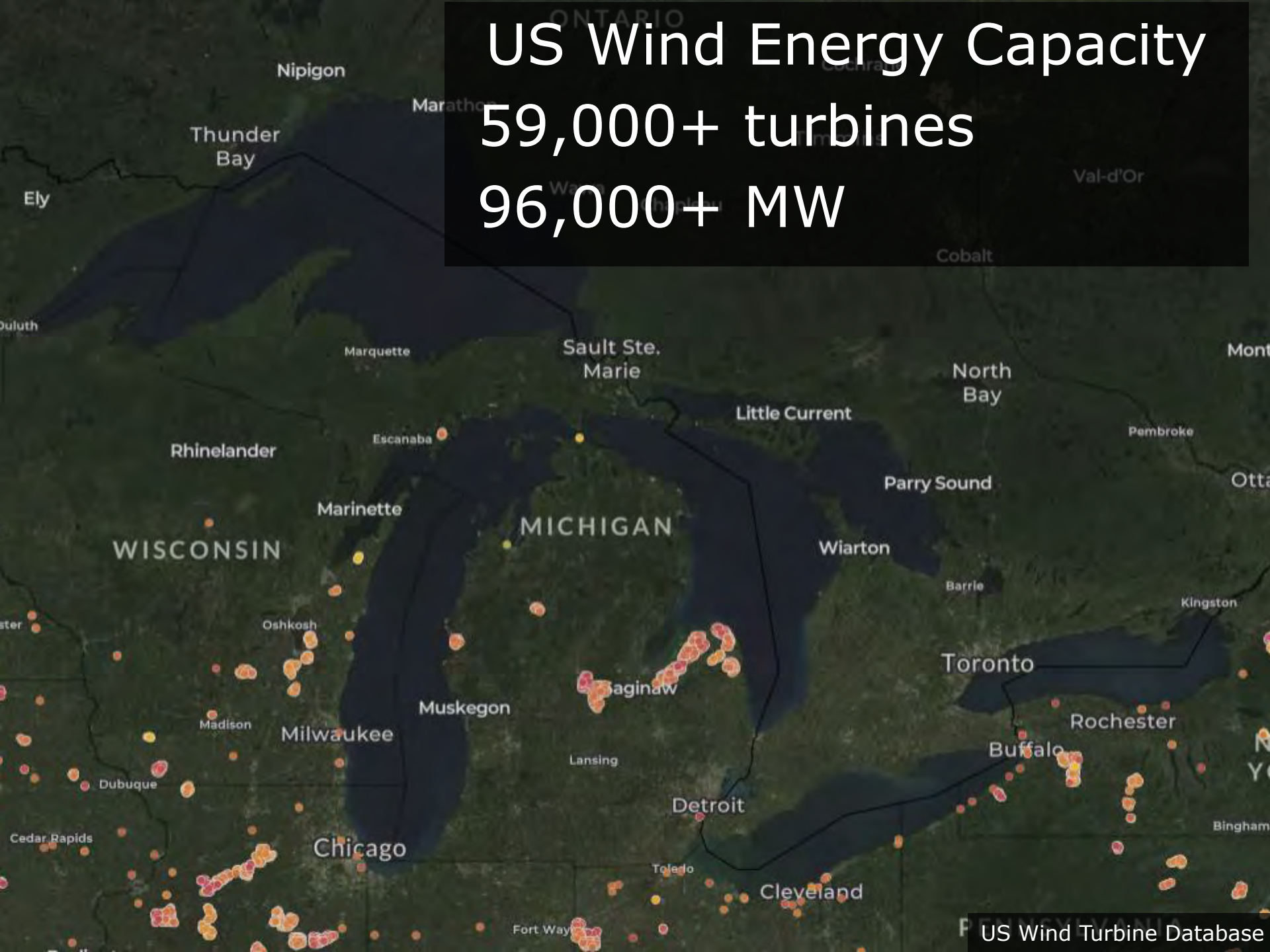
A satellite image of the Great Lakes basin in North America. The five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) are visible as dark blue areas surrounded by green land. The surrounding land is covered in dense green vegetation, with some white clouds visible in the upper right corner.

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?

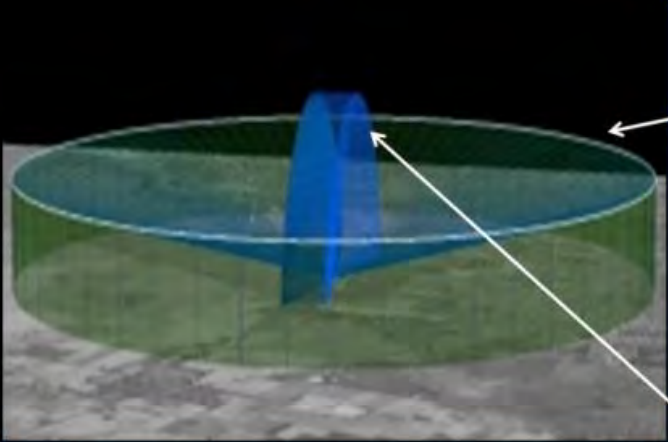
Where are conservation opportunities?





Studying Migration

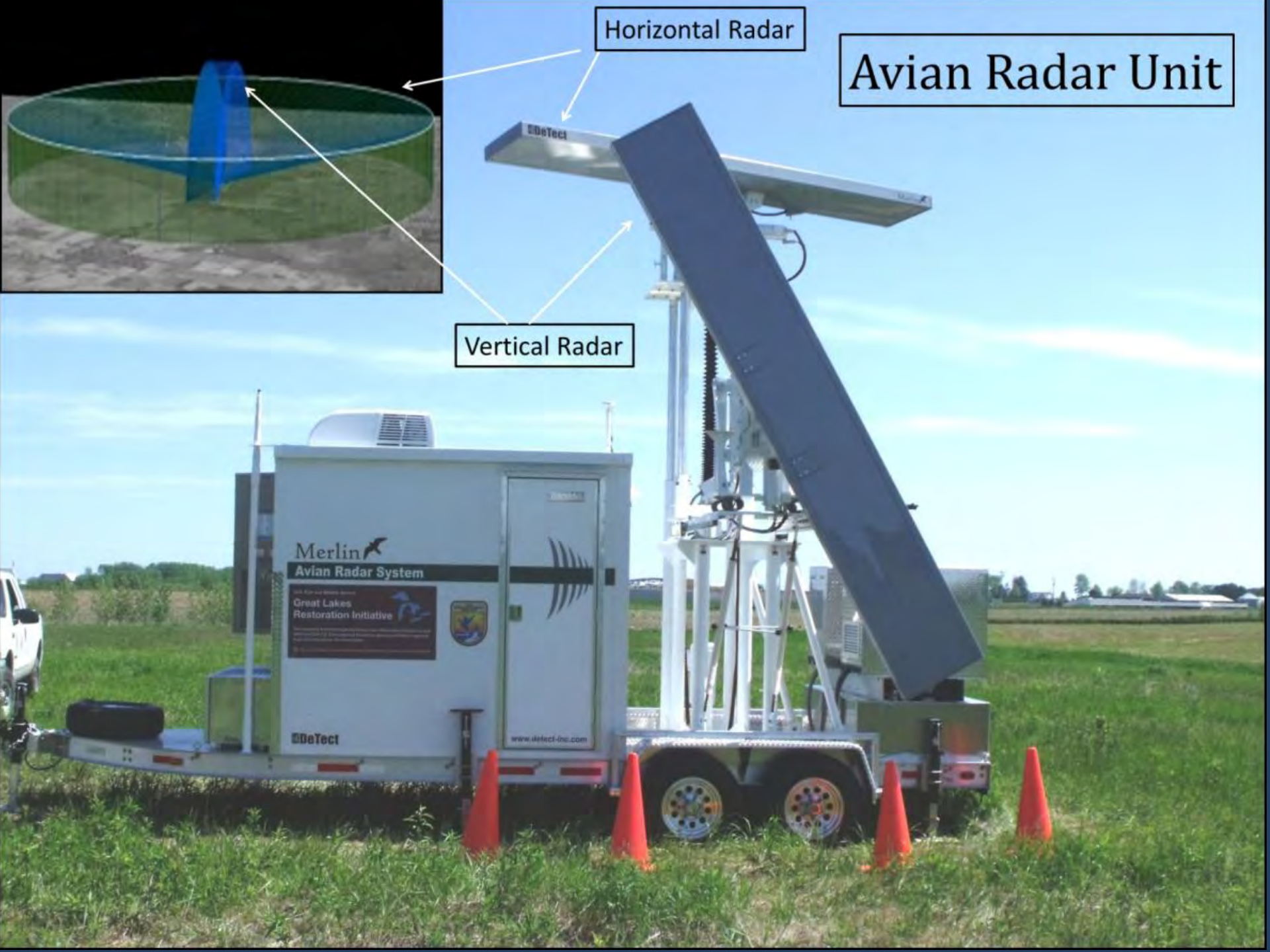
- Challenge: most migrants move nocturnally
- Solution: radar can track migrants

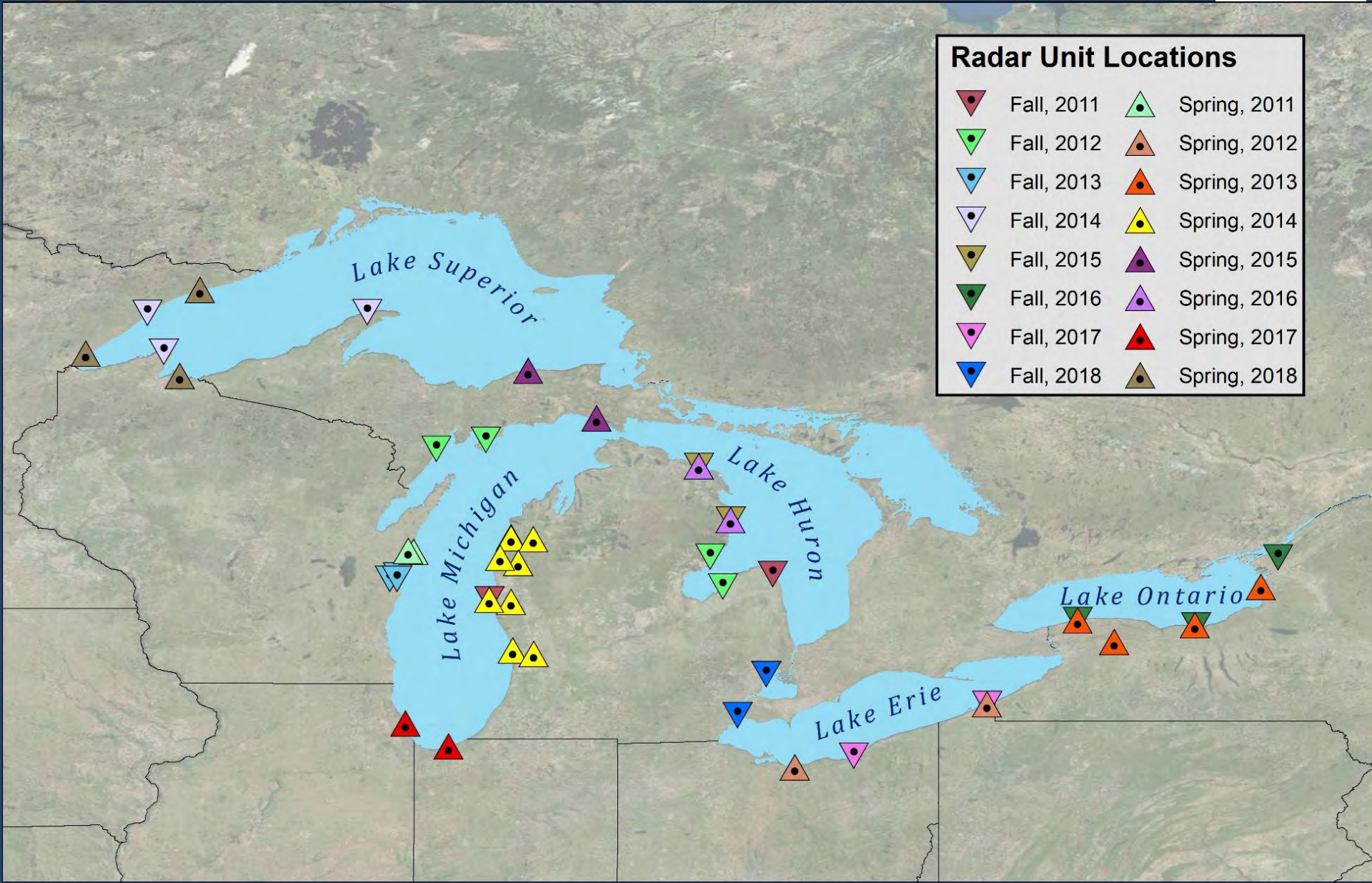


Horizontal Radar

Avian Radar Unit

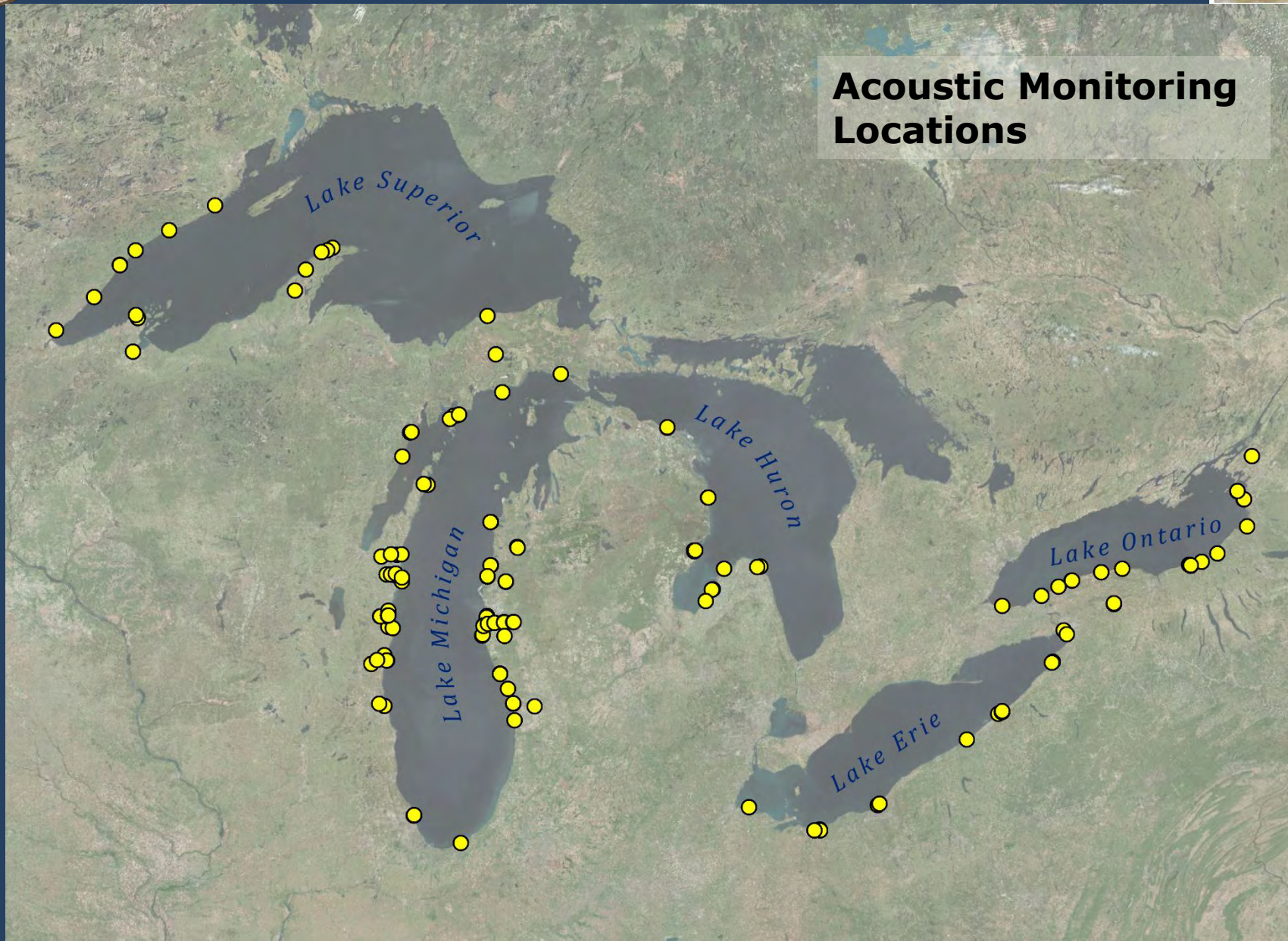
Vertical Radar







Acoustic Monitoring Locations





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

Biological Technical Publication
BTP-R011-2015



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

Spring 2013 Season



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



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

Spring 2012



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



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

Fall Season 2014
Biological Technical Publication
BTP-R001-2017



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

ABSTRACT

Millions of flying migrants cross the Great Lakes on their long-distance journey each spring and fall, but quantitative data regarding how they traverse the region are limited. Shorelines are known areas of migrant concentration due to the ecological barrier effect, but details on the magnitude of this concentration and the flight behaviors during it are largely unknown. Mobile avian radar can provide a unique view of how birds and bats move across landscapes by tracking thousands of individual migrants moving through a sample volume that exceeds multiple kilometers in radius. During the spring of 2014 we used this avian radar to compare migration patterns at shoreline and inland sites along the western shore of Lake Michigan. The radar views moved between inland and shoreline sites over the course of four trial periods spanning the migration season. We found that shoreline activity was significantly higher than activity at inland sites (shoreline to inland activity ratio was 1.17), especially during the hour of dawn. The difference in migration activity was larger during the peak migration timeframe from late April to early June. We also found that while a large proportion of migrants moved westward throughout the night, migrants at shoreline (but not inland) locations shifted their flight orientation back toward the east as dawn, remaining to share from even later. This confluence of migrants along the shoreline helps explain the high numbers migrants often observed there, and we estimated a migrant accumulation rate of 1.91 migrants per hour per square mile within of coastal range of a day. Our findings stress the importance of conserving shoreline riparian habitat for migrating birds and bats, and maintaining a higher level of caution when assessing the potential impacts of development in coastal areas.

INTRODUCTION

Many species of birds and bats experience strong selective pressure during migration (Sillit and Holmes 2002, Fleming and Eby 2003, Newton 2004) and the need for conservation during this life-cycle phase is clear (Harris 2000, Robinson and Matthews 2003, Robinson et al. 2014, Marks et al. 2015). Identifying migration routes, habitats used, and causes of stress or mortality during this phase is as important as understanding the requirements of quality breeding and wintering grounds (Eimer and Haines 1993, Fahrig et al. 2010). Nonetheless, much remains to be known about how migrating birds and bats connect distant habitats.

Technological advances and improved modeling techniques are beginning to close this information gap by identifying consistent level patterns of movement as well as areas where

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

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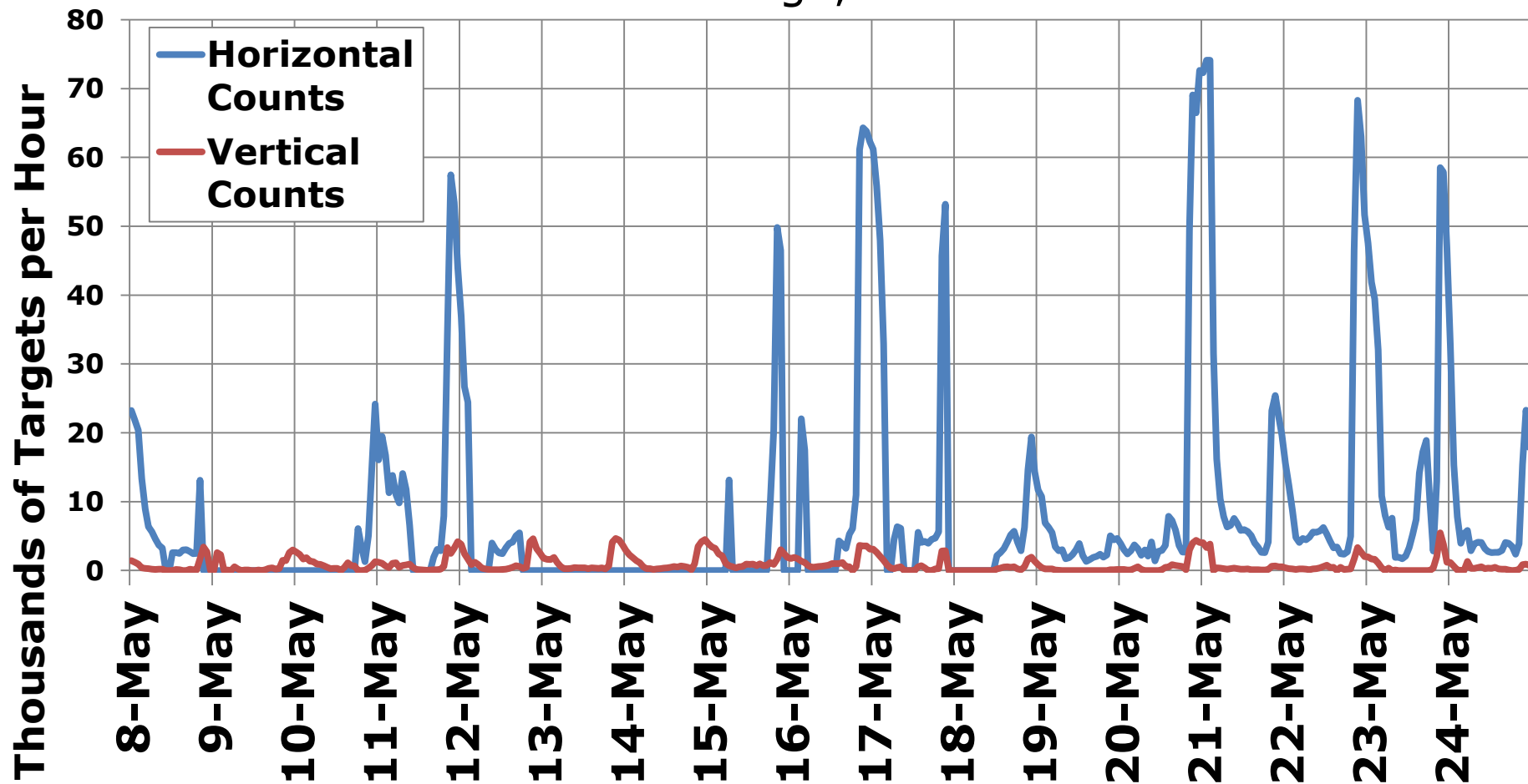
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Disclaimer: The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service. The mention of trade



Magnitude of Migration

Chicago, IL





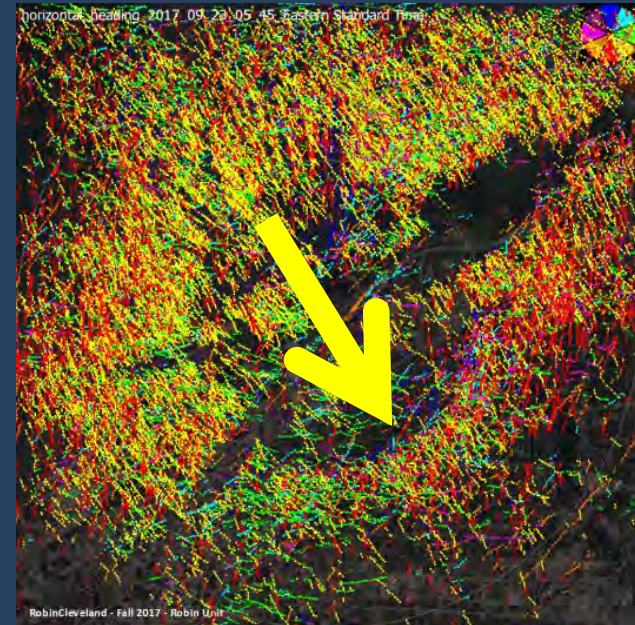
Direction of Flight



Day



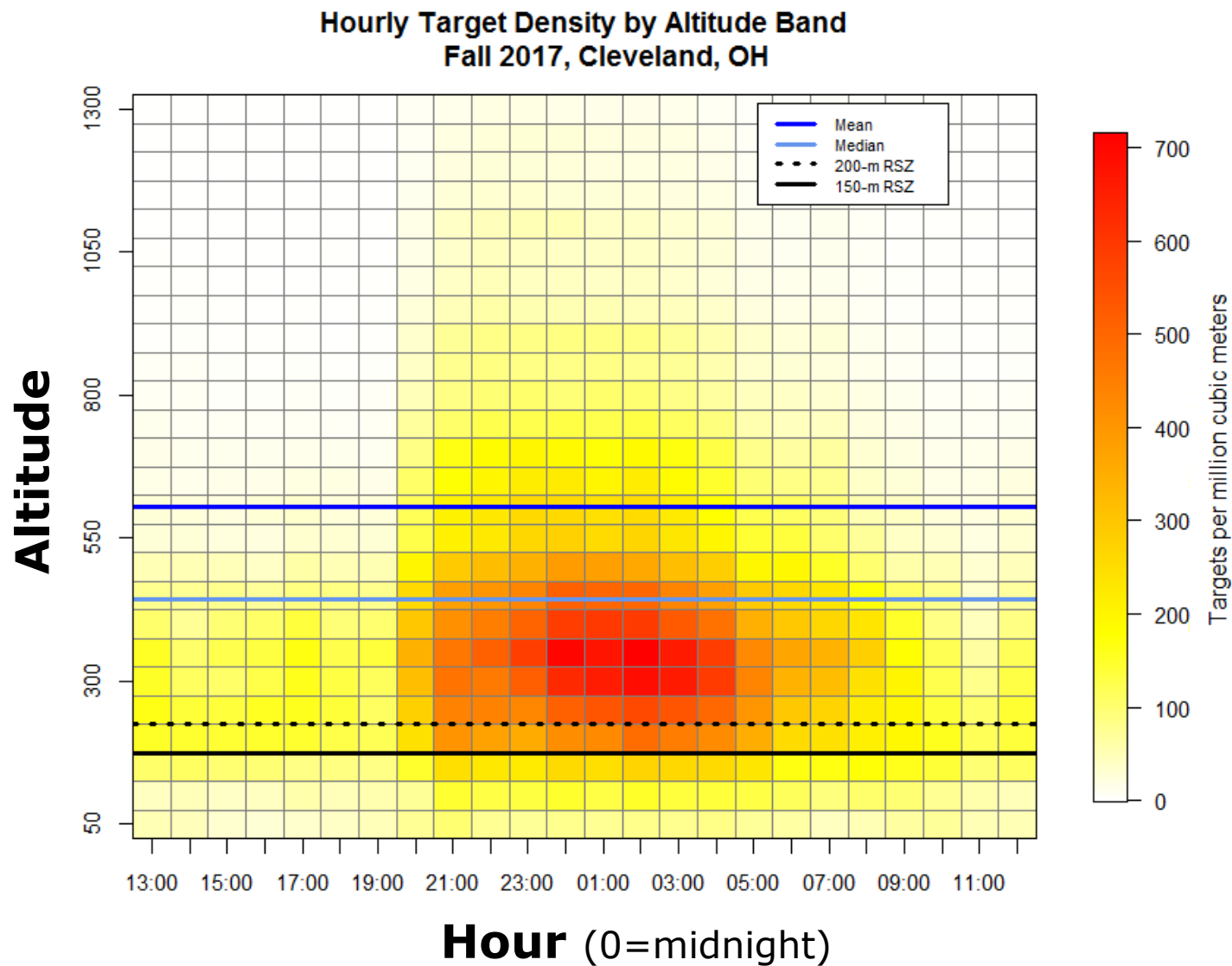
Night



Dawn



Altitude of Flight

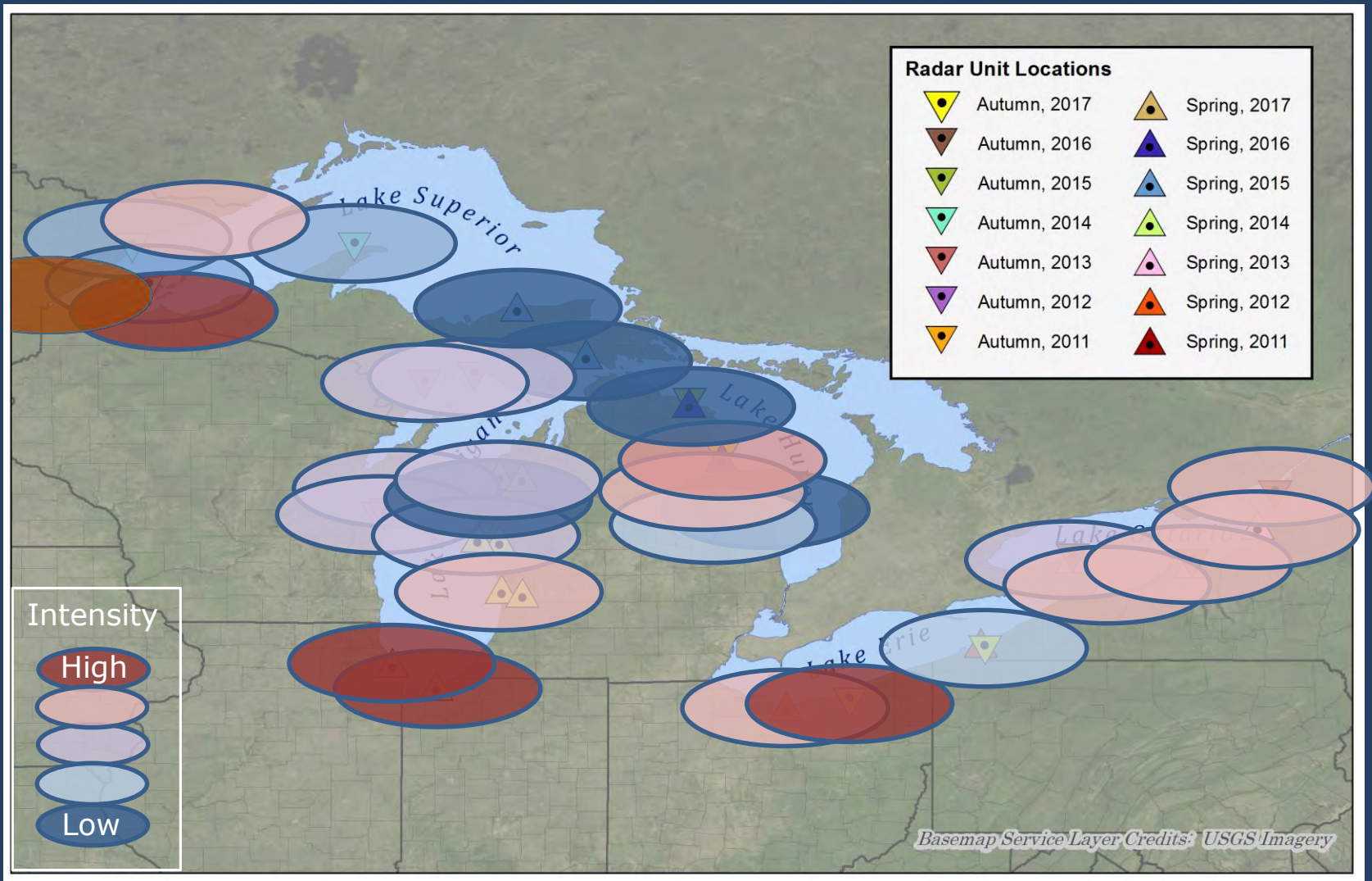




Avian Radar Project

- 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)

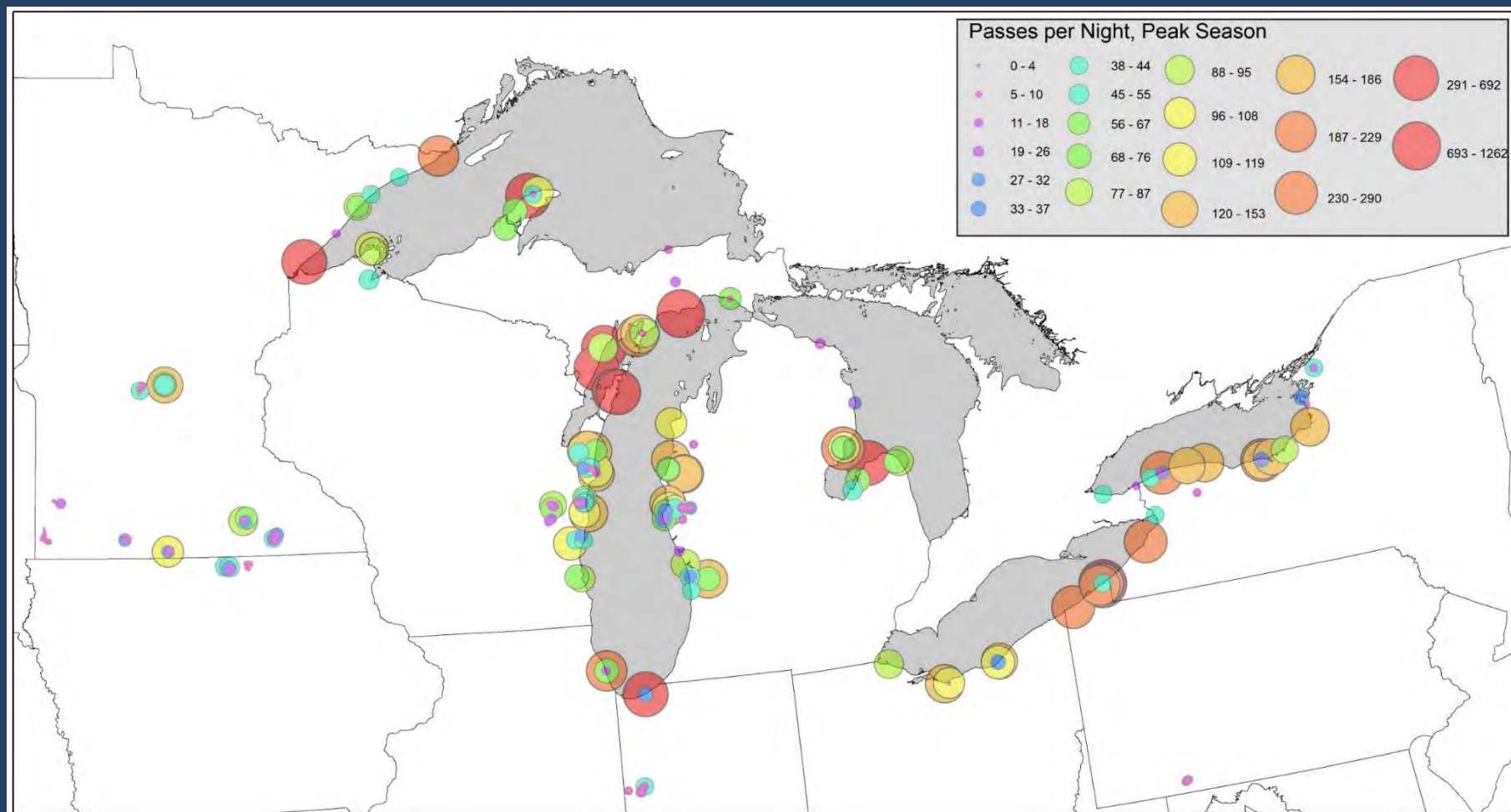






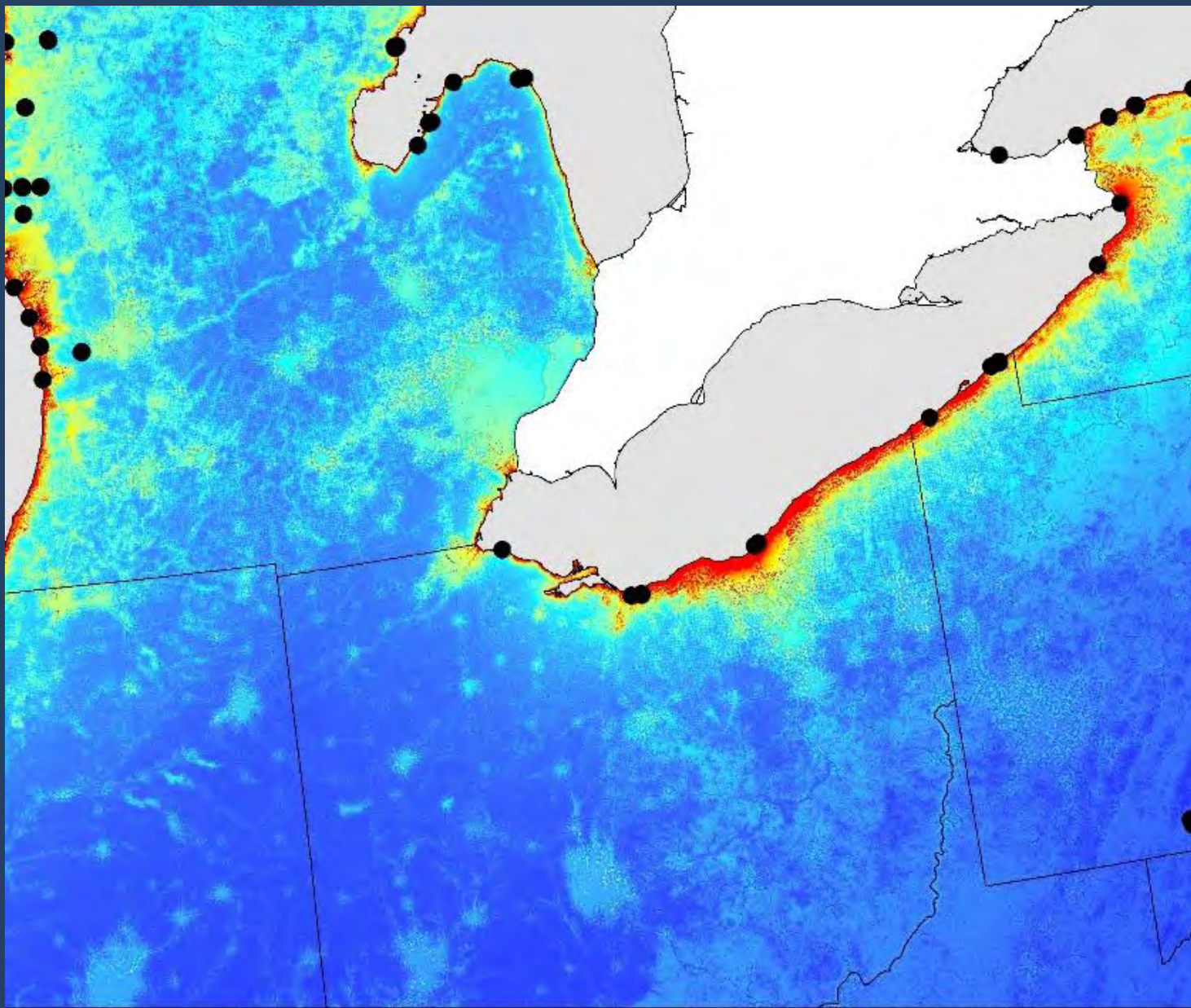
Bat Data

Bat acoustic recording locations, 2010 – 2018





Bat Model



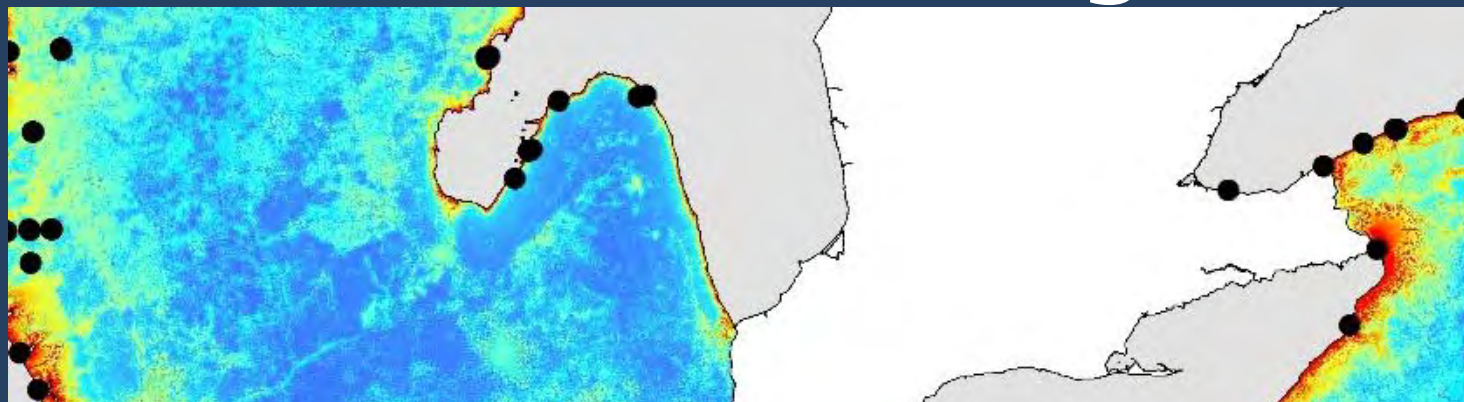


Avian Radar Project

- 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



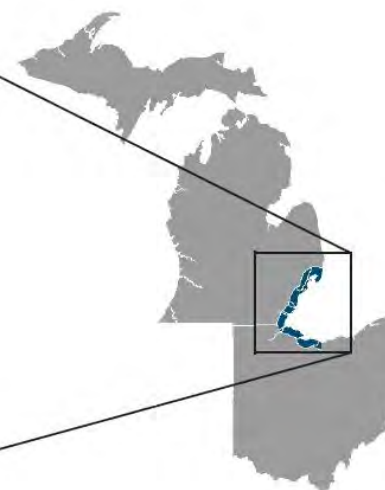
FWS Coastal Program

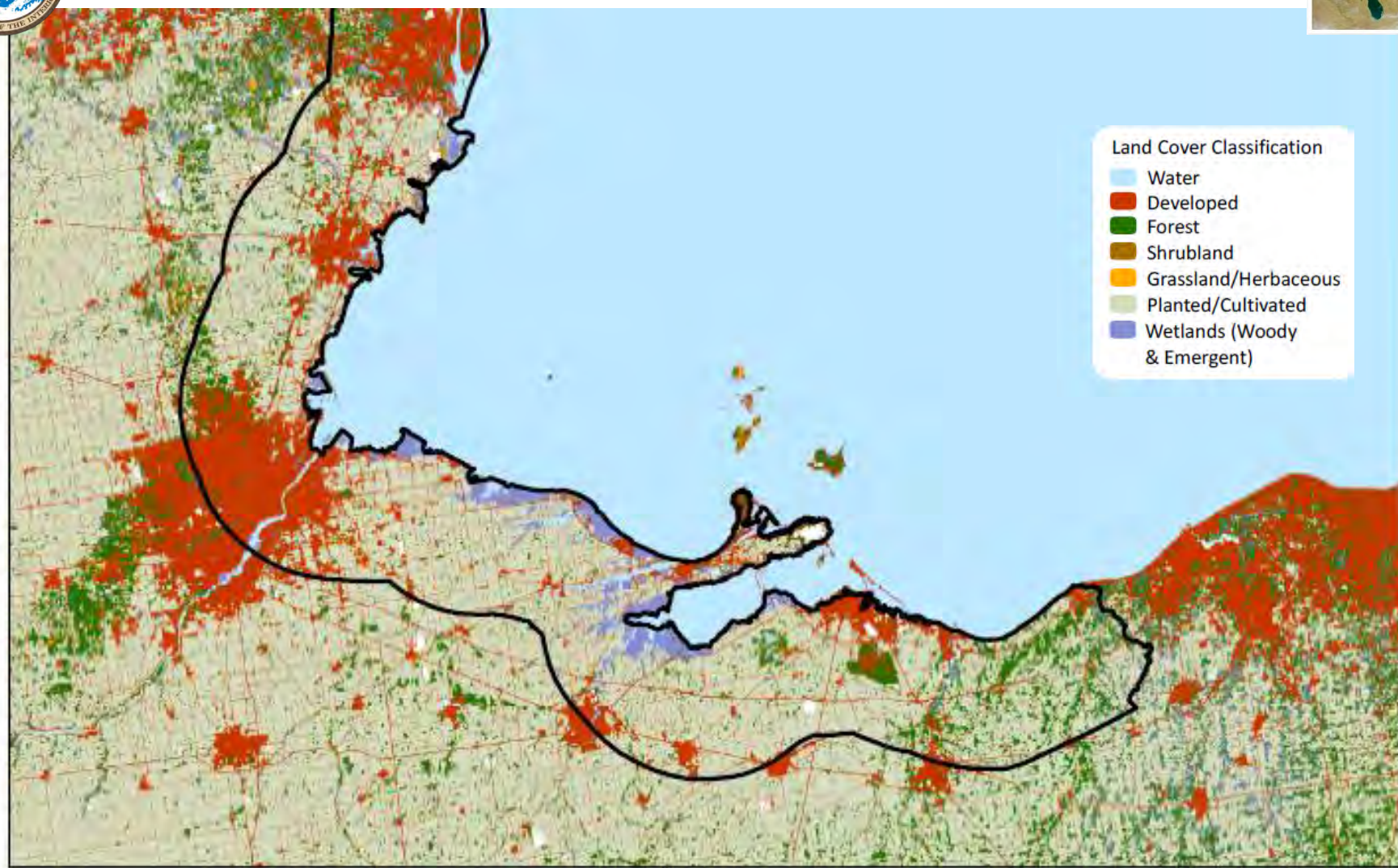


Western Lake Erie/Lake St. Clair Focus Area



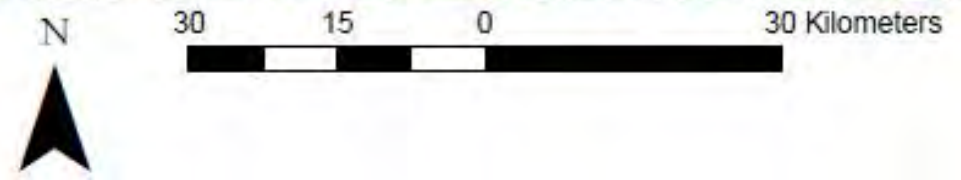
Figure 7. Western Lake Erie/Lake St. Clair focus area.





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