A Summary of Research to Prevent Wildlife-Aircraft Collisions

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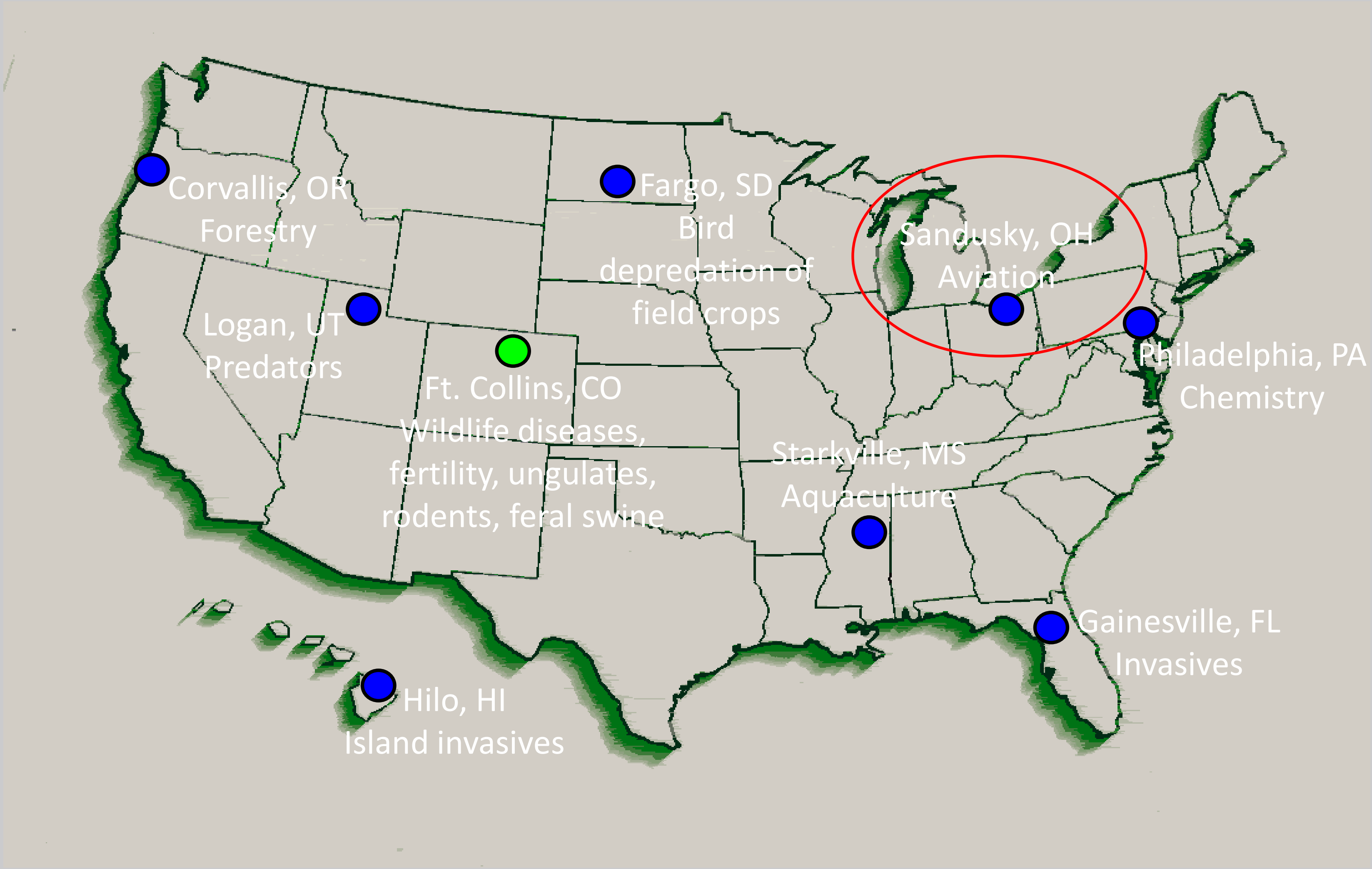
NWRC Locations



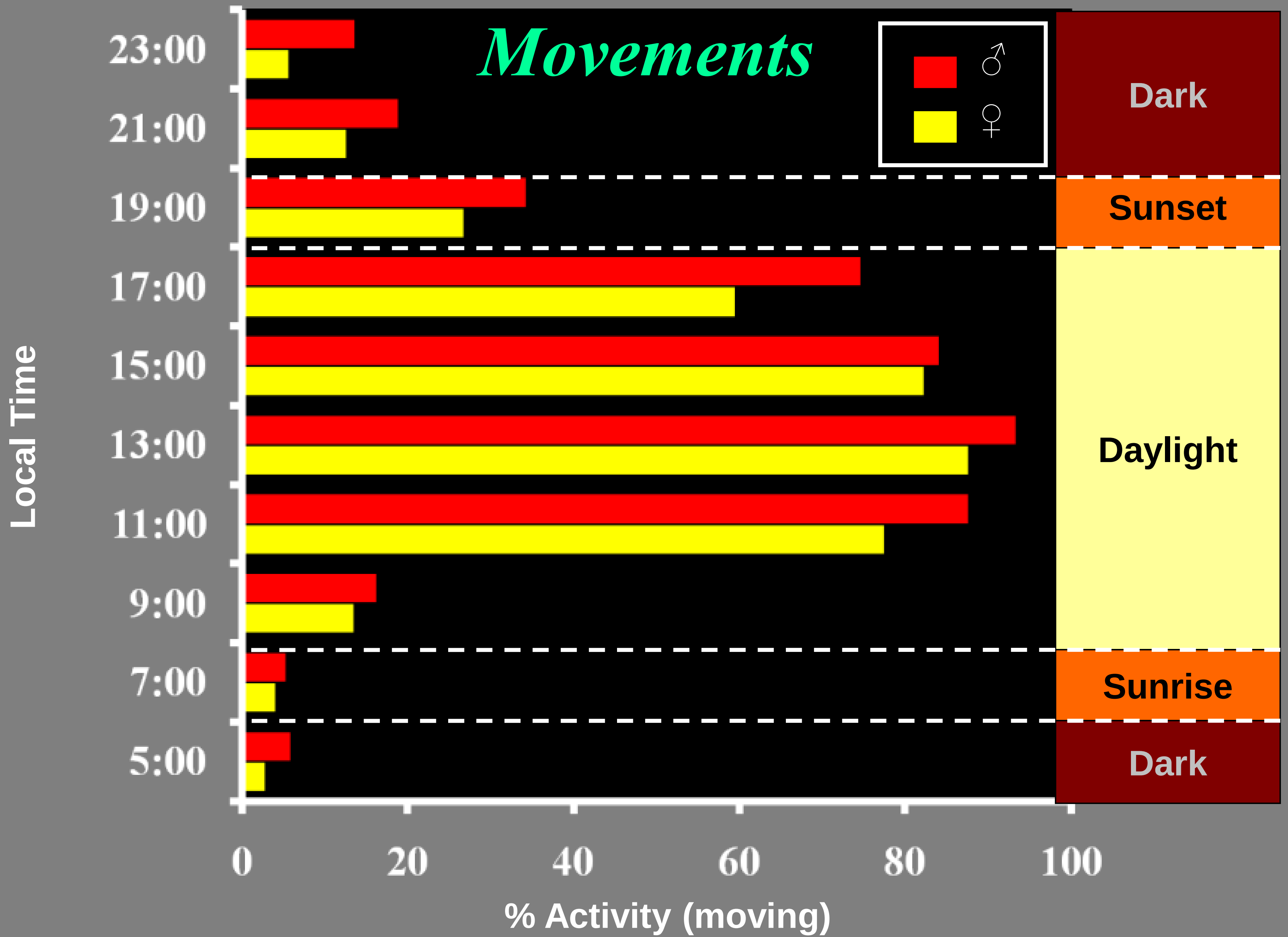
Research to prevent wildlife-aircraft collisions—Broad Topics

- **Habitat/food resource management**
- **Wildlife dispersal, removal, relocation, and exclusion**
- **Detection/prediction of wildlife movements and behavior**
- **Sensory ecology, physiology, and antipredator behavior**

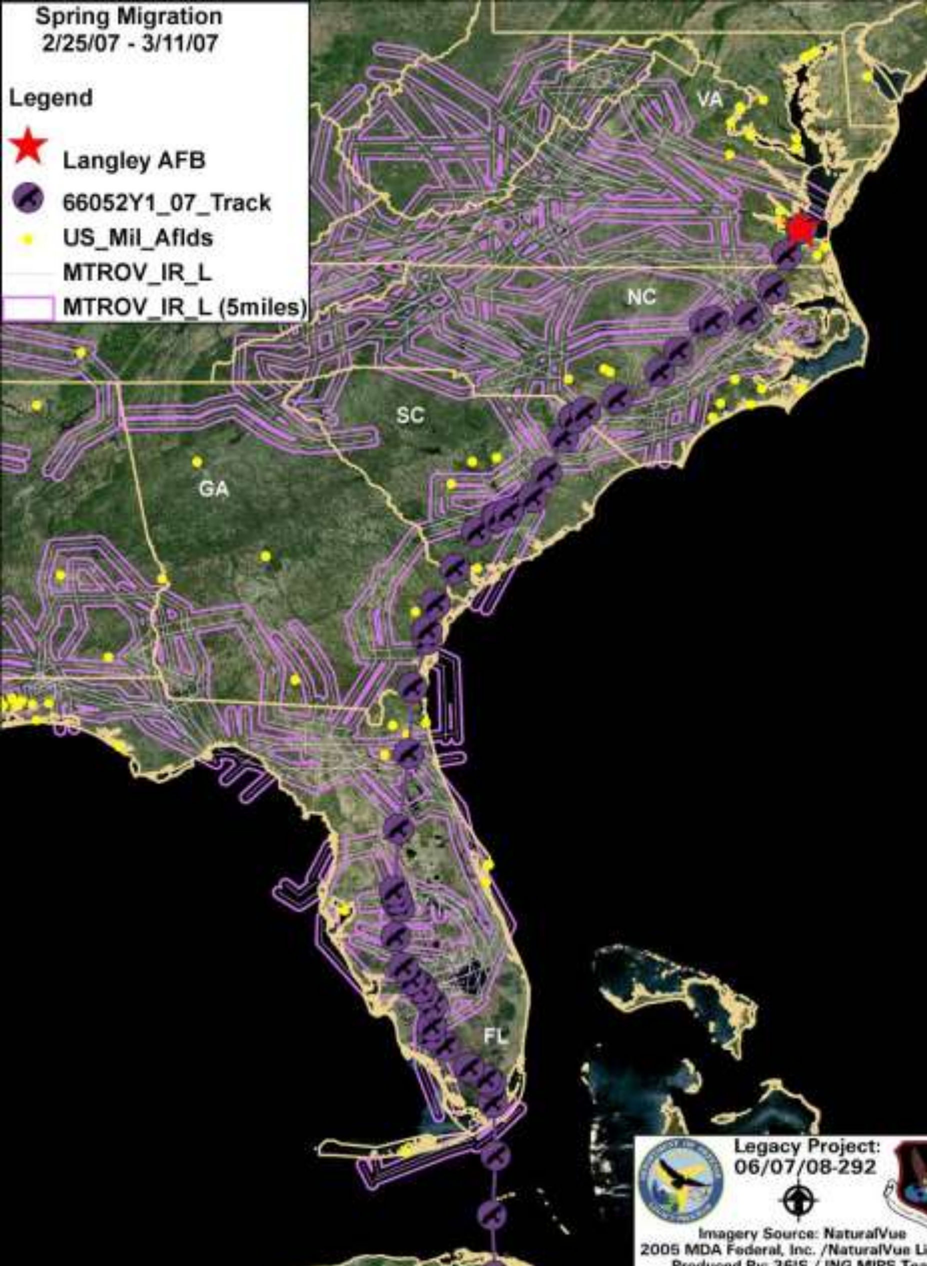
Specific Topics for Today's Presentation

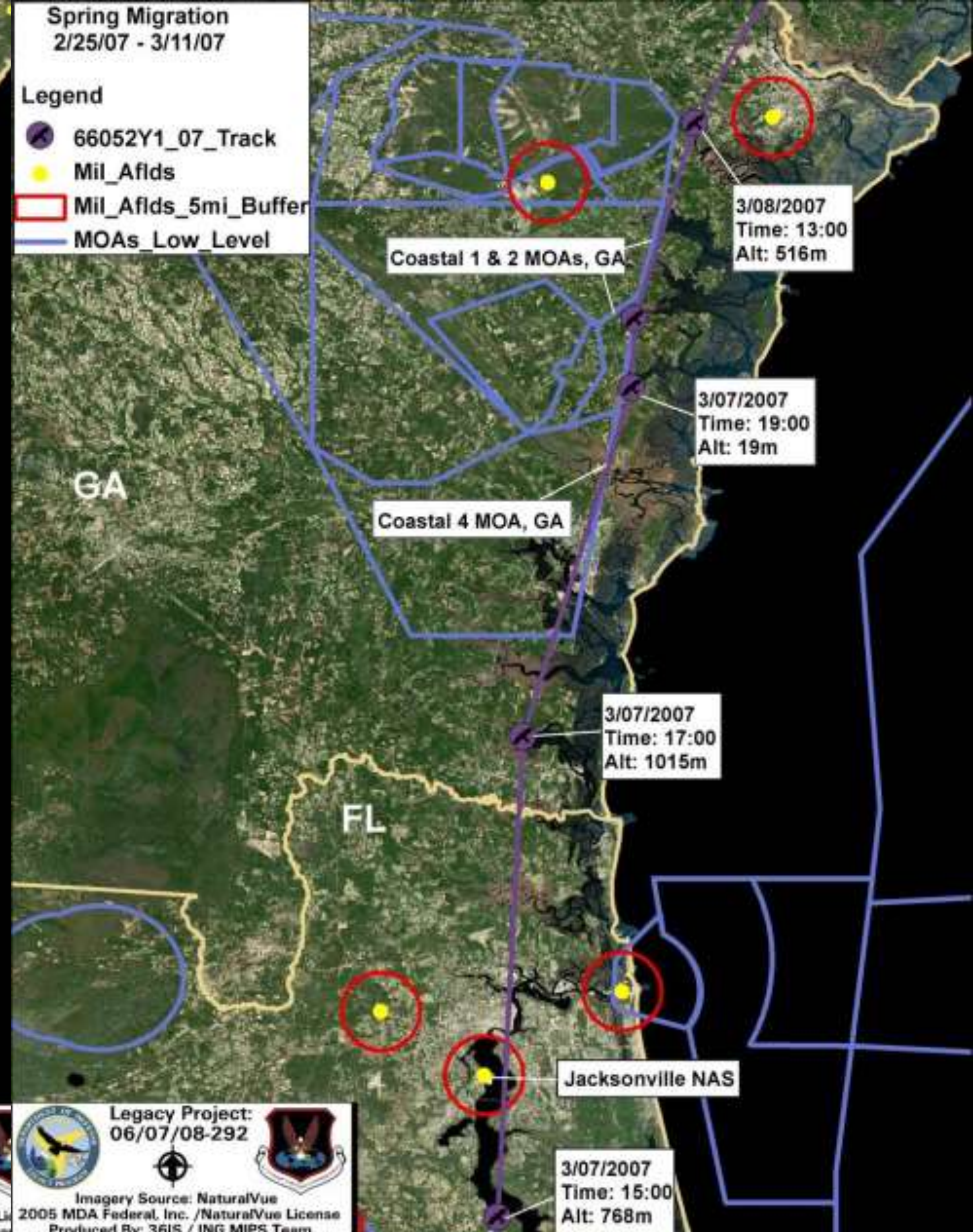
- Quantifying bird movements
- Turfgrass and alternative land covers for airports (solar arrays)
- Evaluation of an acoustic hailing device
- Evaluation of an "air whip" device to disperse birds
- Evaluation of avian radar
- Using GIS to explore the effects of landscape structure on bird strikes
- Development of aircraft lighting to reduce bird strikes

Identify Areas of Overlap in Airspace Use



Movements
♂
♀
Dark
Sunset
Daylight
Sunrise
Dark
23:00
21:00
19:00
17:00
15:00
13:00
11:00
9:00
7:00
5:00
Local Time
0
20
40
60
80
100
% Activity (moving)


Spring Migration
2/25/07 - 3/11/07
Legend
Langley AFB
66052Y1_07_Track
US_Mil_Aflds
MTROV_IR_L
MTROV_IR_L (5miles)
VA
NC
SC
GA
FL
Legacy Project:
06/07/08-292
Imagery Source: NaturalVue
2005 MDA Federal, Inc. /NaturalVue Li
Produced By: 36IS / ING MIPS Tea


Spring Migration
2/25/07 - 3/11/07
Legend
66052Y1_07_Track
Mil_Aflds
Mil_Aflds_5mi_Buffer
MOAs_Low_Level
Coastal 1 & 2 MOAs, GA
3/08/2007
Time: 13:00
Alt: 516m
3/07/2007
Time: 19:00
Alt: 19m
GA
Coastal 4 MOA, GA
3/07/2007
Time: 17:00
Alt: 1015m
FL
Jacksonville NAS
3/07/2007
Time: 15:00
Alt: 768m
Legacy Project:
06/07/08-292
Imagery Source: NaturalVue
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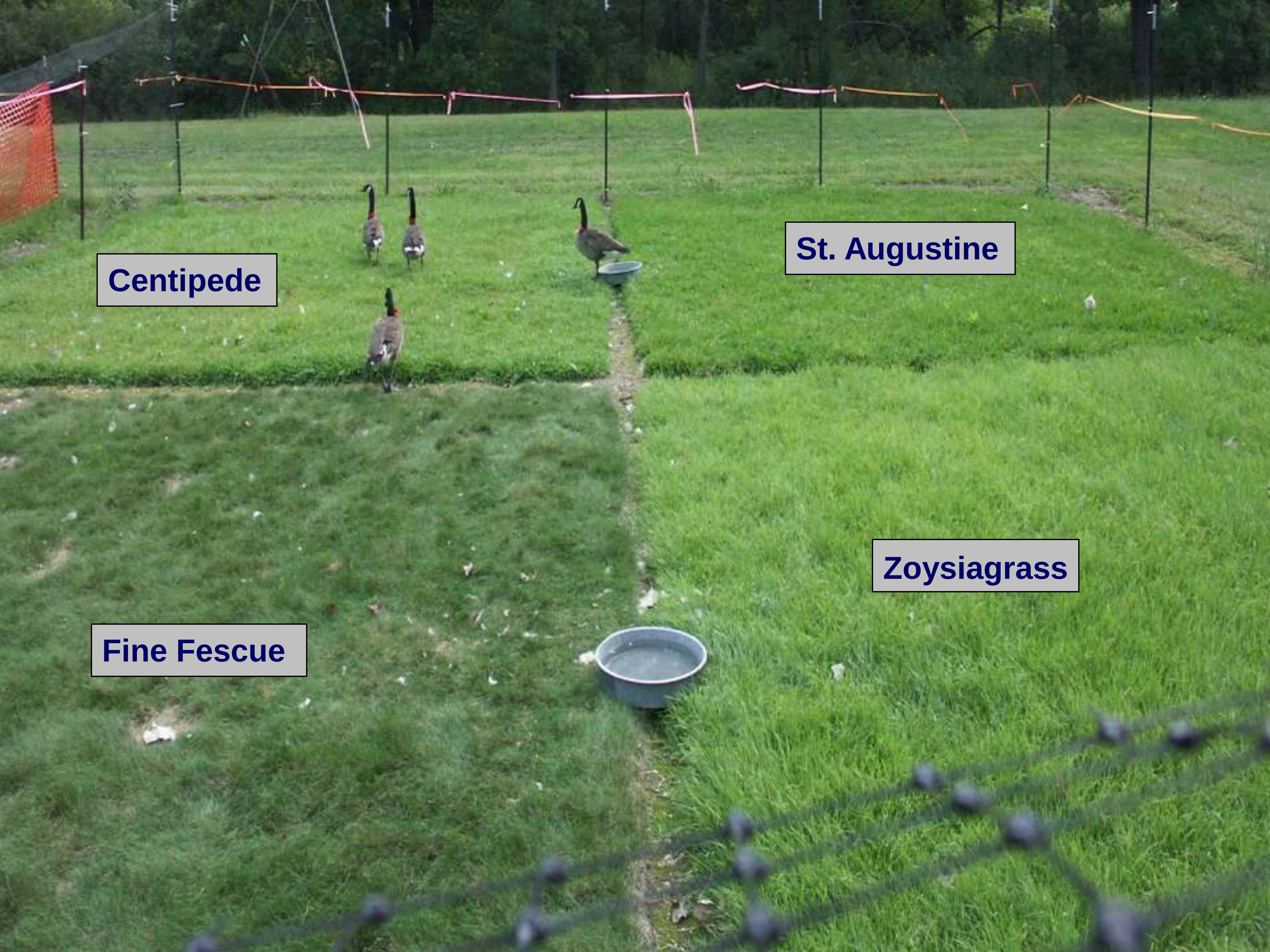
Turfgrass at Airports

>3,306 km^2 of airport grasslands at airports in USA


USDA


Centipede
St. Augustine
Zoysiagrass
Fine Fescue


Pecks Per Minute / 4 Geese
60
50
40
30
20
10
0
Kentucky Bluegrass
Creeping Bentgrass
Fine Fescue, Bermudagrass, Buffalograss
Tall Fescue (mixture)
Zoysiagrass, Centipede, St. Augustine, BG, Litter

What are the other options?

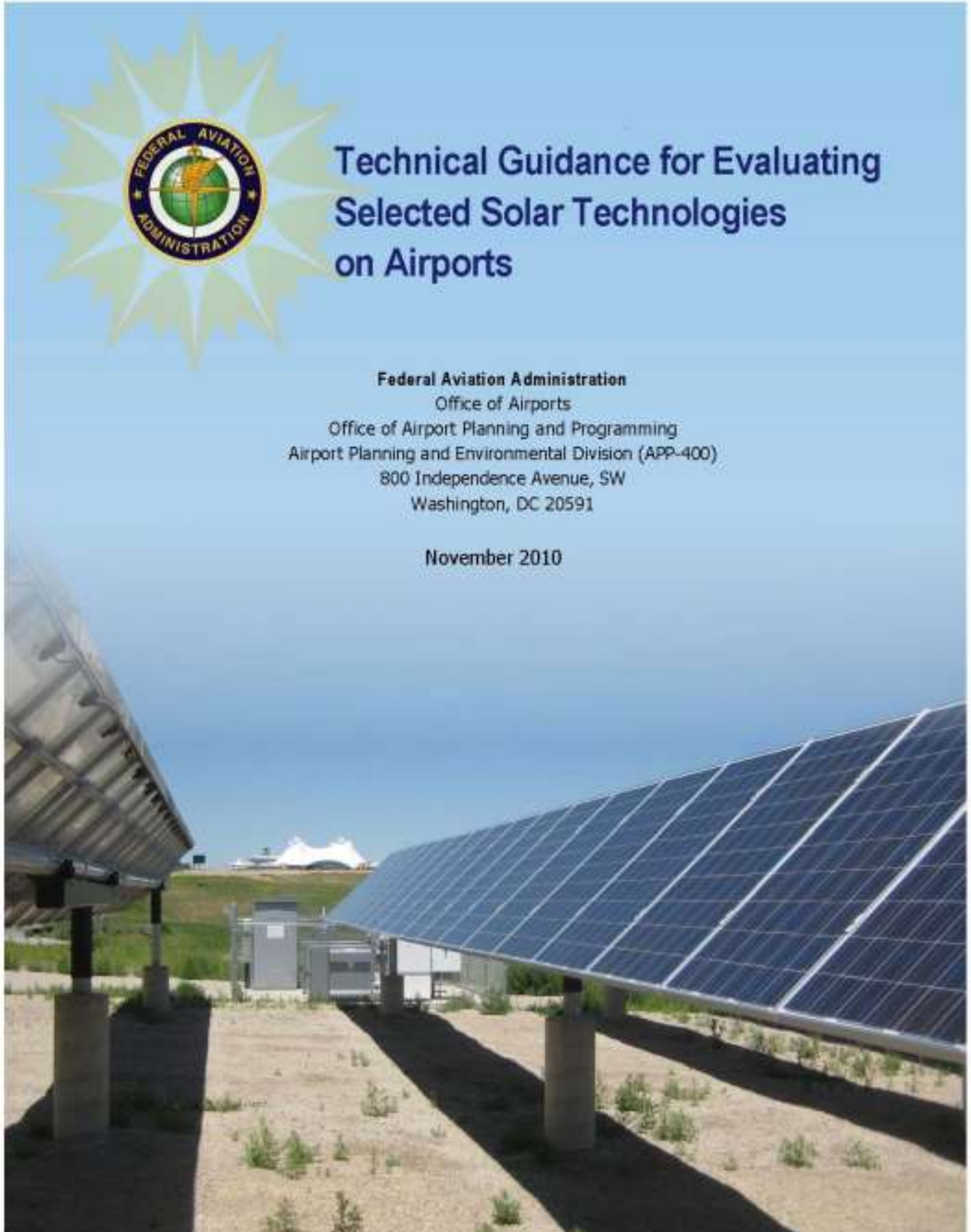
- Non-harvested herbaceous ground covers
- Agriculture
- Solar arrays
- Other alternative energy production (biofuels)

Solar arrays

Fresno Yosemite International Airport

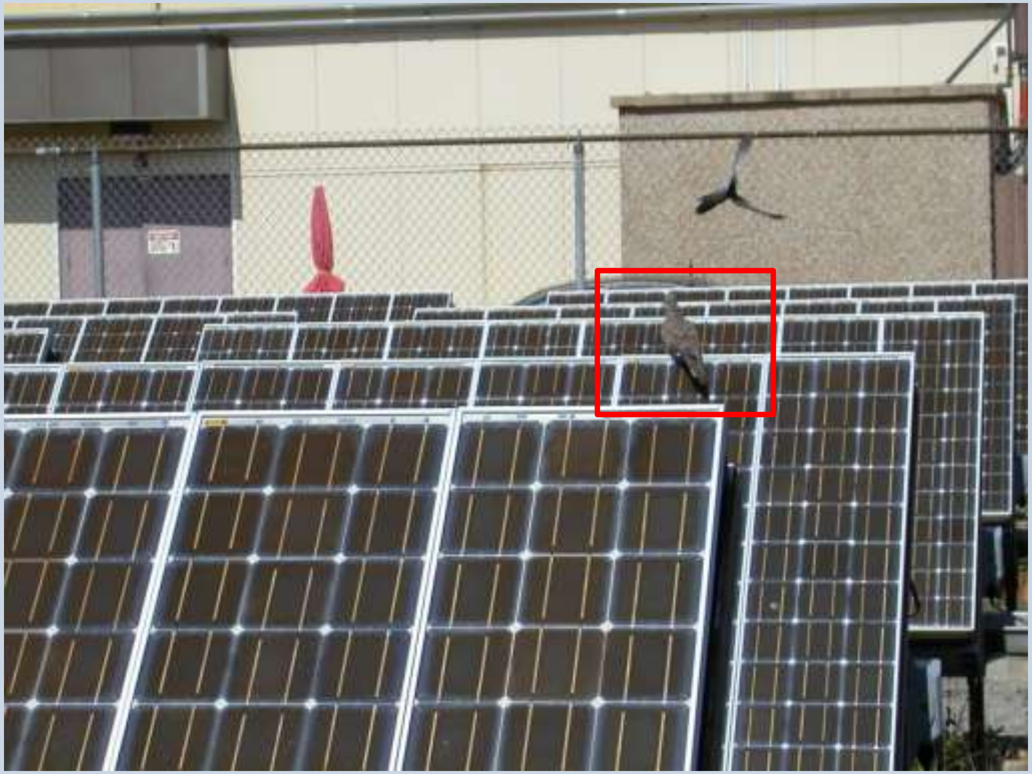
<u>2.4 MW photovoltaic array</u>

- Constructed in 2008
- Occupies ~16 acres (<1% of total airport property)
- Produces 60% of airport's energy demand
- $19 million in energy cost savings over 20 years

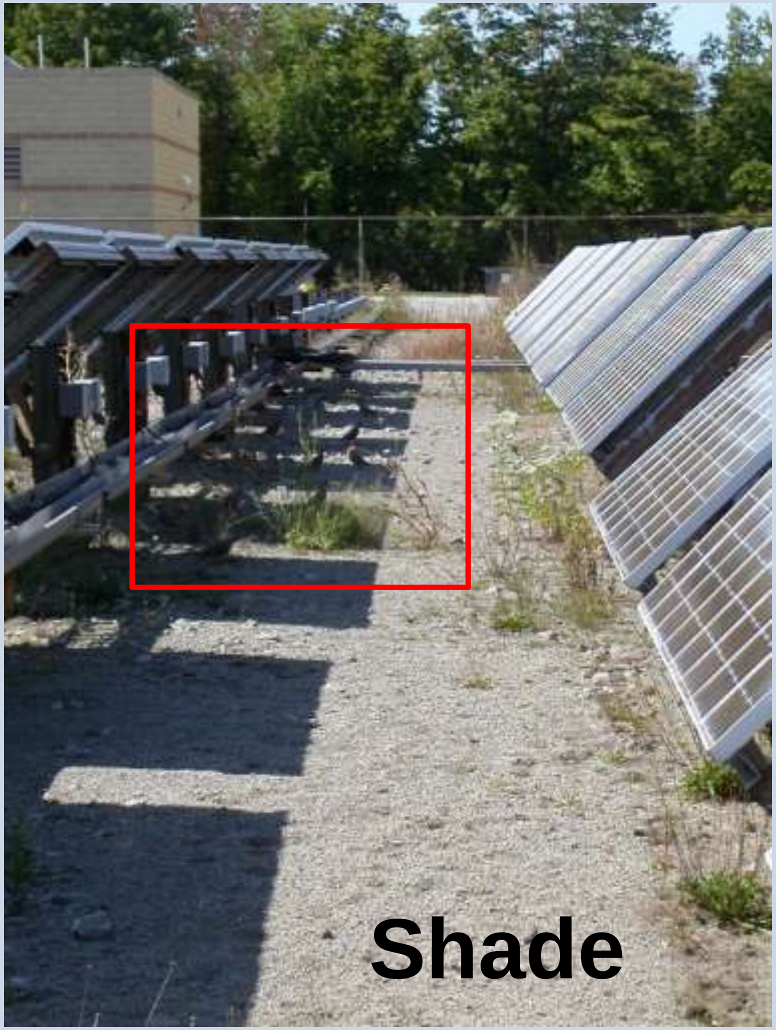


But, lack of information on potential wildlife hazards

Do PV arrays increase wildlife hazards at airports?



Perches

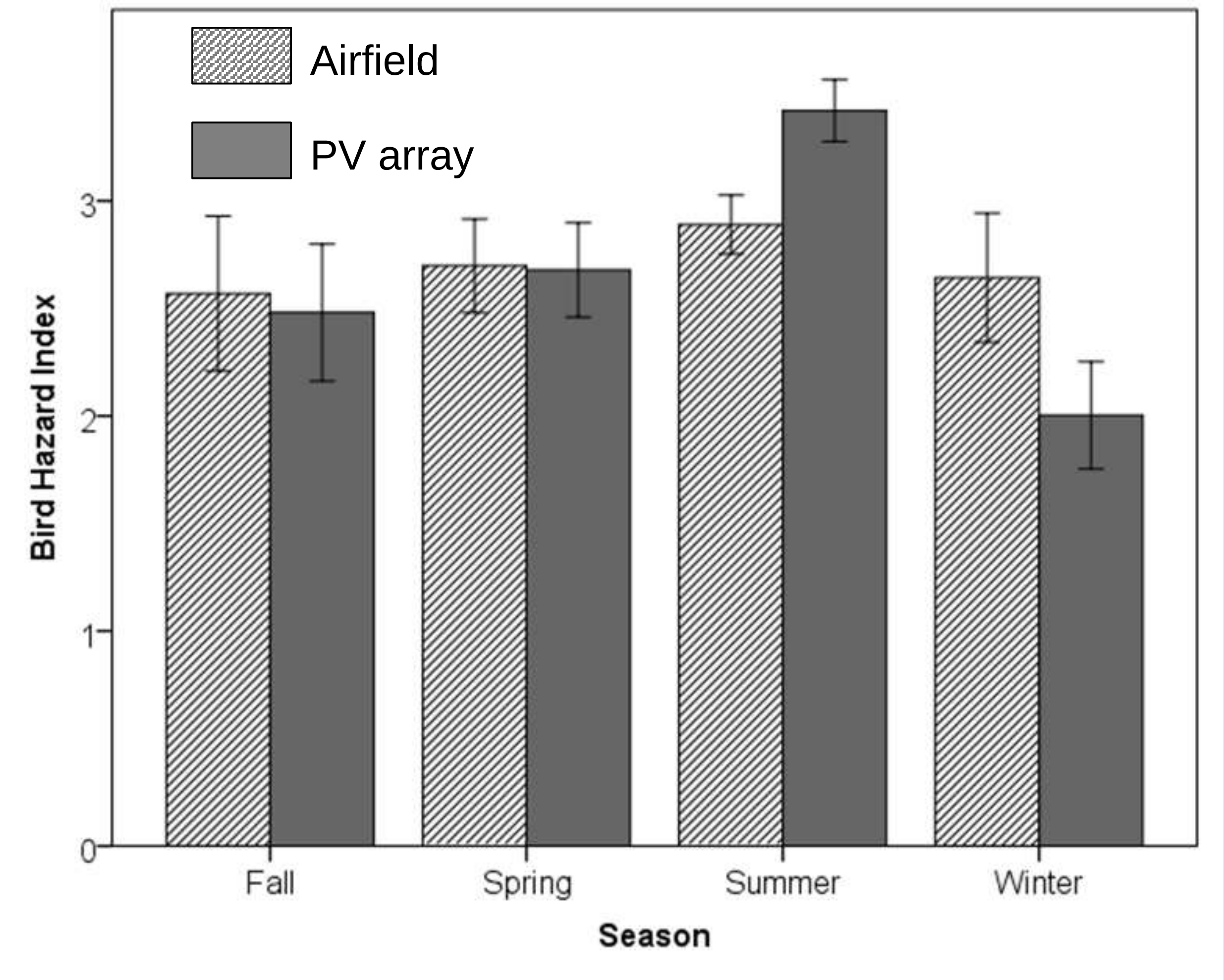


Shade

Solar array study objectives

- Evaluate the hazard level posed by solar facilities to aircraft in OH, AZ, and CO
- Compare bird and mammal use of 2 land cover types
    - Emphasis on high-risk species
- Provide guidance to the FAA and airports

Bird Hazard Index (BHI)—all birds



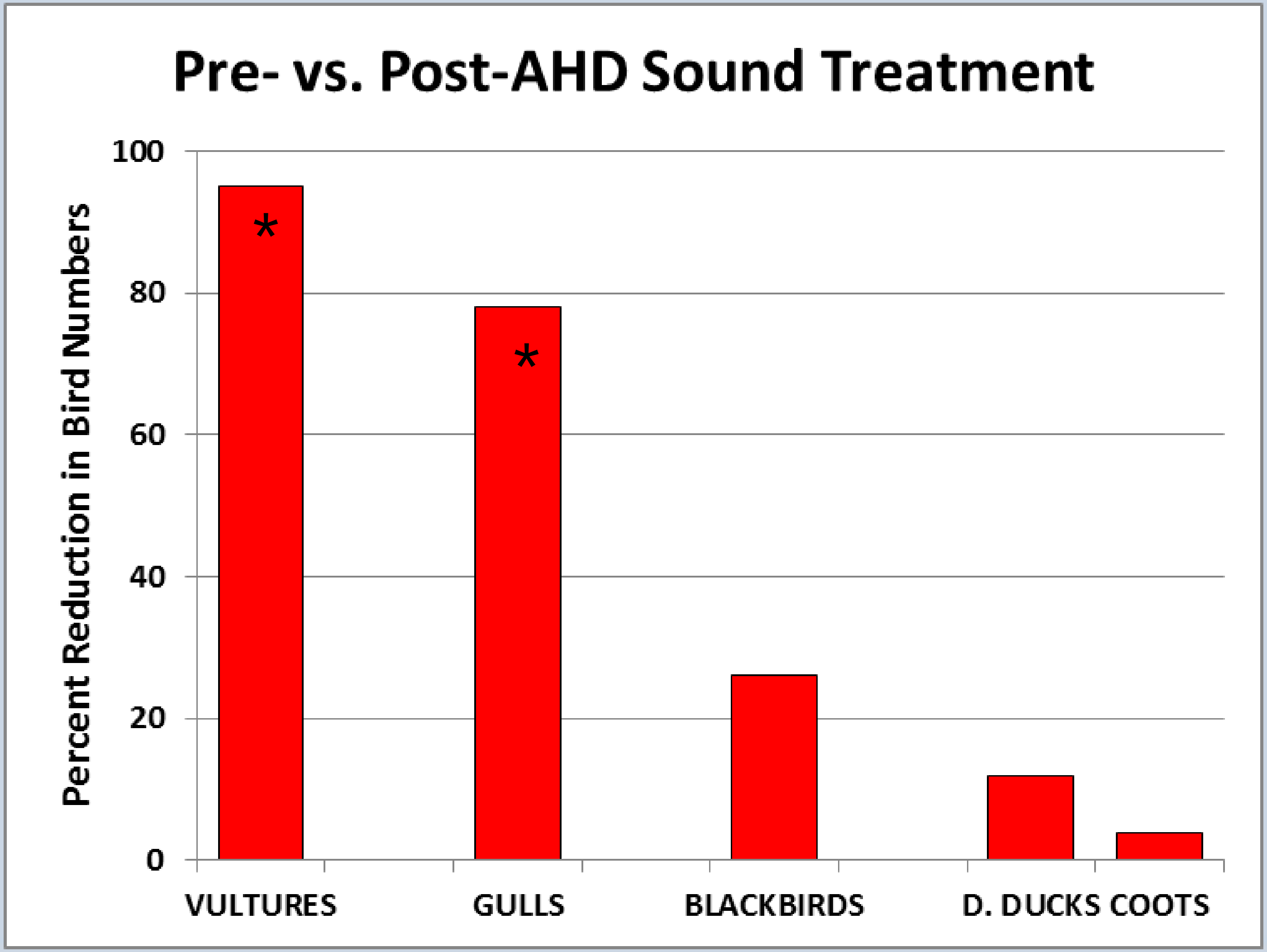
Efficacy of an acoustic hailing device as an avian dispersal tool on airports

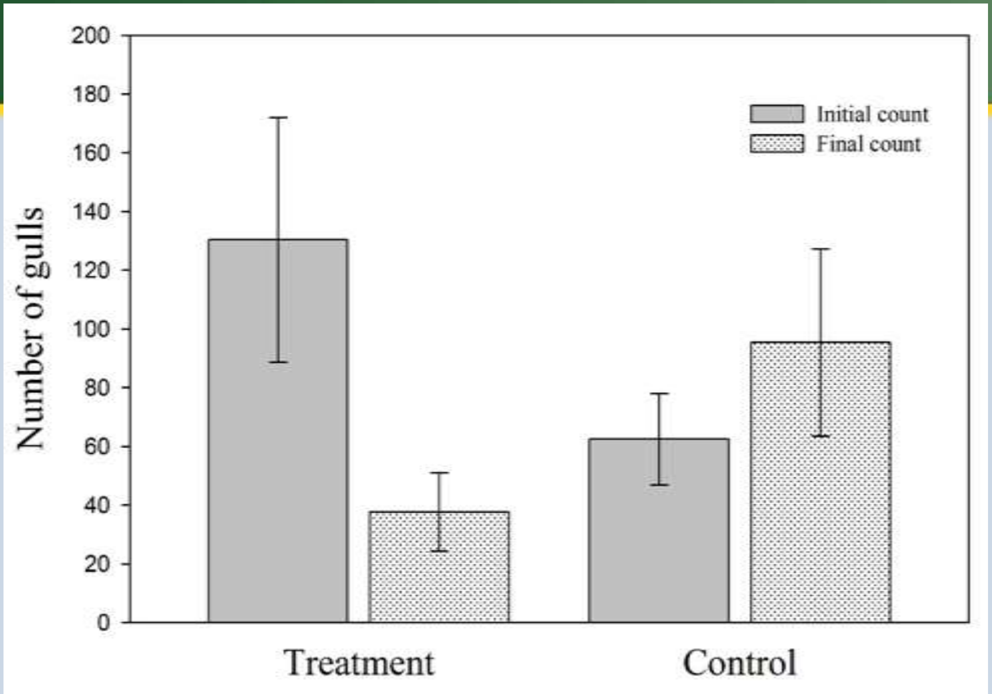
Acoustic Hailing Devices (AHDs)

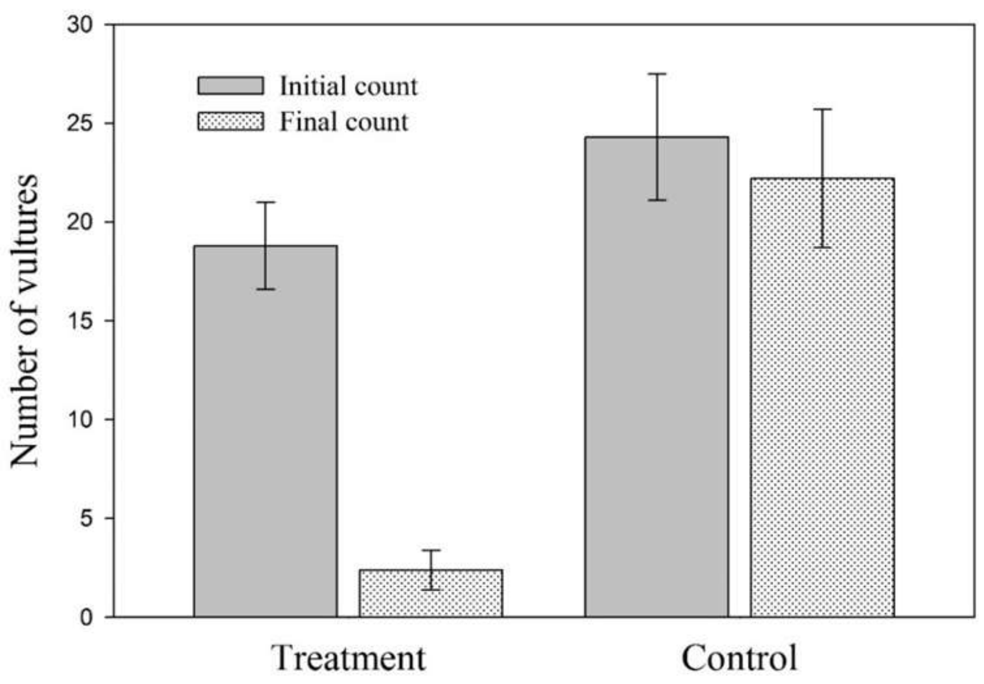
- Also called LRAD
- Developed for long-distance communication and nonlethal crowd control
- Project sound in a narrow beam

- Study Objective: evaluate the efficacy of an AHD as a dispersal tool free-ranging birds recognized as hazardous to aviation safety

Before and after counts of birds


Pre- vs. Post-AHD Sound Treatment
100
80
60
40
20
0
Percent Reduction in Bird Numbers
*
*
VULTURES
GULLS
BLACKBIRDS
D. DUCKS COOTS





Wildlife Society Bulletin, in press

“Air whip”

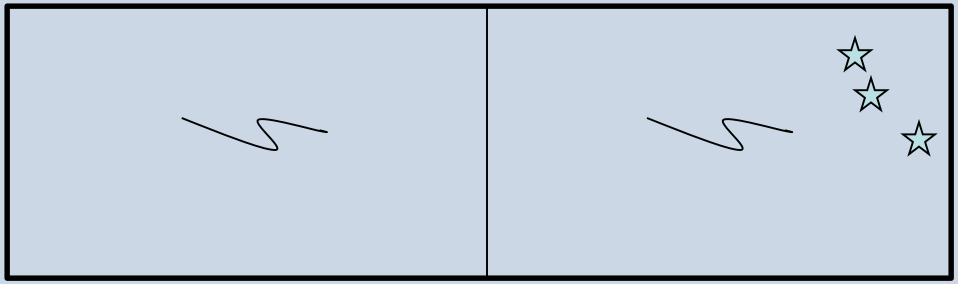
- Developed by South African company—Aztec Electronics, as a nonlethal area repellent for birds
- Compressed air passed through a hose that creates hissing noise and snake-like movement
- No literature available on efficacy

- Study Objective: determine if an erratically moving hose prevents Canada geese from using a desired location for at least 3 hours in pen studies

Methods

- Three experiments with six replicates per experiment
  - Stationary hose (only sound; no movement)
  - Moving hose (sound and movement)
  - Benign threat (black flag; control)

1. Determine preferred side during 1-hr pre-treatment
2. Activate hose (or flag) on preferred side when a goose is present there
3. Determine when geese stop leaving preferred end or do not move away from hose



Results and Conclusions

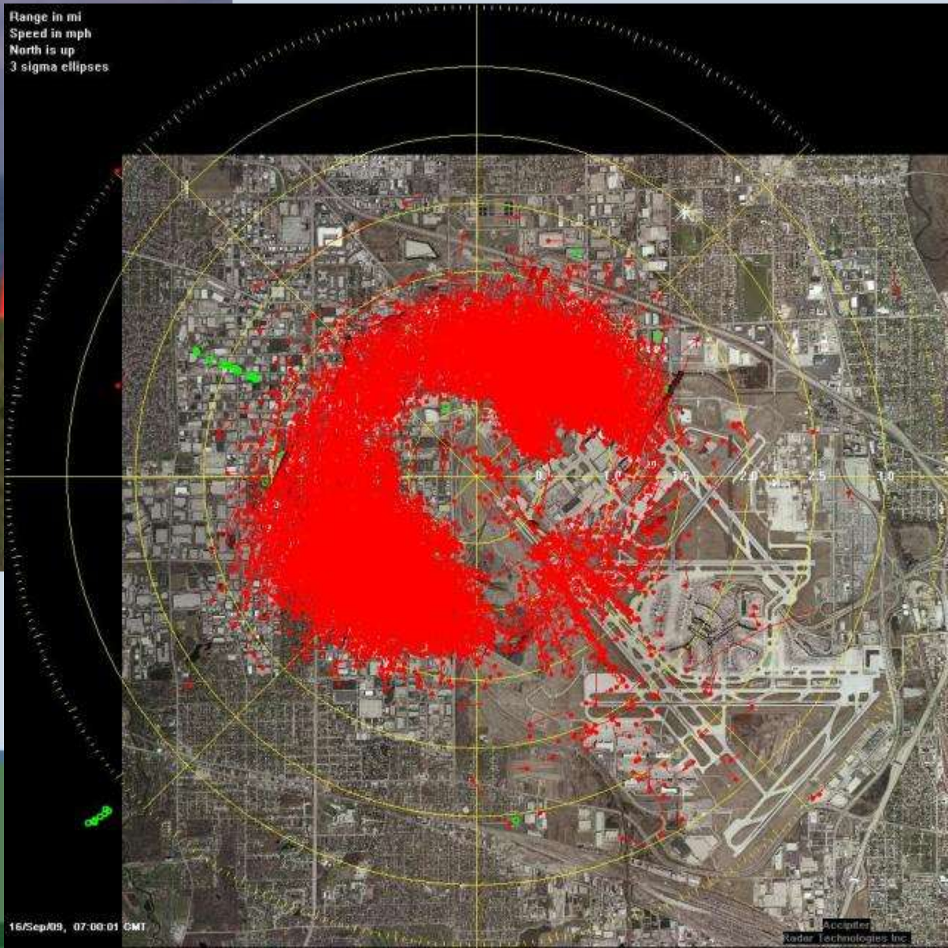
- Geese responded to air escaping from a hose, but more so when the hose was moving than when it was stationary
- Birds soon ignored the sound of escaping air and returned to the preferred side of the pen when the hose was stationary
- No reaction to control (flag)

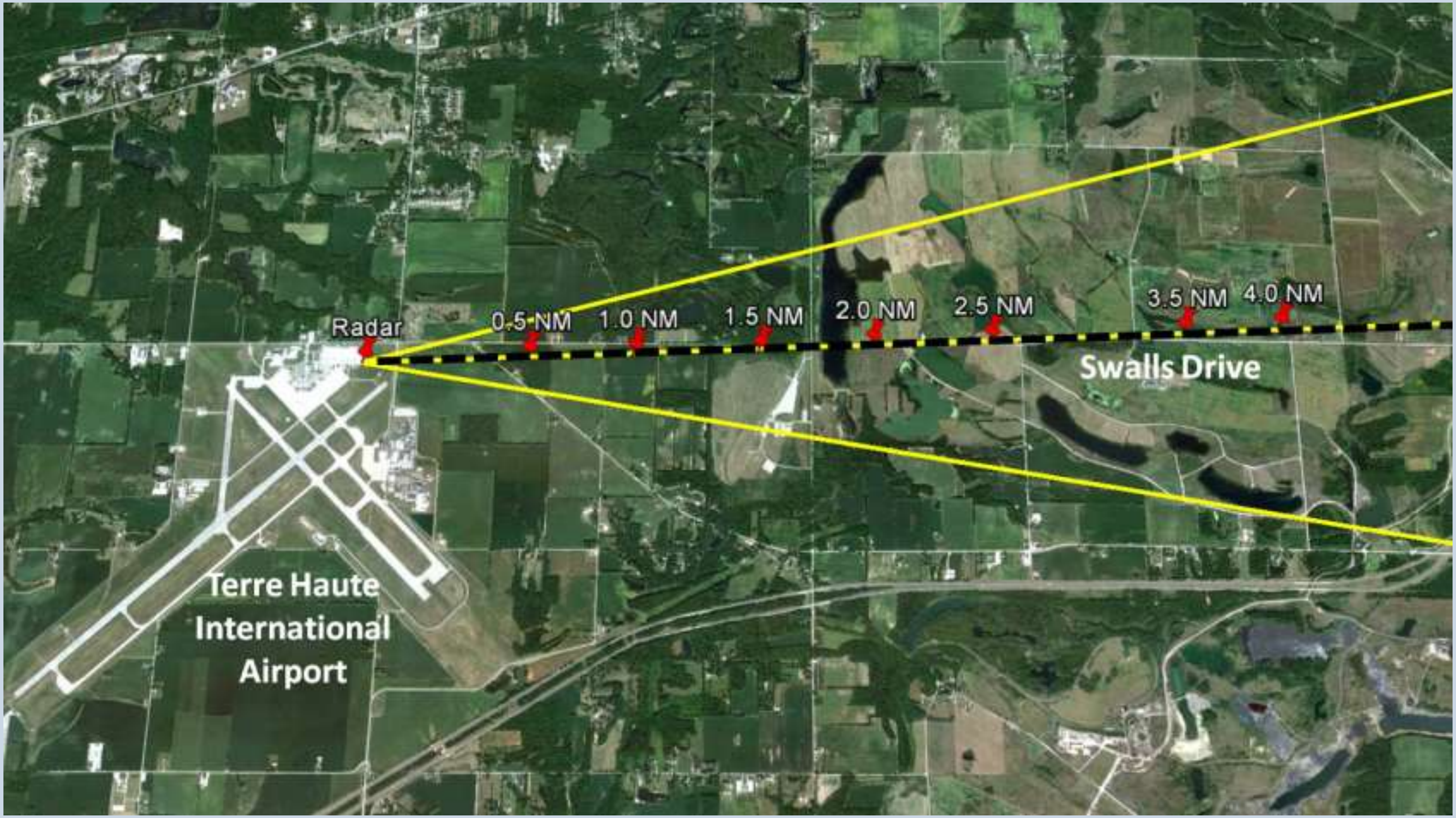
Replicate	Stationary	Moving
1	2.6	6.0
2	1.5	6.0
3	4.3	4.2*
4	3.0	6.0
5	3.6	5.5
6	3.5	5.0

Mean relative location scores for Canada geese moving away from either a stationary or moving air hose.

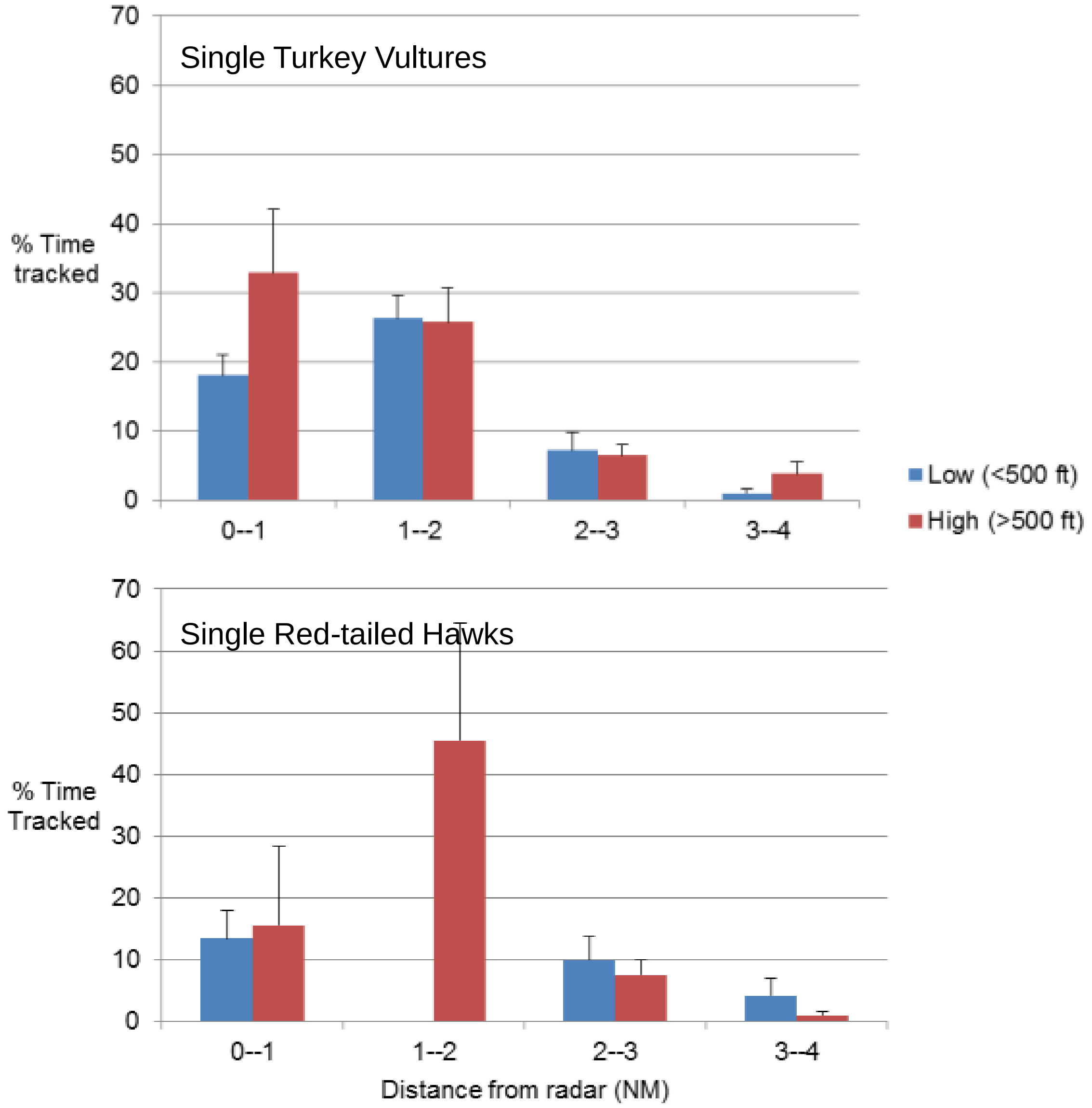
Larger numbers reflect a further distance of geese from the source hose.

Avian Radar

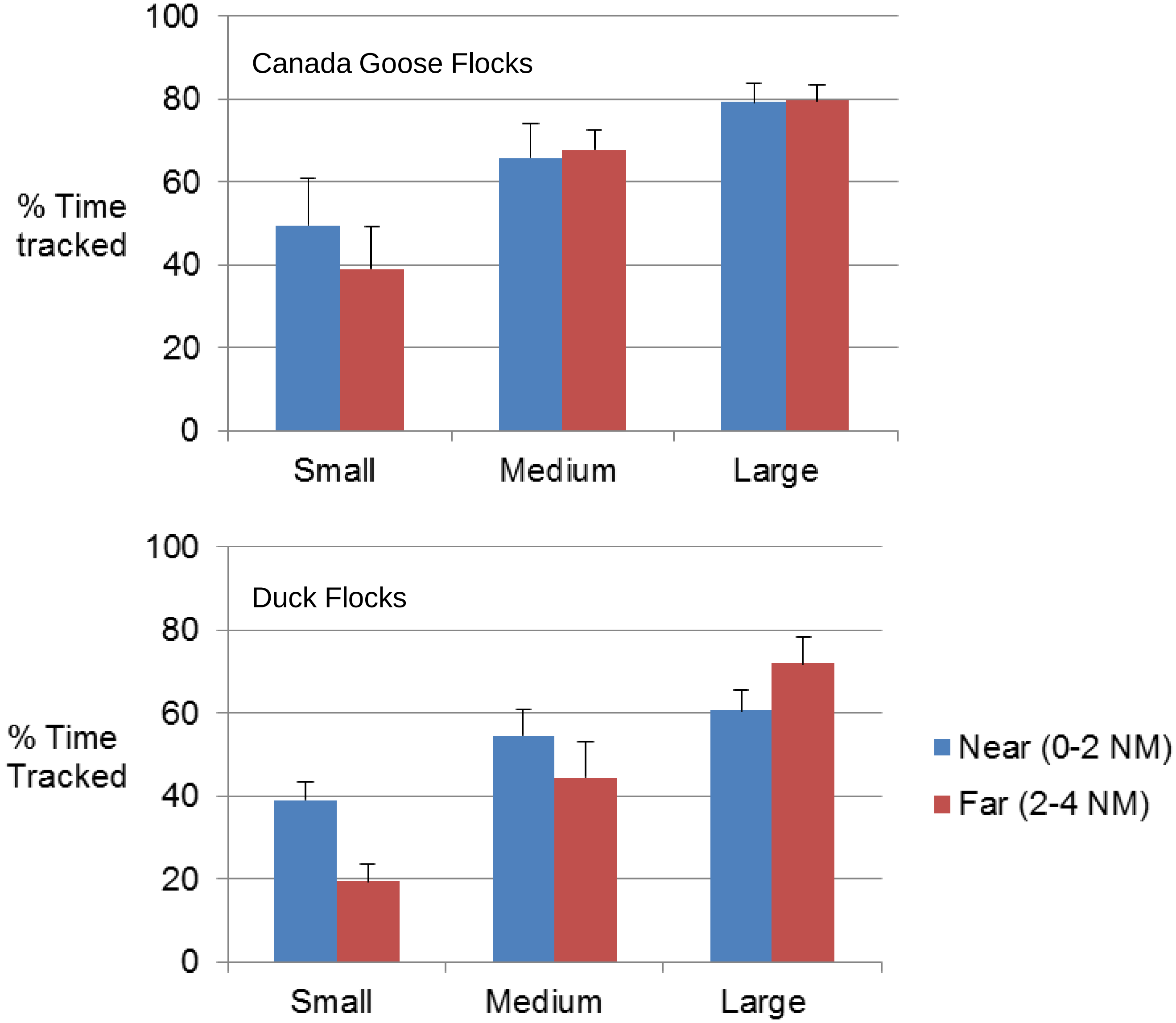

Range in mi
Speed in mph
North is up
3 sigma ellipses
16/Sep/09, 07:00:01 GMT
Accipiter
Radar Technologies Inc.


Radar
0.5 NM
1.0 NM
1.5 NM
2.0 NM
2.5 NM
3.5 NM
4.0 NM
Swalls Drive
Terre Haute
International
Airport

Bird Results—Horizontal Scanning Radar

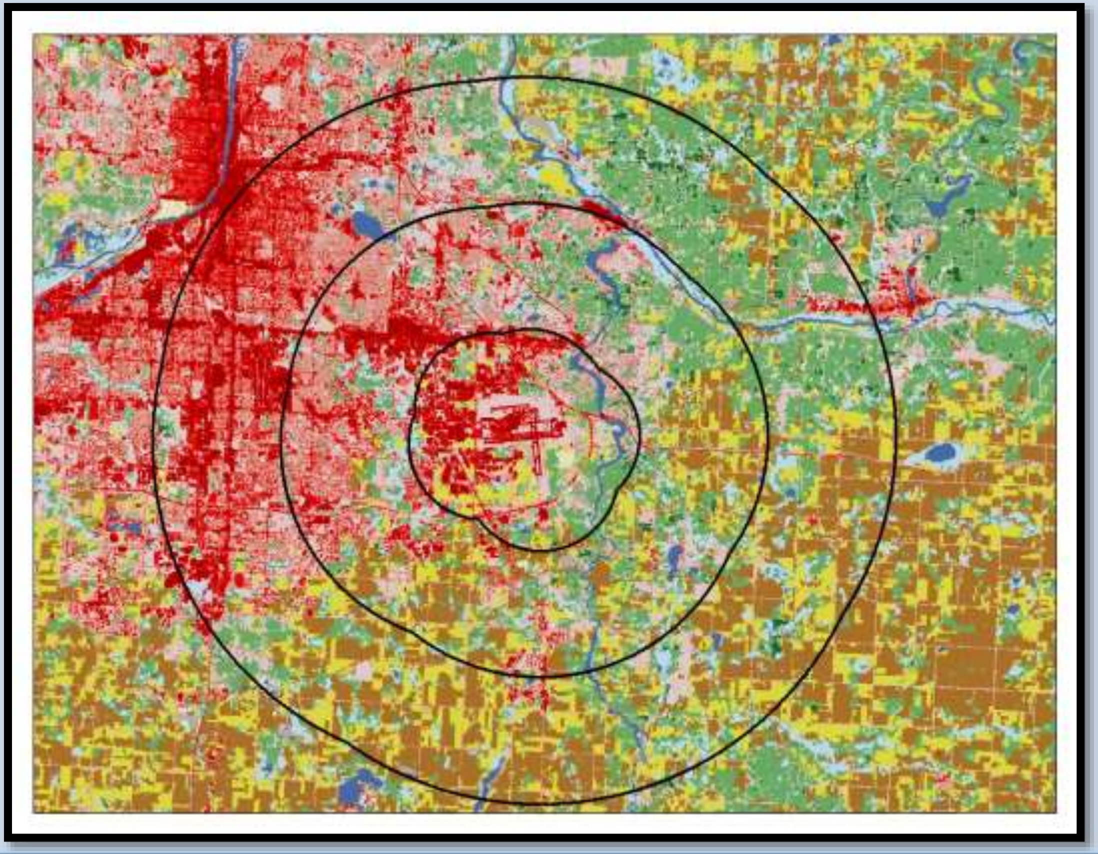


Bird Results—Horizontal Scanning Radar

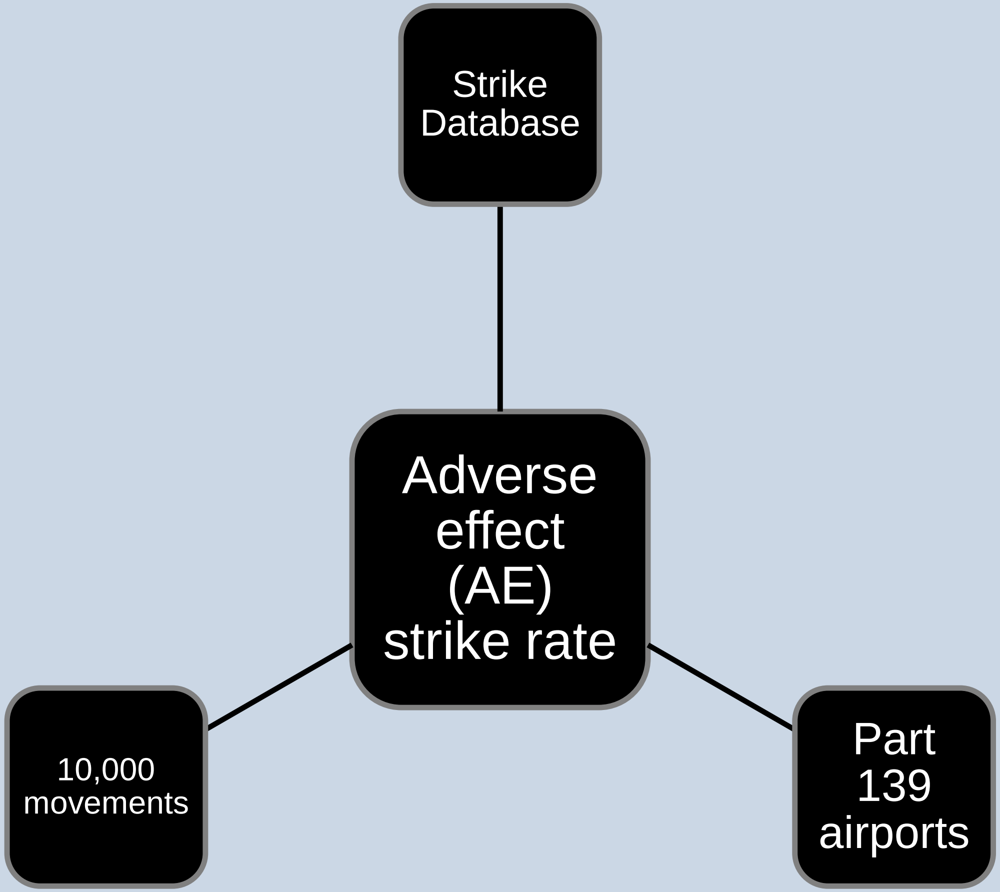


How does the landscape matrix influence the bird strike rate?

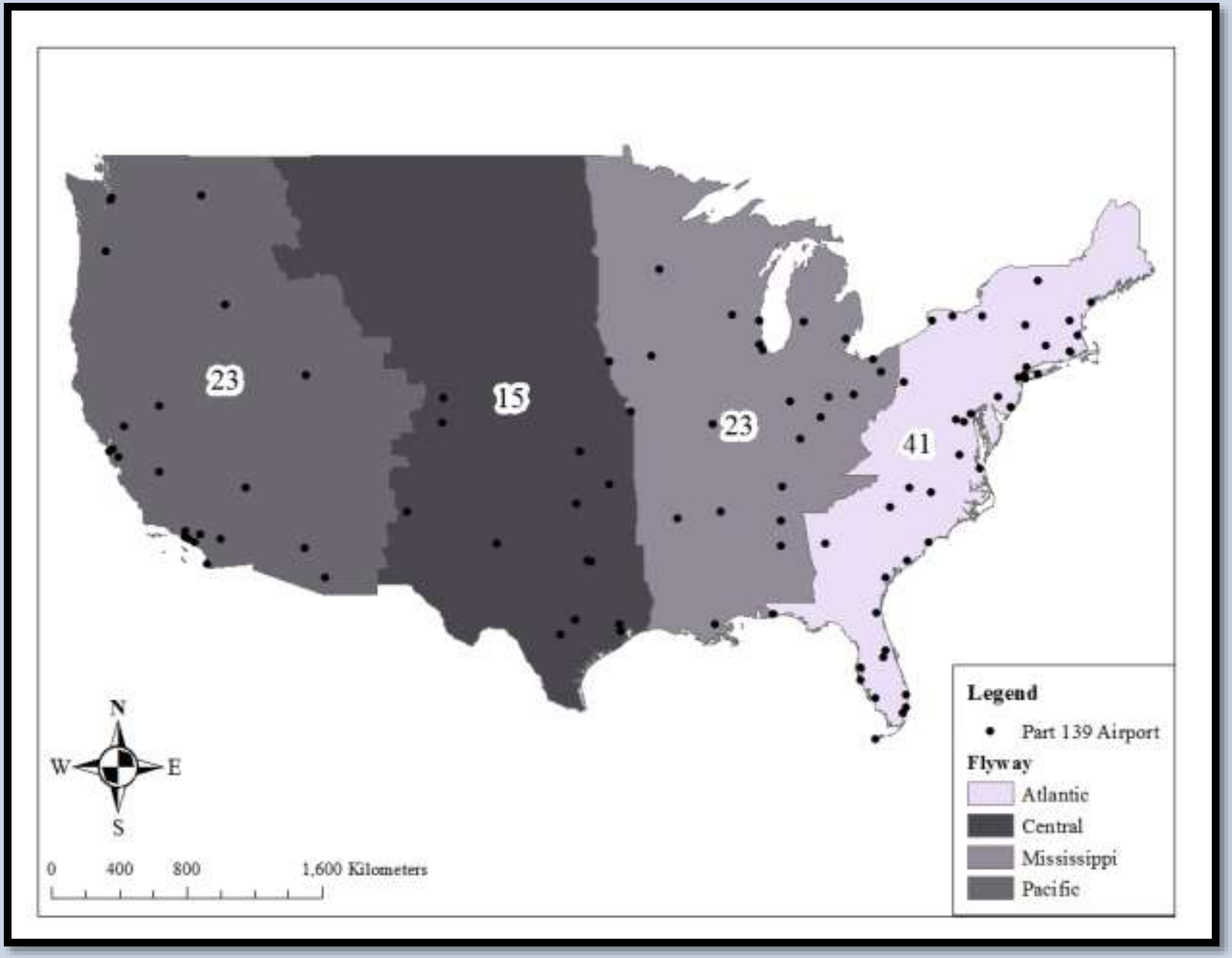
Prediction: The strike rate will differ across airports because of the surrounding landscape matrix and land uses characteristics of fragmentation.

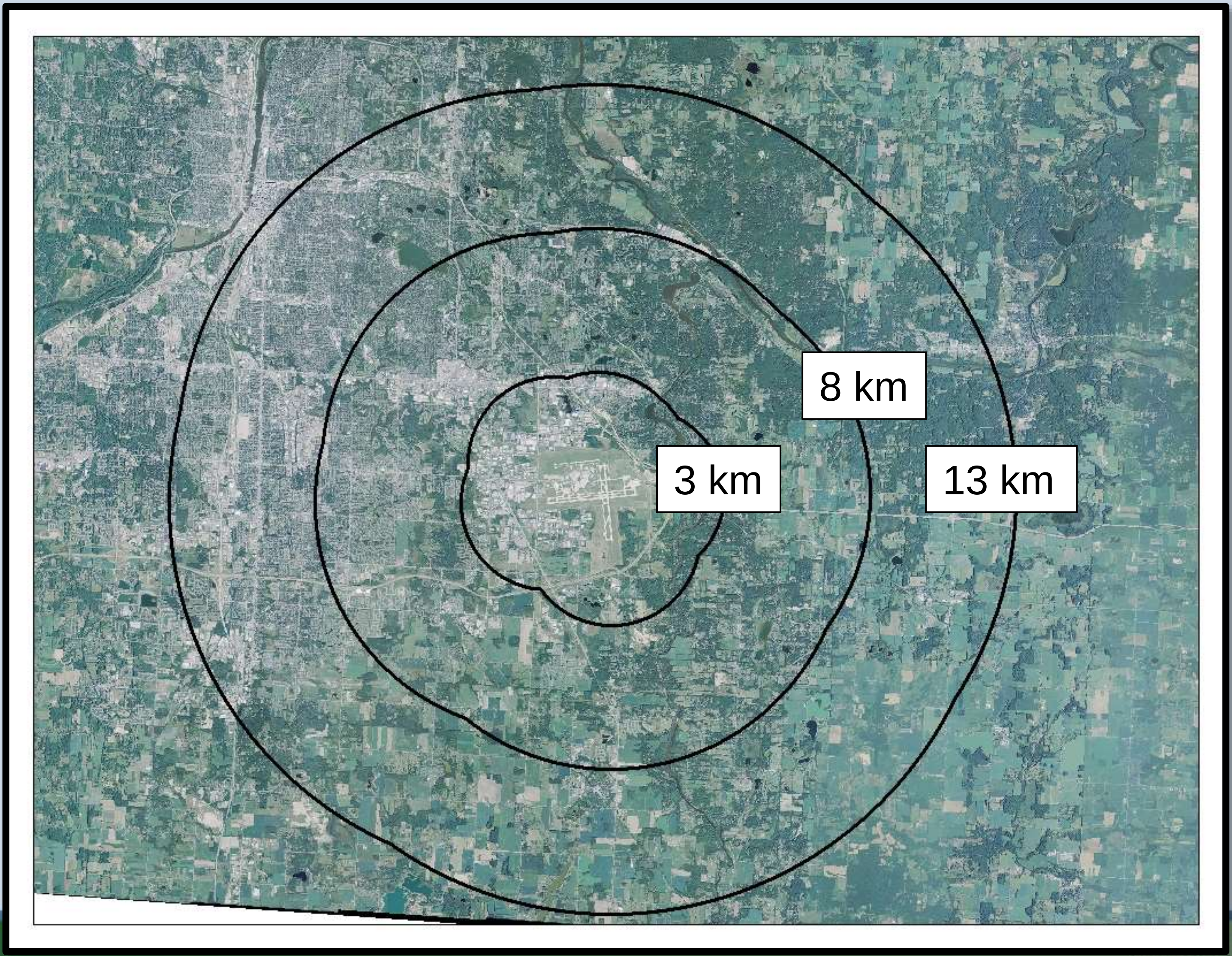


Methods


Strike Database
Adverse effect (AE) strike rate
10,000 movements
Part 139 airports

Sample size = 100 Part 139 airports



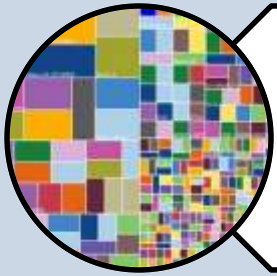

8 km
3 km
13 km

Landscape variables

Based on the ecology of the species

- Landscape level
  - Modified Simpson's Diversity Index
  - Contagion index for dispersion
  - Crop diversity
- Class level (crop, water, wetland, open space)
  - Number of patches
  - Patch percentage of landscape
  - Distance from other patches
  - Total edge of patch

Results—significant predictors of AE strike rate



3 km

- Landscape diversity
- Crop area/edge

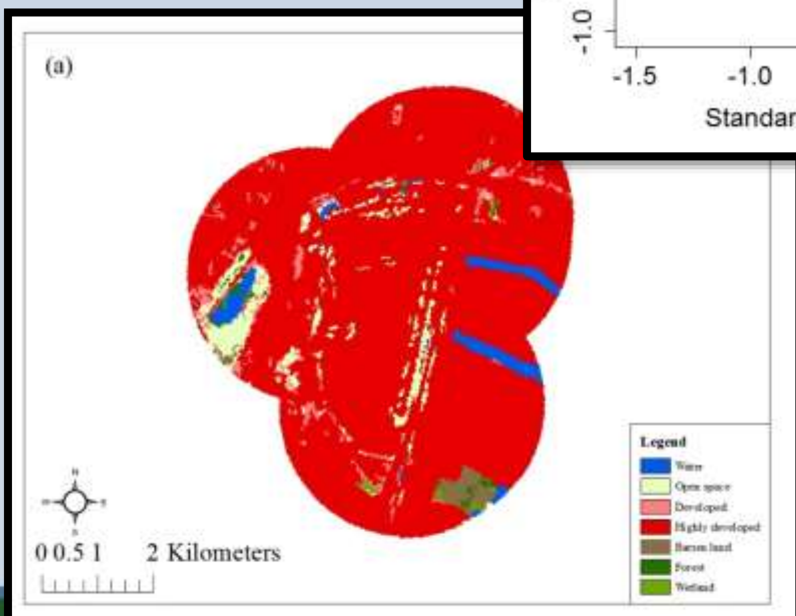
8 km

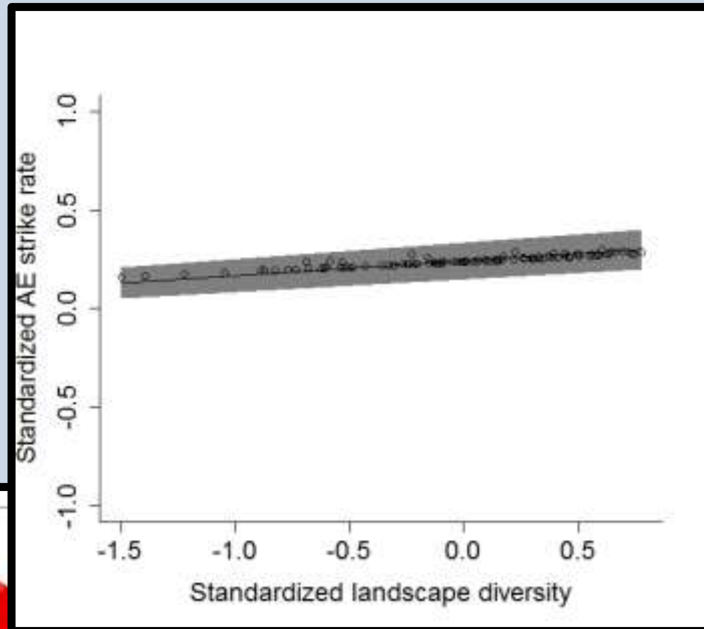
- Wetland patch/edge
- Crop area/edge
- Water patch/edge

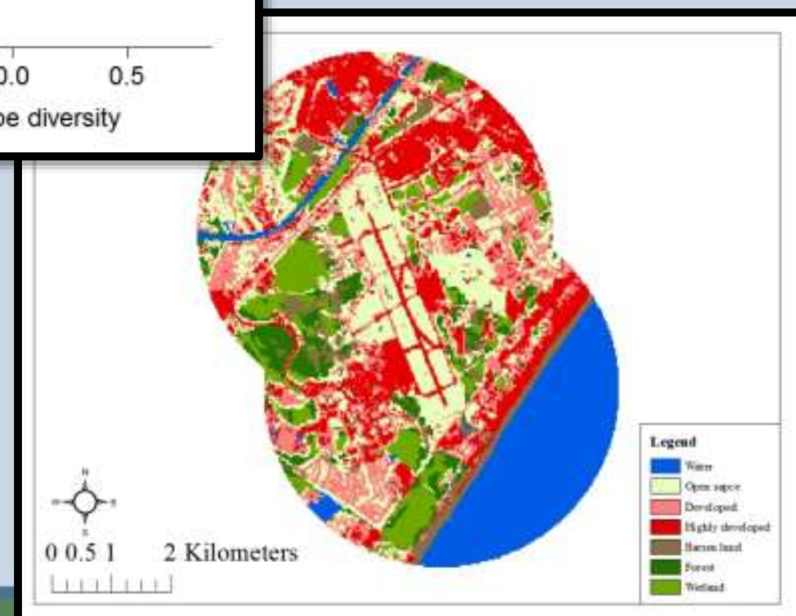
13 km

- Water distance/edge
- Crop area/edge
- Wetland area/edge

Landscape Diversity 3 km



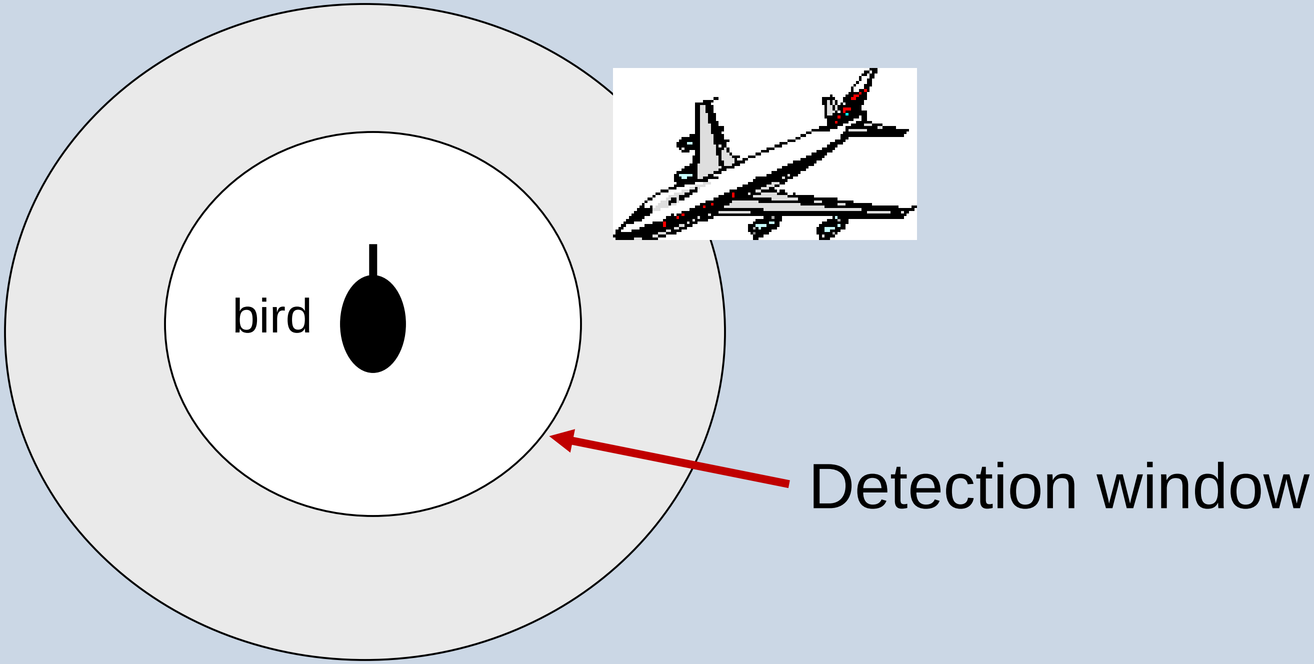




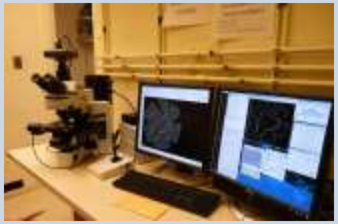
Recommendations

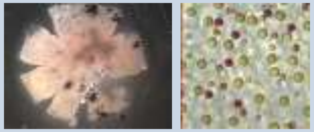
- Land use is important at 3, 8, and 13 km
  - Regulate land use up to 13 km?
- Water, wetland, and crop attractants
- Use in conjunction with other mitigation
- Tool for collaboration

Aircraft Lighting

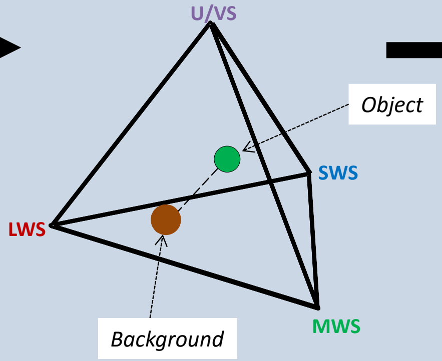


Research Approach





- **Visual field configuration**
- **Visual acuity**
- **Temporal visual resolution**
- **Sensitivity of photoreceptors**

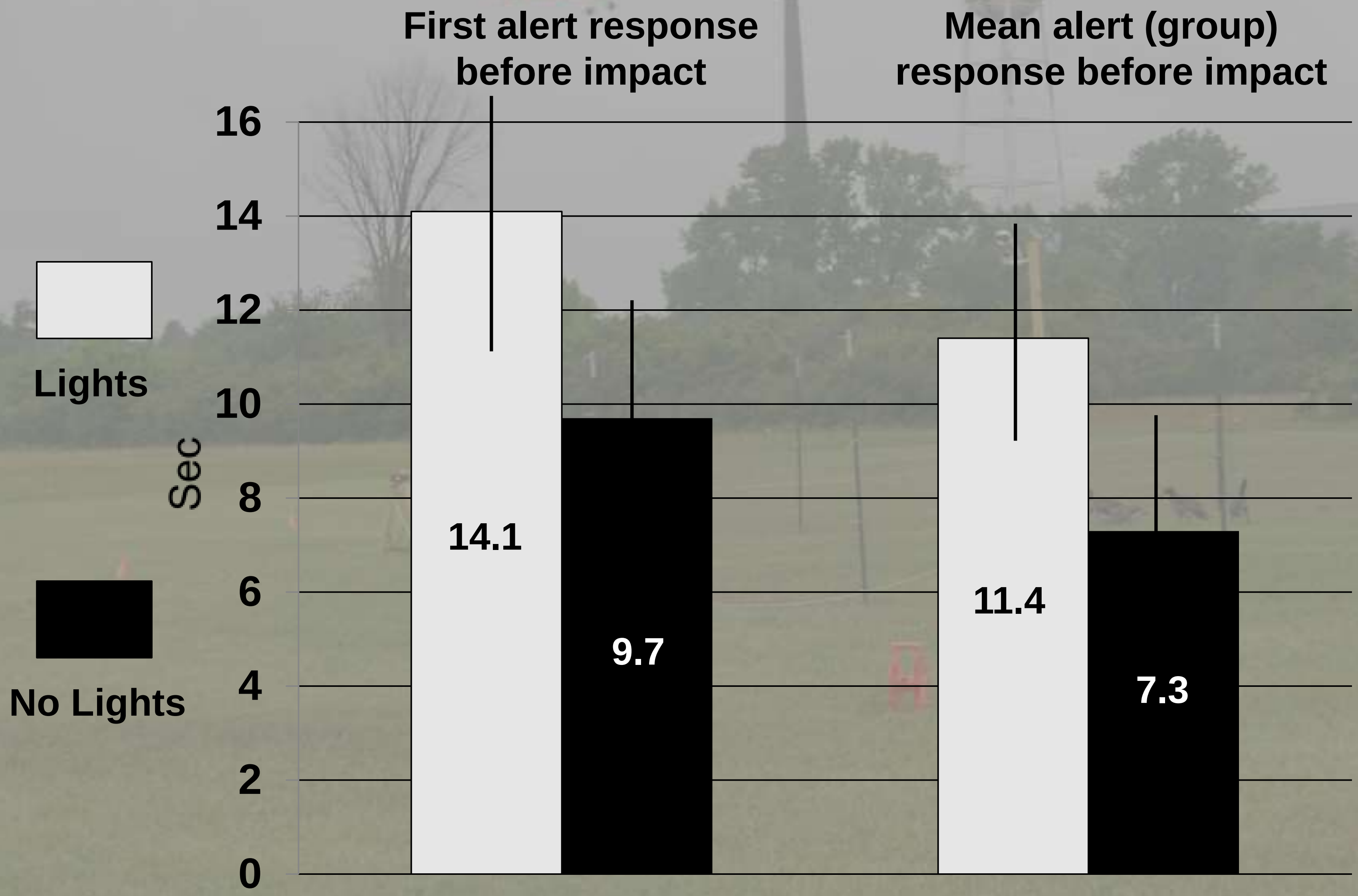


- **Increase conspicuousness of stimuli from the target species' visual perspective**

- **Visual attention**
- **Detection time**
- **Escape time**

Visual physiology → Perceptual modeling → Behavior experiments

Canada Goose – R/C aircraft results



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