

# Boreal Wetlands and Waterbirds Project (BWWP): an Update

Tom Nudds, Luca Börger  
Department of Integrative Biology  
University of Guelph



FESC Forest Science Day  
30 September 2009  
Sault Ste. Marie Ontario

## Co-Investigators

Ken Abraham (Trent University, OMNR)

Jim Baker, Brian Naylor, Rob Rempel

Rod Brook (OMNR)

Ian Thompson, Steve Holmes (CFS)

Mike Cadman, Ken Ross, Don McNicol, Rich Russell (CWS)

## Project Partners

Jim Baker (OMNR),

Kandyd Szuba (Domtar Inc.)

Derrick Romain (Abitibi-Consolidated)

Peter Street (Sudbury and Nipissing Forest)

Charles Francis and Jason Duffe (NWRC)

# Outline

- Why the BWWP?
- BWWP Objectives
- The Data
- Species detectabilities across data sets
- Environmental covariates of species occupancy
- Can we predict the occupancy of some from others?

# CROWN FOREST SUSTAINABILITY ACT (1994)

1. Large, healthy, diverse and productive Crown forests and their associated *ecological processes* and biological diversity should be conserved.

2. The health and vigour of Crown forests should be provided for by using forest practices that, within the limits of silvicultural requirements, emulate natural disturbances and landscape patterns, while minimizing adverse effects on ... social and economic values, ...

# CROWN FOREST SUSTAINABILITY ACT (1994)

1. Large, healthy, diverse and productive Crown forests and their associated *ecological processes* and biological diversity should be conserved.

2. The health and vigour of Crown forests should be provided for by using forest practices that, *within the context of silvicultural requirements, emulate natural disturbances and landscape patterns, while minimizing adverse effects on ... social and economic values, ...*

# Policy as Scientific Null Hypothesis

$H_0$ : “treated” (managed) landscape = “control”, reference landscape



How could we know?

## BWWP Objectives

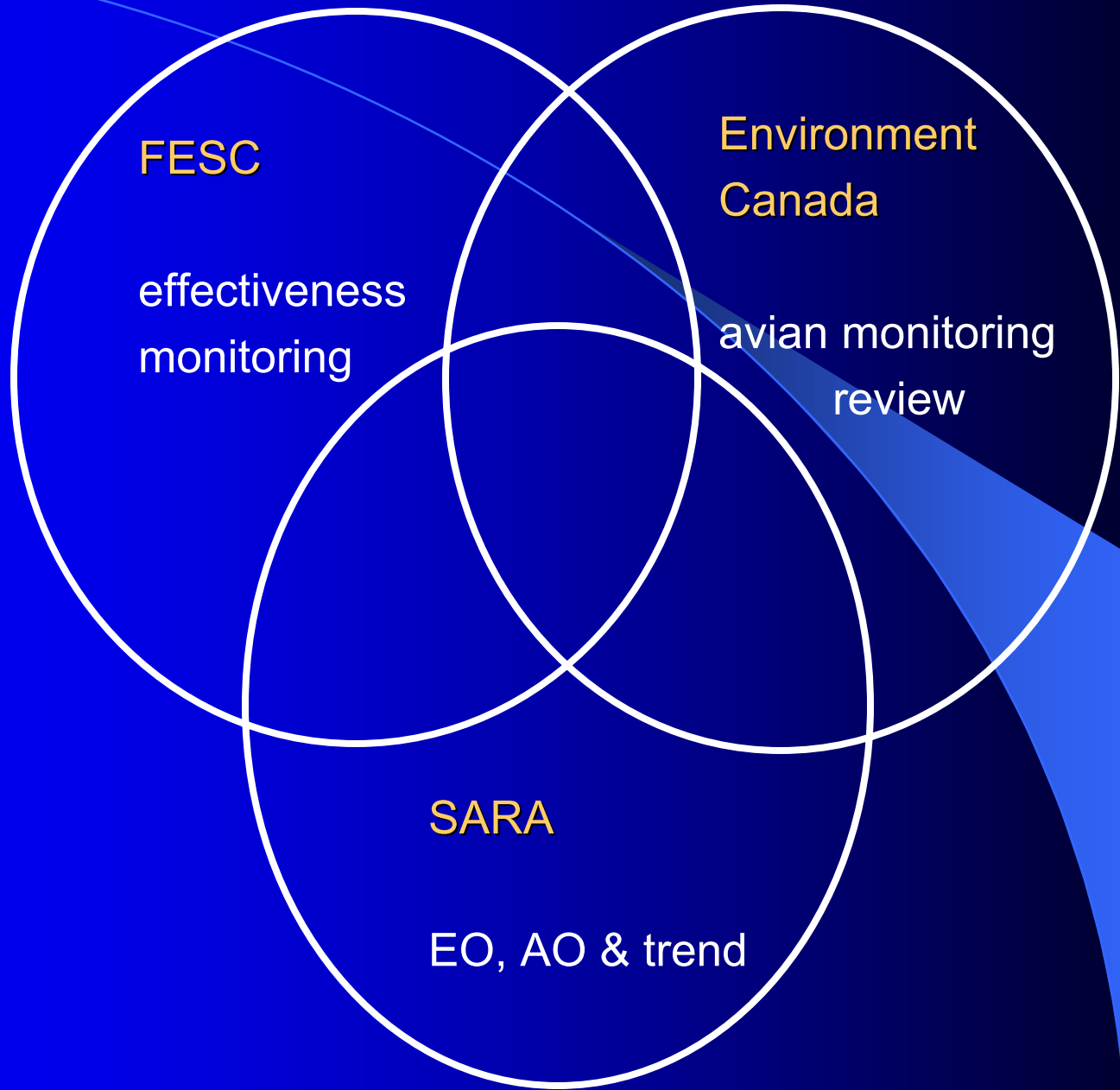
- (1) evaluate effects of past timber management practices on *patterns* and *processes* in waterbird communities;
- (2) evaluate whether results are scale dependent;
- (3) screen waterbird species that might serve as reliable “indicators” of the presence of less obvious species for purposes of developing efficient effectiveness monitoring protocols; and
- (4) develop and test predictive models to estimate numbers of individuals (population size) and extent of occurrence (range size) and area of occupancy (habitat use) of waterbirds, all data relevant to assessment and listing of species putatively ‘at risk’.

# What are waterbirds?

“ ... species that use any resources from wetlands, including songbirds that hawk, glean or otherwise feed on some life stage of aquatic invertebrates or seeds.”



Overlapping  
Interests in  
Boreal  
Bird  
Monitoring



FESC

effectiveness  
monitoring

Environment  
Canada

avian monitoring  
review

SARA

EO, AO & trend

## BWWP Objectives



New data collection

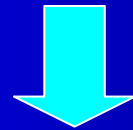


Exploit existing data



What have we got?

US FWS; CWS (BDJV); OBBA; BBS

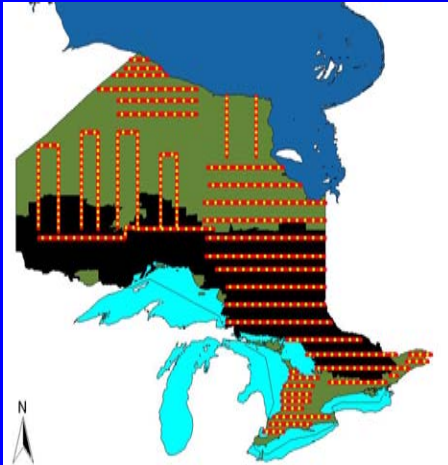


How to use?

## Aerial Counts

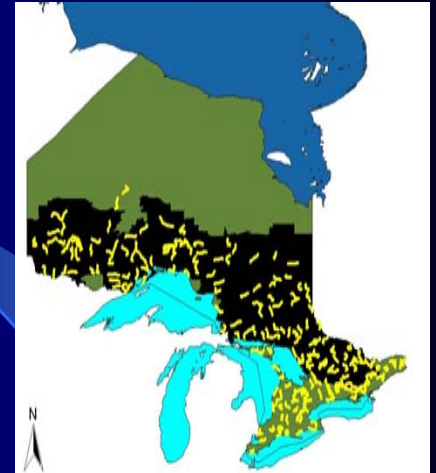
## The Data

## Ground Counts



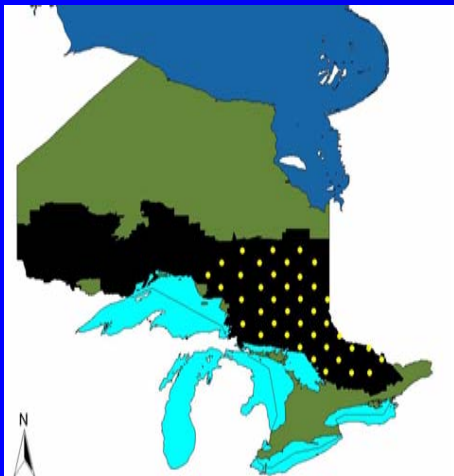
208 segments  
1995/90-2008  
138,820 records  
16 total species  
15 waterfowl  
0 shorebirds  
1 others

### Fixed-wing



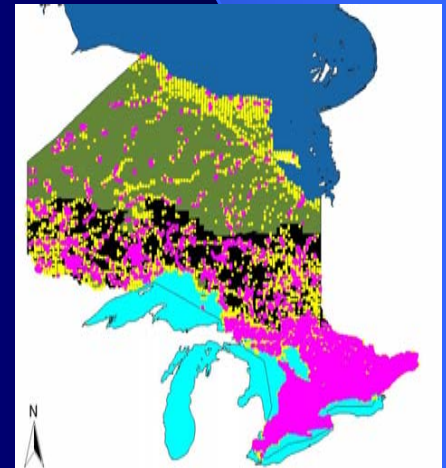
200 routes  
1997-2008  
173,293 records  
322 total species  
23 waterfowl  
24 shorebirds  
52 others

### Roadsides



438 year-plots  
1990-2008  
16,587 records  
70 total species  
23 waterfowl  
12 shorebirds  
12 others

### Helicopter



1792 squares  
2001-2005  
52,000 records  
208 total species  
68 waterfowl  
15 shorebirds  
28 others

### Atlas

common ← Abundance/detectability → rare

not at risk ← Threat status → SC, TH, E



Fixed-wing

Helicopter

Atlas

Roadside

Waterfowl

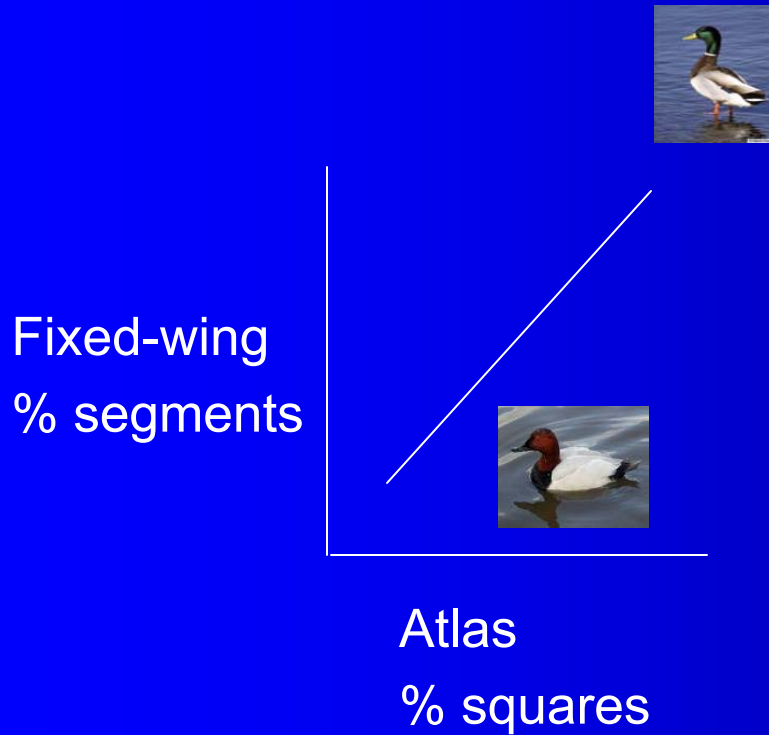


Other

Waterbirds



# How do raw detectabilities vary among surveys?



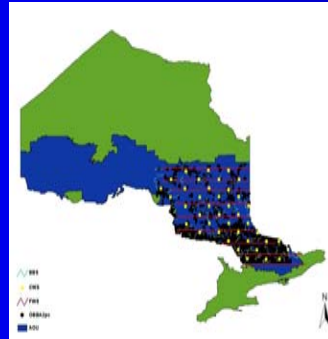
# Inter-survey comparisons constrained by different data

Fixed-wing

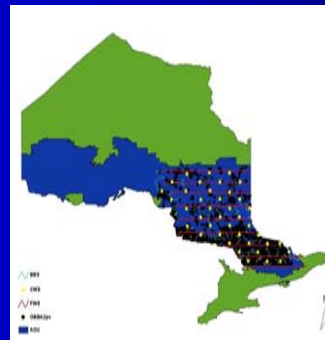
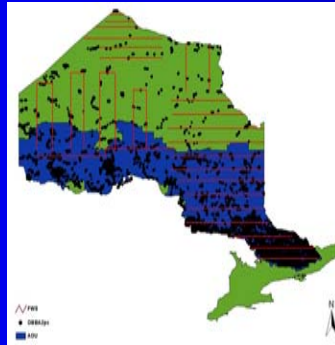
Helicopter

Atlas

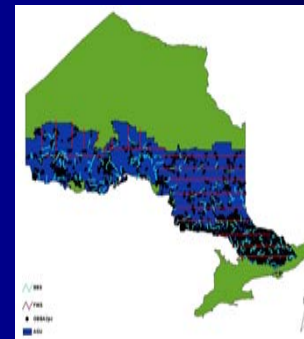
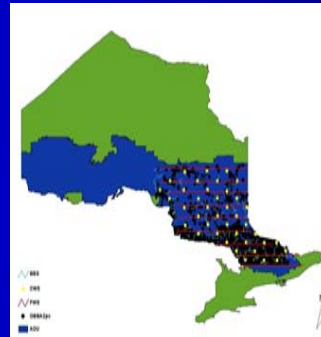
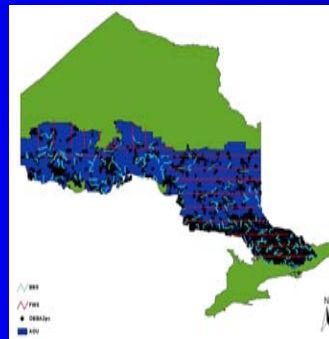
Helicopter



Atlas

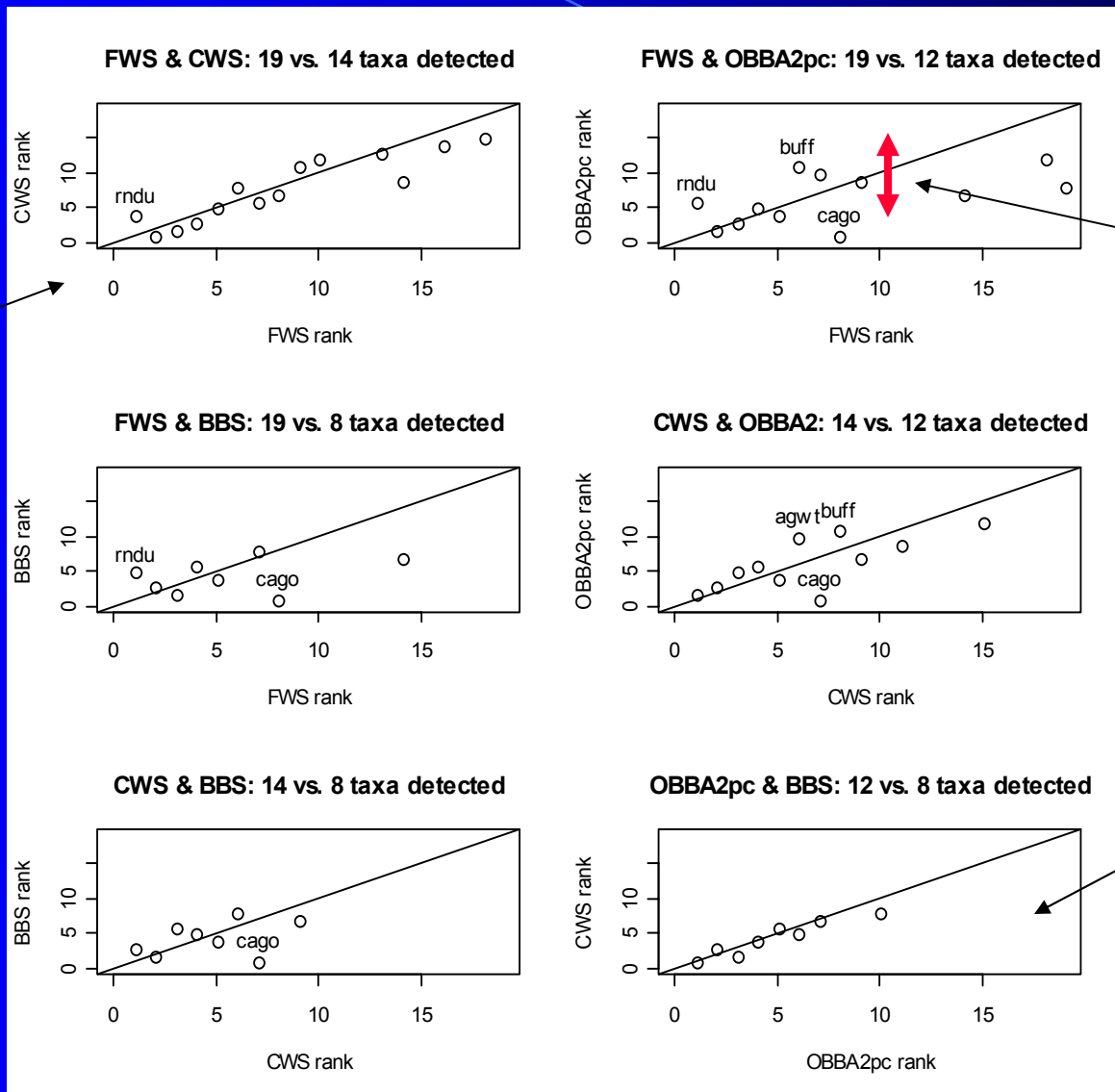


Roadside



# How do raw detectabilites vary among surveys?

aerial vs  
aerial



residuals  
related to  
timing of  
surveys

ground vs  
ground

FAR  
NORTH

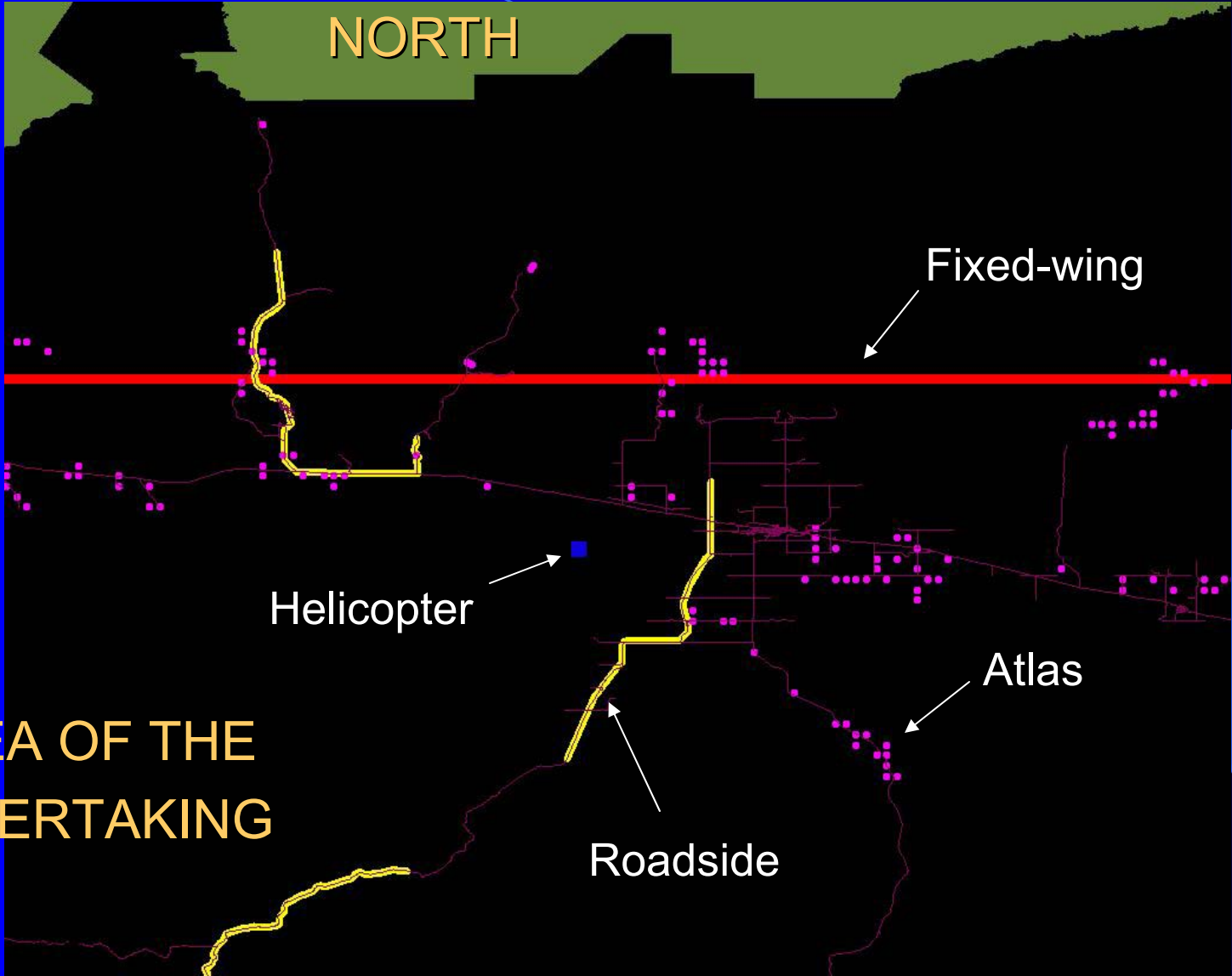
Fixed-wing

Helicopter

Atlas

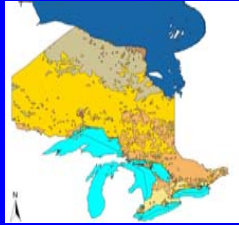
AREA OF THE  
UNDERTAKING

Roadside

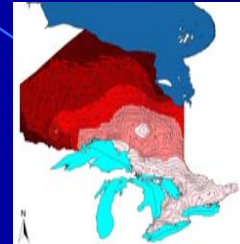


# Occupancy modeling

For each species in each survey type ...



forest, wetlands



precip



temp

$$p(O) = f(\text{local habitat, regional habitat, climate, disturbance})$$

forest type



roads, cuts, burns



# Habitat Classification

| plc28gridcode | plc28name               | plc11class     | plc15class     | plc9class      | plc8class      |
|---------------|-------------------------|----------------|----------------|----------------|----------------|
| 1             | Water                   | Water          | Water          | Water          | Water          |
| 2             | CoastalMudflats         | Marsh          | Marsh          | MarshSwamp     | Wetland        |
| 3             | IntertidalMarsh         | Marsh          | Marsh          | MarshSwamp     | Wetland        |
| 4             | SupertidalMarsh         | Marsh          | Marsh          | MarshSwamp     | Wetland        |
| 5             | FreshwaterMarsh         | Marsh          | Marsh          | MarshSwamp     | Wetland        |
| 6             | DeciduousSwamp          | Swamp          | Swamp          | MarshSwamp     | Wetland        |
| 7             | ConiferSwamp            | Swamp          | Swamp          | MarshSwamp     | Wetland        |
| 8             | OpenFen                 | Fen            | Fen            | FenBog         | Wetland        |
| 9             | TreedFen                | Fen            | Fen            | FenBog         | Wetland        |
| 10            | OpenBog                 | Bog            | Bog            | FenBog         | Wetland        |
| 11            | TreedBog                | Bog            | Bog            | FenBog         | Wetland        |
| 12            | TundraHeath             | CropGrassHeath | CropGrassHeath | CropGrassHeath | CropGrassHeath |
| 13            | DenseDeciduous Forest   | densFor        | densForDecid   | densFor        | densFor        |
| 14            | DenseConiferous Forest  | densFor        | densForConif   | densFor        | densFor        |
| 15            | ConiferousPlantation    | densFor        | densForConif   | densFor        | densFor        |
| 16            | MixedForestDeciduous    | densFor        | mixedForDecid  | densFor        | densFor        |
| 17            | MixedForestConiferous   | densFor        | mixedForConif  | densFor        | densFor        |
| 18            | SparseConiferousForest  | sparseFor      | sparseForConif | sparseFor      | sparseFor      |
| 19            | SparseDeciduousForest   | sparseFor      | sparseForDecid | sparseFor      | sparseFor      |
| 20            | RecentCutovers          | CutBurns       | CutBurns       | CutBurns       | CutBurns       |
| 21            | RecentBurns             | CutBurns       | CutBurns       | CutBurns       | CutBurns       |
| 22            | OldCutoversBurns        | CutBurns       | CutBurns       | CutBurns       | CutBurns       |
| 23            | Bare                    | BareDev        | BareDev        | BareDev        | BareDev        |
| 24            | SettlementDevelopedLand | BareDev        | BareDev        | BareDev        | BareDev        |
| 25            | PastureAbandonedFields  | CropGrassHeath | CropGrassHeath | CropGrassHeath | CropGrassHeath |
| 26            | Cropland                | CropGrassHeath | CropGrassHeath | CropGrassHeath | CropGrassHeath |
| 27            | Alvar                   | CropGrassHeath | CropGrassHeath | CropGrassHeath | CropGrassHeath |
| 28            | Unclassified            | NA             | NA             | NA             | NA             |

# Occupancy modeling

|                 | mall | merg | gold | rndu | abdu | cago |
|-----------------|------|------|------|------|------|------|
| Habitat local)  |      |      |      |      |      |      |
| Water           | +    | +    | +    |      | +    |      |
| Bog&Fen         |      | -    | -    |      |      |      |
| Marsh&Swamp     |      |      |      |      |      |      |
| Deciduous for.  | +    |      |      |      |      |      |
| Crop&Grass      | +    | -    |      |      |      |      |
| Road:Bog        |      | +    | +    |      |      |      |
| Road:water      |      | +    | +    |      | -    |      |
| Road:Crop&Grass |      |      |      |      |      |      |
| Road:oldBurn    |      | +    |      |      |      |      |

# Occupancy modeling

mall

merg

gold

rndu

abdu

cago

Climate zone

Temp  
Seasonality

-

-

-

Prec  
Seasonality

+

May weather

Temp

-

Prec

-

Snow

+



# Policy as Scientific Null Hypothesis

$H_0$ : “treated” (managed) landscape = “control”, reference landscape



# Occupancy modeling




|                  | mall | merg | gold | rndu | abdu | cago |
|------------------|------|------|------|------|------|------|
| HUMAN<br>DISTURB |      |      |      |      |      |      |
| Road density     | +    | -    | -    |      | +    | +    |
| Recent cut       |      | +    |      |      |      | -    |
| Recent burn      |      | -    |      |      |      |      |
| Old cut/burn     | +    | -    |      | +    |      |      |

# Percent occupancy correctly predicted

| Atlas | Fixed-wing |   |      |   |      |   |      |   |      |   |
|-------|------------|---|------|---|------|---|------|---|------|---|
|       | MALL       |   | RNDU |   | GOLD |   | MERG |   | CAGO |   |
|       | P          | A | P    | A | P    | A | P    | A | P    | A |
| P     | 56         | 2 | 30   |   | 70   | 2 | 26   | 2 | 88   | 9 |
| A     | 42         |   | 70   |   | 28   |   | 72   |   | 3    |   |

N = 2101 squares

## BWWP Objectives

- (1) evaluate effects of past timber management practices on *patterns* and *processes* in waterbird communities; 
- (2) evaluate whether results are scale dependent; 
- (3) screen waterbird species that might serve as reliable “indicators” of the presence of less obvious species for purposes of developing efficient effectiveness monitoring protocols; and 
- (4) develop and test predictive models to estimate numbers of individuals (population size) and extent of occurrence (range size) and area of occupancy (habitat use) of waterbirds, all data relevant to assessment and listing of species putatively ‘at risk’. 