

Game Birds & the Landscape of Fear:

The effect of human disturbance on Canada goose (*Branta canadensis*) habitat selection

Karen Beatty

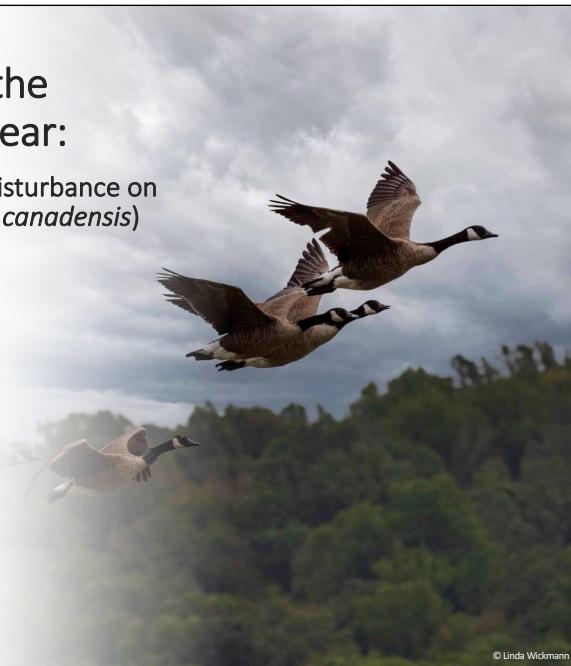
Acknowledgements:



Dr. Franny Buderman
Quantitative Wildlife Ecology Lab



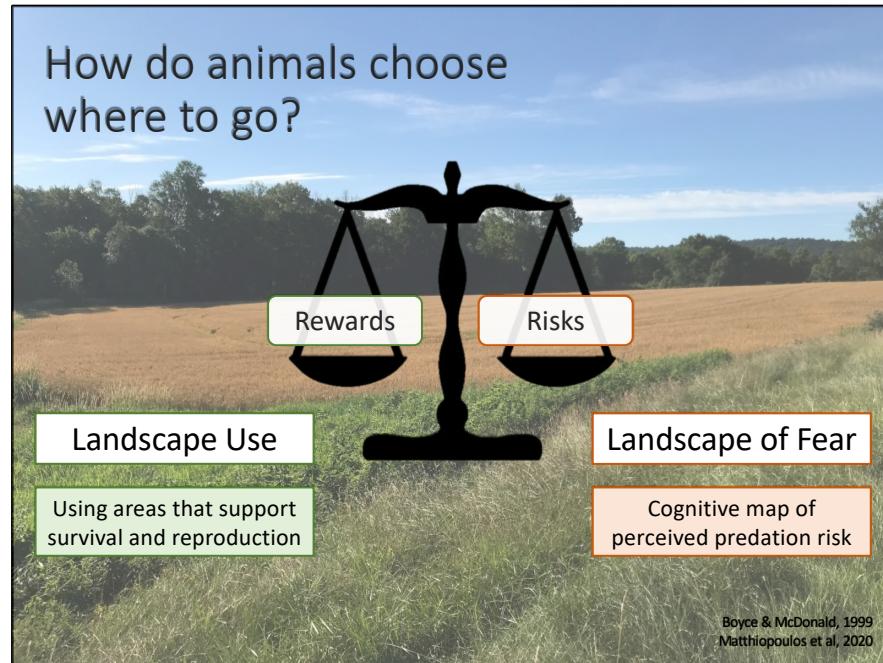
Pennsylvania Game
Commission



© Linda Wickmann

Today I'll be describing one chapter of my thesis research, which focuses on Canada goose landscape use.

I'd first like to acknowledge my advisor, Franny Buderman, and my lab-mates in the QWEL, as well as the Pennsylvania Game Commission, who is funding this research.



In wildlife ecology one of the big questions is “Why do animals choose to move where they do?”

Habitat selection is important because if we know which areas animals prefer or avoid it can help us better manage species and conserve their habitats.

This process of choosing where to go was called habitat selection by Boyce and McDonald.

Habitat selection is a balancing act of navigating risks and rewards on the landscape.

On one hand we have rewards, which are environmental features that are appealing to an individual because they support survival and reproduction.

On the other hand there are risks, which deter an animal from using a certain area. Laundre and colleagues call this the landscape of fear, a mental map of predation risk

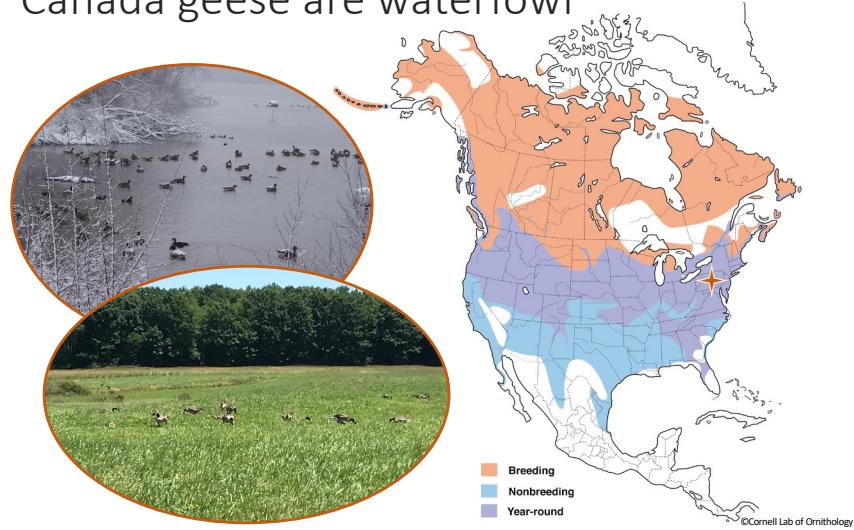


Human activity is an ever-evolving component of the 'landscape of fear', especially for game species, including geese.

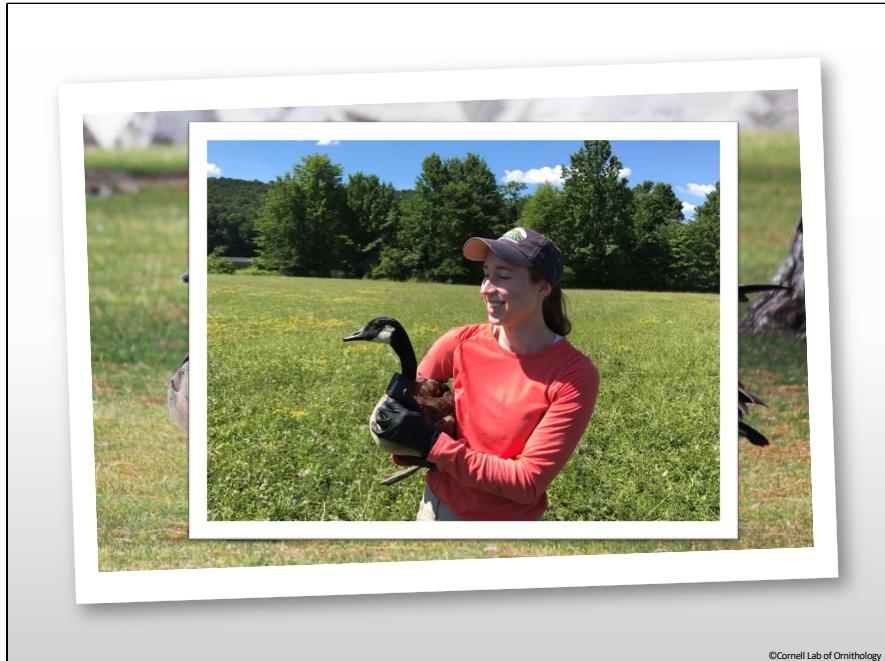
The broad question I aim to answer with my thesis is "How are geese responding to the current level of hunting on the landscape?"

There are several ways to answer that question; today I'll focus on one, which is examining how hunting affects habitat selection.

Canada geese are waterfowl



waterfowl species – rely on land and water
PA in middle of range where geese are present year-round



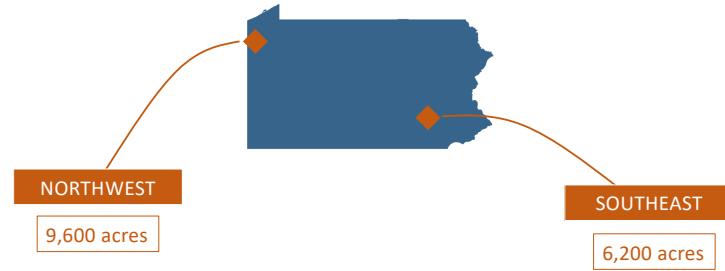
©Cornell Lab of Ornithology

In defense of geese...

They get a bad reputation because they can be defensive around their goslings, and humans act the same.

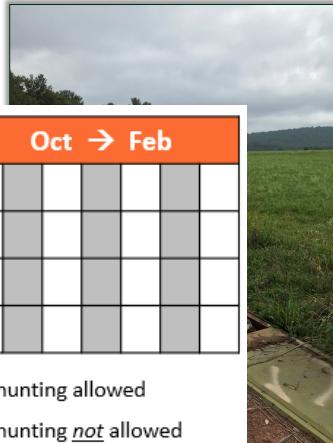
But they are sweet big birds and they won't be aggressive unless they feel threatened.

2 study sites



Two PGC wildlife management areas managed specifically for hunting

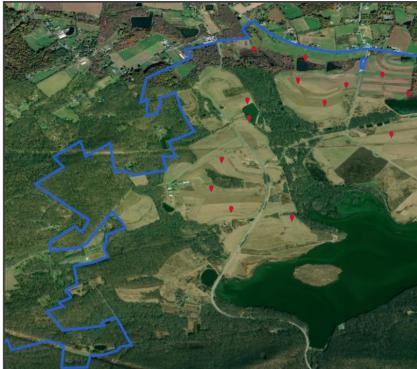
Hunting occurs from stationary locations on specific days



Oct → Feb

Oct → Feb							

■ hunting allowed
■ hunting *not* allowed



Stationary hunting blinds

Hunting geese is only allowed between about mid-Oct to mid-Feb.

And only on certain days – grey vs white.

Because this is an observational study, this temporal layout serves as a natural experiment wherein the non-hunting days act as a control or reference and the hunting days act as a treatment.

This not only minimizes the influence of temporal variability, but also allows us to compare day-by-day and look for daily patterns in the goose behavior.

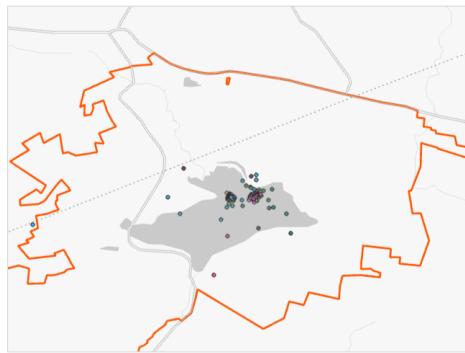
Fitted geese with **GPS collars** to track their locations



We track goose locations using GPS receivers, which are attached around a goose's neck during the summer molt when they cannot fly away from us.

The receivers mark a location, upload that information to the cloud automatically, and we access it through a repository.

Collected data every 10 minutes
for 2 years



138
individuals
+
27,000
observations
per bird
=
3,700,000
data points

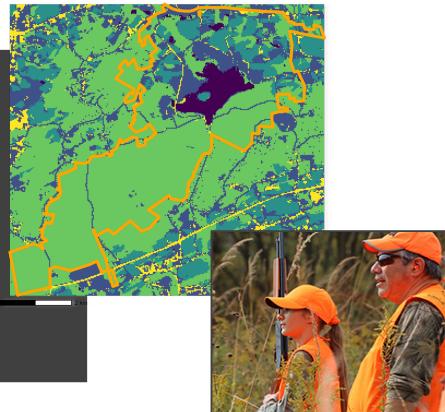
Data collected every 10 minutes for 2 years, and we end up with a large collection of dots on a map. This animation covers a 1-week period.

We have data from 138 geese, which totaled about 3.7 million data points.

When analyzing these data, we need to consider which environmental features could be affecting selection...

Resource Selection Function → logistic regression model

- Habitat type
- Hunting activity:
 - Hunting day
 - Number of hunters
 - Distance to hunting blind



Manly et al, 2002

"These are environmental factors that we think might be affecting selection"

Habitat type – NLCD land cover grouped into 5 categories. See map. Forest, water, developed, crop, grass.

We also wanted to capture certain hunting variables:

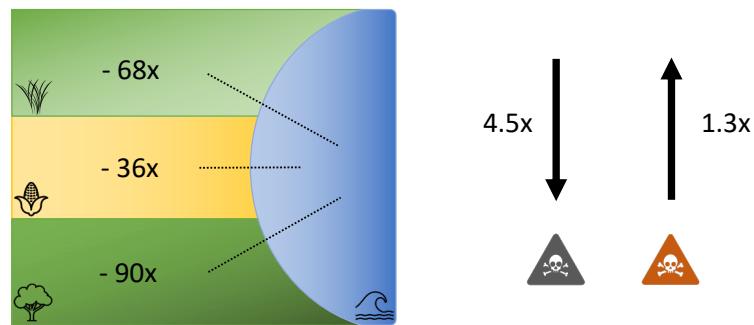
was there hunting (whether hunting is allowed on a given day),
magnitude of hunting (number of hunters per day),
and proximity to hunting (distance to hunting blind).

The standard way to model habitat selection is using a method first proposed by Manly and colleagues, a resource selection function.

It is essentially a logistic regression model.

Compare these covariates at the observed goose locations, which we know from the GPS data, and compare them to the covariate values at all the locations within the study area where the geese could have chosen.

Geese are primarily driven by proximity to water



68x more likely to choose water than grassland

36x more likely to choose water than cropland

90x more likely to choose water than forest

We also tested whether hunting changes these likelihoods, and it doesn't have a noticeable effect.

4.5x more likely to be *closer* to a blind on a day without hunting

This makes sense because blinds are typically placed in appealing habitat

On a hunt day, 1.3x more likely to be *farther* from a blind

How does hunting affect goose habitat selection?

Landscape of Fear

Geese responded to perceived predation risk

- *but it wasn't* the strongest influence

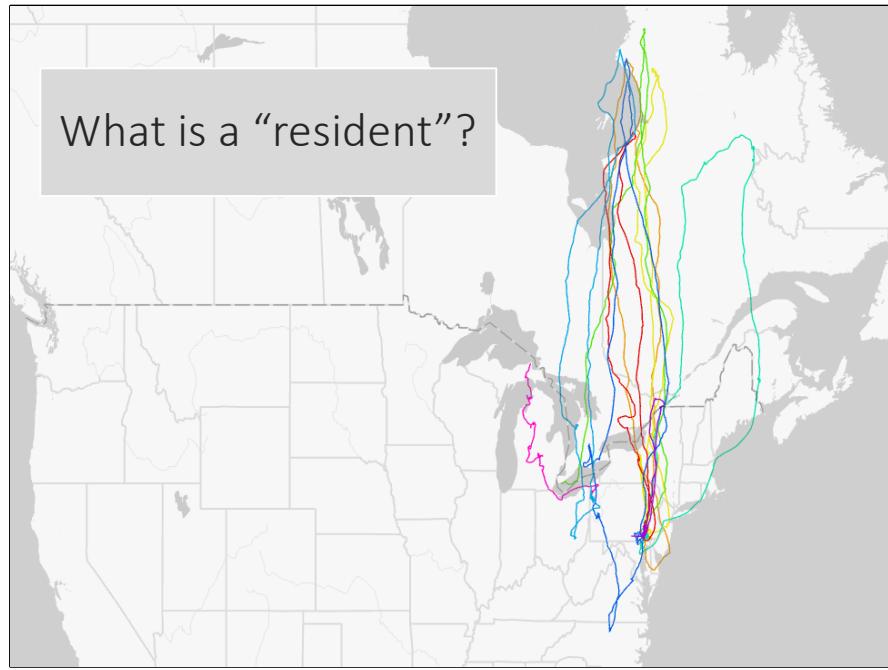
Water is the primary motivation for these birds, but hunting is mostly terrestrial, so the effects are relatively small

Other Analyses

Movement analysis

- Hidden Markov models to estimate behavioral transitions

Geese respond to predation risk, but it's not the main driver of habitat selection Water is the primary motivator, and right now the hunting threat does NOT overlap enough with water to cause major behavioral changes (Hunting affects terrestrial use, but that was already a relatively small part of their motivation)



We thought we collared ‘resident’ geese, but some of them migrated in unpredictable ways (place, timing). So... What is a resident vs migratory animal?? Where do we draw that line?

