Black Bear Habitat Selection and Movement in Response to Wind Energy

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Introduction

- Growing commitment to renewable energy solutions worldwide
- Wind energy among fastest growing sectors[1]
- Concerns regarding indirect effects to wildlife
- Wind farms influence animal behaviour through various mechanisms:
  - Noise, visuals, shadows, vibrations, as well as changes to habitat, electromagnetic fields, and microclimate[2,3,4,5]

- First industrial-sized wind project built within a National Forest in the US
  - Wind turbines built in high-quality black bear (*Ursus americanus*) habitat
    - Intact stands of American beech (*Fagus grandifolia*)
    - Beech nuts are a highly sought-after food item for bears in the fall[8]
  - Potential impact on bears' use of these beech stands in close proximity to wind turbines
  - Impacts to habitat and food availability are highly correlated with human-bear conflicts

Study Area

- Green Mountain National Forest, Vermont, USA
- 3 km buffer from wind energy facility (70 km^2)
- Wind turbines built on highest elevation ridgelines
- Beech stands also found on these high elevation ridgelines
- **Potential impacts where black bear habitat and wind energy facility intersect at high elevations**

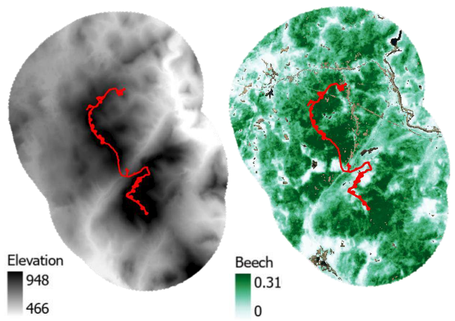


Fig 1. Study area polygon with wind energy facility footprint in red. Darker areas indicate higher elevations (left) and higher beech density areas (right).

Objectives

PC: Tom Rogers

Evaluate the impacts of wind energy on black bear habitat selection and movement

Compare patterns of habitat selection by black bears during the three different phases of the wind energy development:

- Pre-Construction
- Construction
- Post-Construction (Operation)

Methods

Black bear telemetry data:

- 40 bears collared between 2012-2020
- Locations collected every 2h50min
- Locations filtered:
  - Within study area
  - Good beech mast years only
  - Fall season only

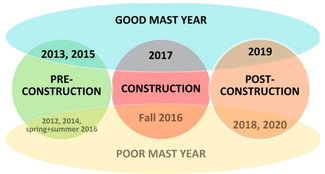
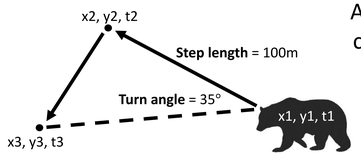


Fig 2. Pictogram depicting beech mast years and wind farm construction timeline as it pertains to study duration.

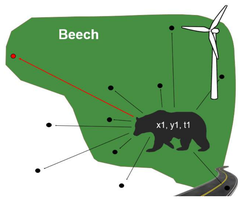
Integrated Step Selection Analysis

Habitat attributes, movement parameters, and their interaction with one another are used to predict how an animal moves across a landscape[9,10].

Movement Parameters:

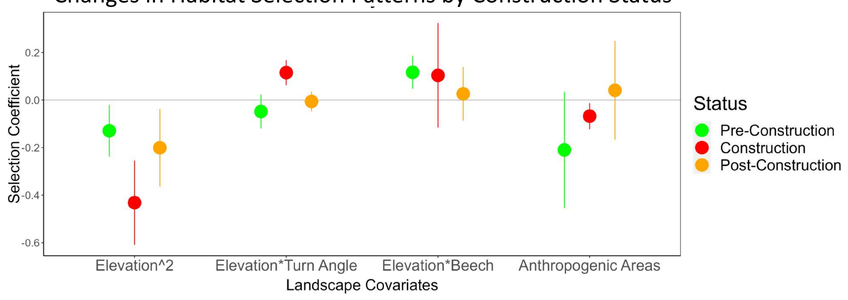


Attributes of **1 used step** contrasted with those of **10 available steps** to calculate selection strength.



Results

Changes in Habitat Selection Patterns by Construction Status

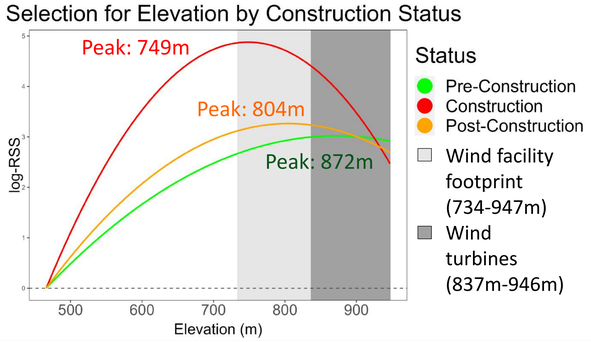


Elevation

Bears using lower elevations in response to wind energy activities

- Construction: avoiding wind energy facility being built
- Post-construction: avoiding wind turbines in operation

Selection for Elevation by Construction Status



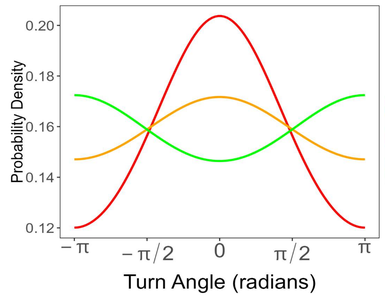
Results Continued

Movement

Comparing turn angles at different elevations provides insights on behaviour:

- Turn angle = 0: directional persistence, or straight-line **directed travel**
- Turn angle = π/-π: tortuosity, or **foraging**

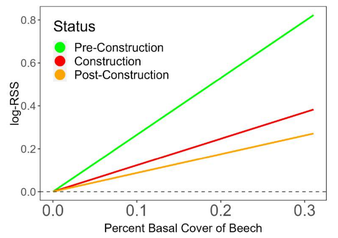
Movement at high elevations where beech stands and wind turbines intersect:



Bears no longer displaying foraging movement behaviours at high elevations where beech and wind turbines intersect.
While mostly avoiding these high elevation areas, when bears venture here they are moving through rather than foraging.

Beech

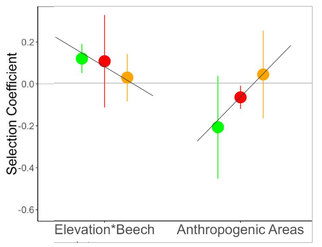
Selection strength for beech:



Bears exhibit lower selection for beech during wind energy activities than they did pre-construction.

Lowest selection for beech observed post-construction when turbines are operating.

Anthropogenic Areas



When selection for beech **decreases**, selection for anthropogenic areas **increases.**

This is most pronounced post-construction.

Increased selection for anthropogenic areas (roads, residential and agricultural areas), heightens the risk of human-bear conflicts.

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Contact & References

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More info on the project:

References: