RENEWABLE ENERGY WILDLIFE | RESEARCH FUND

RESULTS SUMMARY

PUBLISHED FEBRUARY 13, 2024

Does Size Matter? Investigation of the Effect of Wind Turbine Size on Bird and Bat Mortality.

A study funded by the Renewable Energy Wildlife Research Fund investigating the influence of turbine size parameters on collision-based bird and bat mortality.

PROJECT OVERVIEW

Wind turbine size has increased as turbines have become increasingly energy productive. How bird and bat mortality is affected by turbine size, however, is not fully understood. We investigated the influence of turbine size parameters on fatality rates and fall distances of three representative species: hoary bat (*Lasiurus cinereus*), horned lark (*Eremophila alpestris*), and red-tailed hawk (*Buteo jamaicensis*). Through the development of a Bayesian hierarchical model, we demonstrated that the turbine size covariates of ground clearance, rotor diameter, and power rating have varying effects on fatality rates and fall distributions among the three representative species.

STUDY OBJECTIVES

Our primary objective was to determine the effect of different turbine size parameters on collision-based bird and bat mortality. Addressing this objective required simultaneously assessing the effect of turbine size on the fall distributions of bird and bat carcasses. In meeting these objectives, our goal was to enhance the ability to predict and avoid collision-risk to bird and bat species based on existing data and expand the available information on species fall distributions.

HOARY BAT

WIND TURBINES | AIMEE DELACH

ANALYSIS

We incorporated post-constructing monitoring data from a variety of sources, including the American Wind Wildlife Information Center (AWWIC) database, within a paired sample study design using the concept of "project mosaics" to isolate the effect of turbine size. A project mosaic was defined as a grouping of turbines of two or more sizes, and could be derived from one or more facilities that had performed monitoring in the same county within the same year. This approach allowed us to control for environmental effects on fatality rates potentially present within the datasets.

We developed a custom Bayesian hierarchical model to capture the potential influence of turbine size parameters on fatality rates and carcass distributions, leveraging prior datasets from published literature to inform the model.

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KEY PROJECT FINDINGS/TAKEAWAYS

When organized by turbine size covariate, our results yielded the following:

- Smaller ground clearances:
  - Increased fatality rates; most pronounced for the hoary bat.
  - Increased the fall distances of hoary bats and red-tailed hawks, decreased fall distance for horned larks.
- Larger rotor diameter:
  - Increased fatality rates for horned lark and red-tailed hawk; negligible effect for the hoary bat.
  - Decreased fall distances for horned larks and red-tailed hawks.
- Higher power ratings:
  - Increased the fatality rates for horned lark and red-tailed hawk.
  - Increased fall distances for horned larks and red-tailed hawks; negligible effect for the hoary bat.
- Repowering existing towers with larger blades without increasing hub heights may increase hoary bat and red-tailed hawk mortality.
- Typical search plot sizes are missing a sizeable proportion of horned lark and red-tailed hawk fatalities and increase the uncertainty in the associated fatality rates.

NEXT STEPS

- Expanding the model to examine correlates of turbine size on fatality rates and fall distances for other species/groups of interest (e.g., large raptors, small grassland birds, migratory tree-roosting bats) would improve the utility of the model and determine whether the three focal species are representative examples.
- Future research should incorporate anisotropy (i.e., non-symmetrical fall distribution) which could improve the understanding of fall distribution patterns revealed by the current study, and improve the accuracy of fatality estimation science.
- Including the airspace below the rotor-swept area in future bat acoustic monitoring studies at operational wind facilities would improve the understanding of the relationship of ground clearance on bat collision risk.

CITATION

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RED-TAILED HAWK AND TURBINES