European Migratory Soaring Birds and Wind Energy Development

Photo by Dennis Schroeder, NREL 47329

EUROPEAN MIGRATORY SOARING BIRDS

Some birds, such as raptors and vultures, have large wings relative to their body size, providing good lift in rising air currents. Soaring birds can sustain flight for long periods without flapping their wings, but are largely dependent on ascending currents resulting from the uneven warming of the Earth's surface or the wind blowing over mountain ridges. This dependency leads some species such as Griffon Vultures to gather in predictable migratory corridors, generally moving across land or narrow water crossings. However, species who hunt fish, such as Osprey and White-tailed Sea Eagles, appear to be adapted to sustained flight over larger bodies of water.

INTERACTIONS BETWEEN MIGRATORY SOARING BIRDS AND WIND ENERGY

Collisions of large soaring bird with wind turbines are of particular conservation concern, given their they are long-lived, have low reproductive rates with few eggs in each clutch, and invest considerable time in rearing their young.

The main factors influencing collsion risk of soaring raptors with wind turbines include:

- *species-specific* factors related to the birds' phenology, abundance, behavioral traits, sensory perception (e.g., large vultures may fail to see obstacles located straight ahead), morphology (wing loading, turn capacity) and their movement behaviors (flight altitude & behavior);
- *site-specific* factors such as the landscape topographical features, weather conditions, habitat quality, and distance to turbine(s), commuting and foraging areas, and food availability and flight paths; and
- *wind farm-specific* factors including the configuration (number of and distance between turbines), turbine features (dimension, visibility, type), and capacity factor (hours of operation).

Thousands of soaring birds converge upon certain migratory bottlenecks, which in some cases have favorable conditions for wind energy development, such as the Strait of Gibraltar and the Egyptian Red Sea coast. When wind turbines are located along ridges that overlap with orographic lift, the potential

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risks to soaring birds may increase. Persistent strong winds in these areas may impair the birds' ability to avoid turbines, and in cases where large flocks congregate during migration can result in multiple fatality events.

MINIMIZATION ACTIONS

Impacts of wind farms on soaring birds may be reduced by avoiding sensitive migratory areas during the planning phase of a wind farm, taking into consideration both regional and local scales. Sensitivity maps have been developed to identify biodiversity hotspots, and, combined with the use of micro-siting techniques, locations of known bird concentrations can be identified and avoided. These efforts can decrease exposure of birds to collision risk.

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Minimization strategies to reduce impacts may include the use of visual or auditory deterrents. However, deterrent technologies are still undergoing validation studies to assess their efficacy. An effective detection system such as trained human observers, computer vision cameras, or radar, is necessary to manually or automatically trigger deterrent systems. Limiting deterrent events to specific instances when raptors are approaching reduces the likelihood of habituation and disturbance to humans and other wildlife. Detection systems can add considerable cost to monitoring around turbines, but may reduce regulatory risk for a wind farm.

Curtailing wind turbines by feathering turbine blades or raising cut-in speeds during periods of risk may also reduce the impact of wind farms on soaring birds. These measures can be applied seasonally, at known migratory bottlenecks, or when sensitive species are present. Similar to deterrents, curtailment can be triggered by trained human observers, cameras or radar to reduce unnecessary shutdown periods and minimizing loss of energy production.

For some migratory species, conservation actions not associated with wind farms can have significant positive effects if they are undertaken in breeding areas, wintering areas or at stopover sites along the migratory route. In some jurisdictions, compensation of residual impacts from wind farms and other anthropogenic activities may be appropriate.

RESEARCH PRIORITIES

Knowledge of specific migratory paths within flyways is needed to avoid siting in critical habitat. The understanding of species-specific behaviors, phenology, and physiology could lead to additional solutions for target species. Additionally, knowledge of birds' behavior during specific weather patterns could lead to innovative mitigation solutions in some areas. Collecting sufficient data to understand bird behavior at the scale and magnitude of soaring bird migration, when thousands of individuals congregate, will continue to be a financial and technical challenge.

Improvements to radars, cameras, and video processing software are needed to improve bird detection and identification capabilities. Improved integration of these technologies with direct turbine shutdown-on-demand systems or deterrent technologies could significantly reduce mortality while maximizing renewable energy production.

Soaring birds: birds with large wing spans, such as raptors and vultures; many carry out long range migration, often relying on ascending currents in large open areas for flight.

Bottleneck: an area of high bird concentration during migration or other long-range movements.

Cut-in speed: the wind speed at which turbine blades begin rotating and generating electricity.

Curtail: to reduce or halt wind turbine operation and power output, generally used as a mitigation measure to protect wildlife or to protect the blades during very high wind conditions.

Deterrent: typically a visual or audio stimulus used to deter wildlife from approaching the rotor-swept area, thus reducing the risk of collisions while allowing wind turbines to operate normally

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WREN Working Together to Resolve Environmental Effects of Wind Energy

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