GONE WITH THE WIND

Implications of Wind Development for Raptor Populations

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Lynn, bald eagle (*Haliaeetus leucocephalus*) Photo credit: Hannah Baker

Willow, barred owl (*Strix varia*) Photo credit: Hannah Baker

As climate change continues to be a salient topic in both the scientific and political realms, investigations into how we can best address climate change have become increasingly popular and, in some cases, controversial. In the U.S, energy production is a primary contributor to overall emission rates, with as much as 40% of all carbon emissions produced by the electric sector alone.

With a projected growth of 39% in U.S. electricity demands by 2030, high emission rates will continue to be an issue unless drastic policy and infrastructure changes are implemented (DOE 2008).

One strategy for abatement lies in increasing our use of renewable resources for energy productions. There are various forms of renewable energy, but for the purposes of this study, I focus specifically on wind. While wind energy provides a viable solution for emission reductions, it comes at an environmental cost, particularly for birds.

As wind energy grows in popularity, its environmental impacts are becoming more apparent. Recent studies indicate that wind power has negative effects on proximate wildlife. These impacts can be direct—collision fatalities—and indirect—habitat loss (Fargione *et al*. 2012; Glen *et al*. 2013).

Negative impacts associated with operational wind farms include collision mortalities from towers or transmission lines and barotrauma for bats. Habitat loss and fragmentation, as well as avoidance behavior, are also consequences resulting from wind farm construction and related infrastructure.

The potential harm towards protected and migratory bird species are an urgent concern, especially for wind farms located along migratory flyways. In terms of mortality, wind turbines kill an estimated 300,000 to 500,000 birds, annually (Smallwood 2013). The high speed at which the fan wings move and the concentration of turbines create a gauntlet

Jinx, red-tailed hawk (*Buteo jamaicensis*) Photo credit: Hannah Baker

of hazards for birds to fly through. For example, Texas's Gulf Wind Farm in Kenedy County sits within two critical Central Flyway migratory paths and is ranked as the second-worst located wind farm in the US (American Bird Conservancy 2016). Exacerbating these issues is the fact that the height of most wind turbines aligns with the altitude many bird species fly at (Bowden 2015). Birds of prey—raptors—are of particular concern because of their slow reproductive cycles and long lifespans relative to other bird species (Kuvlesky 2007).

In response to the potential negative impacts of wind turbines and farms, my research explores direct impacts on raptors, stakeholder perceptions of these impacts, and plausible solutions. Specifically, I evaluate wildlife rehabilitation as a post-development mitigation strategy for birds of prey. The results of my research enable stakeholders to better understand the negative impacts of wind farms on birds of prey by providing data on bird injury frequency and severity as well as the types of environmental compensation and indemnities that can be provided in exchange for increased wind development.

Survey Data

In 2016, I sought to determine the number of raptors directly injured by turbines, the frequency of rescue after injury, the types of injuries received, and the level of recovery most often attained. Using a multi-step study framework—literature review, survey research methods, and post-survey interviews—I integrated biological and social sciences data through the analysis of peer-reviewed literature and local knowledge (i.e., information gained from surveys and interviews). This integrative process enables researchers, practitioners, and the public to see a more comprehensive picture of the problem and potential solutions.

Questionnaires were sent out to raptor rehabilitation centers in the six states that contain the largest percentage of wind development (Texas, Oregon, Washington, California, Iowa and Minnesota) (Fischlein *et al*. 2012). This provided a new source of data by addressing local rehabbers, and thereby exploring a local aspect of the human dimension that is often overlooked. Both the pre-survey literature review and post-survey interviews served to provide additional context.

The sample population consisted of rehabilitation centers and individuals with a state certification for wildlife rehabilitation (N = 76). The questionnaire focused on collecting important information regarding injury type, species treated, and rehabbers' opinions regarding mitigation options. Of the questionnaires returned (N = 24; 32% response rate), data revealed that the red-tailed hawk (*Buteo jamaicensis*), great horned Owl (*Bubo virginianus*), American kestrel (*Falco sparverius*), and red-shouldered hawk (*Buteo lineatus*) were the most commonly treated species across states. The majority of respondents reported wing or neurological injuries. Figure 1 displays the breakdown of all injury types as cumulatively reported, without separating out for state or birds with multiple injuries.

Wing injuries typically consist of compound fractures or open lacerations. Neurological injuries included ataxia (loss of body movement control) and non-ambulatory injuries, i.e., unable to walk. Beak injuries were least common. The category for "other" injuries included reports of malnutrition, electrocution, poisoning, and gunshot wounds, among others.

According to a post-survey interview with Luke Hart, the Executive Director of the Raptor Advocacy, Rehabilitation, and Education (RARE) group in Iowa, non-life threatening wing injuries at his center have a recovery and re-release rate of 30-40%. Figure 2 demonstrates the outcomes of different injury types of all centers surveyed, and

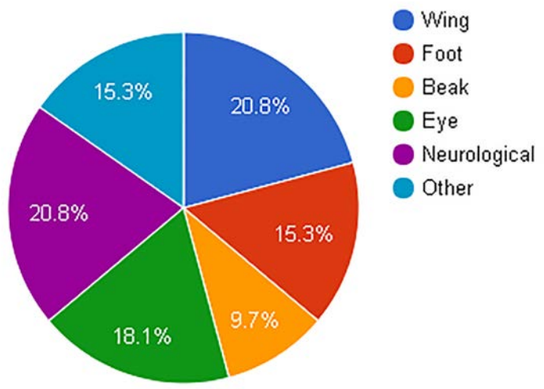

Figure 1. Percent of each injury types treated as reported by rehabilitation facility respondents.

emphasizes the low survival rate associated with neurological injuries. This figure provides a similar re-release rate for wing, foot, neurological, and miscellaneous injuries.

Interestingly, while 73% of rehabbers stated they were within 100 miles of a wind farm, only 40% believed they treat birds with injuries from wind turbine collisions. Rehabbers expressed low expectations that the birds they treat sustain injuries from turbine collisions; the highest estimate from rehabbers was 20%. Concerning rehabbers' opinions on mitigation options, 87% called for pre-development mitigation options as opposed to post-development mitigation or restitution. Examples of pre-development strategies included changing blade design or initial wind farm layout, while payment of fines was the example used for post-development mitigation. 100% preferred that wind farms minimize their impact on wildlife instead of simply providing restitution.

So What Does That Mean for Birds & Wind?

The data collected via surveys provide a quantitative account of the types of injuries sustained and number of birds that can be re-released after injury. The data collected

from interviews helped to provide context for the answers provided through the surveys, and offered added insight into the hurdles facing rehabilitation as a mitigation strategy. Post-survey interviews were conducted with experts in the field, from both rehabilitation and advocacy groups. Questions were tailored to the expertise of each individual interviewed, but in general asked for opinions regarding the extent of the impact that wind energy is having and what type of solutions should be pursued.

To represent the local rehabilitation centers, we interviewed Mr. Luke Hart, Executive Director of RARE. This organization takes in close to 200+ birds a year from eastern Iowa and Illinois. To represent advocacy groups, we interviewed Dr. Michael Hutchins, Director of the American Bird Conservancy's (ABC) Bird-Smart Wind Energy Campaign. This group aims to improve company decision- making and push for better regulations that mitigate bird and bat deaths caused by commercial wind energy. Dr. Hutchins claims that many conservation organizations have embraced wind energy without asking enough questions, and this campaign aims to ask those tough questions.

Mr. Hart helped to explain the low percentage of rehabbers reporting birds treated for injuries sustained by wind turbine collisions, clarifying that, in most cases, it is hard for rehabbers to tell exactly what happened to the birds when they are brought in. This, in turn, makes it difficult for survey respondents to say with certainty if raptors sustained wind turbine-related injuries. He also cited the low likelihood of those birds ever making it to a rehab center as a likely explanation. When asked about his opinions on the likelihood of recovery, Mr. Hart was not overly optimistic. Turbines have what Mr. Hart calls a "slice-and-dice" effect. He believes that a collision would result in either immediate death, or a traumatic injury that is unable to be treated.

To emphasize this low likelihood of immediate survival post-collision, some states have

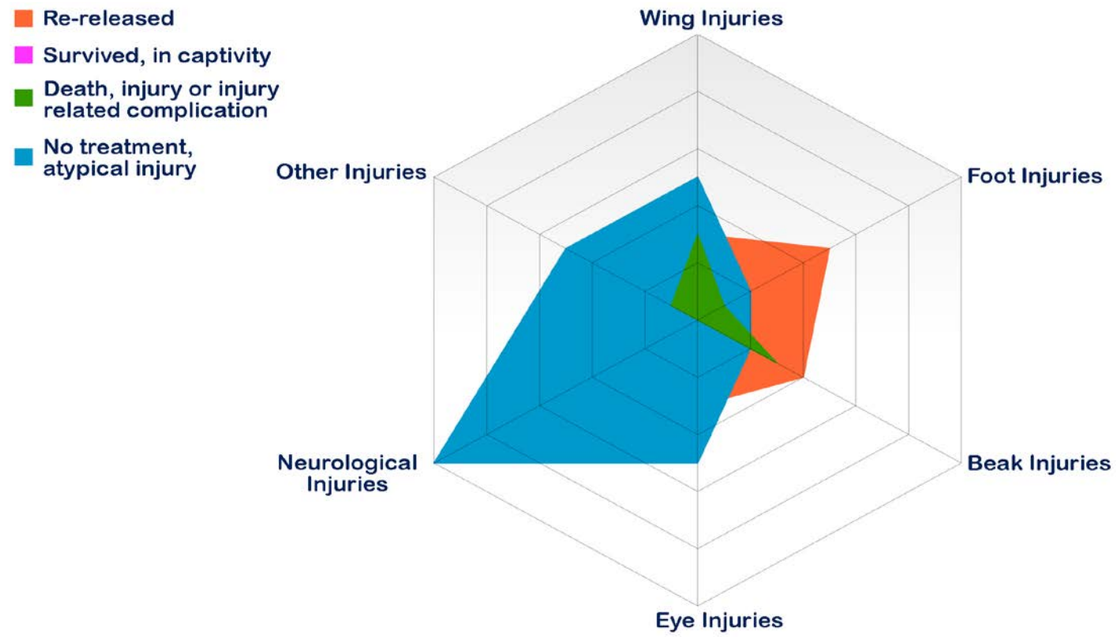

Figure 2. Radar chart displaying typical rehabilitation outcomes categorized by respective injury type.

laws in place that dictate how particular injuries must be treated. The loss of a wing or leg, for example, would result in the animal being euthanized (USFWS Form 3-200-10b). Therefore, even if the animal survives the collision, the type of injuries that are likely to be sustained may still result in death via euthanasia. Dr. Hutchins similarly expressed concern that turbine-related injuries would be too extensive. He believes most birds die on impact, and that those that survive would both be difficult to find and to treat. The combination of uncertainty of causation with injuries and the low threshold for survival post-collision help to explain the absence of wind-farm related injuries in adjacent rehabilitation centers.

Alongside the issues associated with the lack of recovery potential for birds injured by wind farms, Dr. Hutchins' interview helped to shed light on the political and social components of the conflict between commercial wind energy development and wildlife. He revealed yet another obstacle to the use of rehabilitation as a form of post-development mitigation, lack of publically available information. It is difficult to get a full picture of the number of birds that are injured or killed each year due to collisions with wind turbines because the mortality data is not readily accessible.

According to Dr. Hutchins, the lack of transparency between wind facilities and the public presents a major problem. He cites the lawsuit that Pacificorp brought against the U.S. Fish and Wildlife Service in 2014. This lawsuit was intended to block the release of information regarding bird deaths at Pacicorp facilities, which Dr. Hutchins sees as evidence of this lack of transparency (Cappiello 2014). He states that the collection of the mortality data also presents a possible bias, as paid consultants collect data for the industry, as opposed to independent researchers. This data is not required to be collected in most states, as the protocols are voluntary. With policies such as the Bald and Golden Eagle Protection Act imposing fines on companies that cause deaths of protected species, companies are not likely to be willing to report injured birds if they think it might result in fines or other sanctions. At the same time, however, these policies are not heavily enforced. With only two prosecutions against wind companies for violations of these policies, the track record for protecting species is not particularly strong. Policies initially thought to help preserve wildlife are encouraging opaqueness from wind facilities and discouraging companies from implementing mitigation policies and practices. This represents an unfortunate consequence and ineffective public policy, wherein mutually beneficial resolutions are needed for real-world progress, both for renewable energy development and avian wildlife conservation.

Policy and Mitigation Implications

As alluded to above, mitigation-focused regulations are likely to play a role in future commercial wind farms operate siting. The creation of siting regulations could provide a viable form of pre-development mitigation. Disturbance-based siting, for example, encourages development in areas that have already been fragmented, and thereby help preserve areas of higher quality habitat (Kiesecker et. al 2011; Fargione et al. 2012). Post-development mitigation options mostly include structural changes to turbines, wind farm layouts, and operational adjustments, or compensation that could be provided in exchange for increased wind development. Our rehabilitation strategy aimed to add to these options.

When asked for their opinions on how serious of a threat they believed wind farms posed to raptors, both Mr. Hart and Dr. Hutchins believed it to be non-trivial. The losses are cumulative, and when all the anthropogenic influences are added up they become significant. The turbines are not the only danger, as the associated infrastructure (power lines, communication towers, etc.) also kill birds through collisions and

electrocution. Regarding mitigation techniques, Mr. Hart felt that reducing the "slice-and- dice" effect of wind turbines by changing their design would be the most effective way to minimize both the rate and severity of injuries. He would also like to see energy companies conducting more extensive impact studies pre-development to establish baseline information alongside a more thorough understanding of potential impacts. Dr. Hutchins added a preference for siting regulations that would move wind facilities out of areas with high bird abundance, e.g., migratory flyways. These sentiments were in line with the 87% of rehabbers who voiced a preference for pre-development mitigation techniques.

Conclusion

Results of this study suggest injuries sustained from collisions with wind turbines are unlikely to have a high rehabilitation success rate. Raptors either die on impact or suffer irreparable traumatic injury that results in euthanasia. This low success rate suggests that the use of rehabilitation as a form of post-development mitigation would be ineffective. In addition, we determined that the current state of communication and cooperation between commercial wind energy facilities and wildlife agencies and practitioners is not favorable for the creation of this type of program.

For successful rehabilitation, companies would need to be more willing to report injured birds and allow their collection. The lack of incentive for companies to report injured birds is a serious obstacle. Amongst local rehabbers, pre-development mitigation strategies were preferred, and minimization of impacts to wildlife is favored over restitution.

Integrating the scientific literature, professional expertise, and local knowledge offers a unique perspective of a complex issue. By assessing the knowledge of local rehabbers, who are on the front lines and deal directly with injured birds, we were able to gain a fuller understanding of recovery rates from collisions.

By identifying the probability for low survival rates, we were then able to conclude that preventative measures are better taken before injuries are incurred. This enabled us to establish an informed platform when we began talking with experts in the field, who were better able to explain to us the reasoning behind some of the obstacles we recorded. They then offered their own professional opinions about future solutions. Overall, pre-development mitigation strategies are preferred (e.g. siting, blade design, etc.).

Implications for Future Research

This project served as a pilot study, intending to identify gaps in the current research and highlight further research needs. Findings suggest that, as it stands, rehabilitation is not a viable mitigation option due to the severity of injuries sustained and the lack of industry cooperation.

To remedy some of these obstacles, further study is needed to explore alternative viable solutions. Design options that reduce the severity of injuries, bladeless technologies, and the creation of proper siting regulations are all possible resolutions. This study demonstrates the usefulness of using local knowledge to understand large-scale problems.

Follow-up research could include using this form of local knowledge to inform stakeholder preferences for pre-development mitigation strategies. Importantly, developing cooperative and transparent relations with companies would facilitate the collection of more accurate mortality data and strengthen understanding of the problem and potential solutions. Findings suggest that there is much uncertainty surrounding the extent of wind energy impacts on birds of prey, as well as the effectiveness of mitigation strategies. ☐