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The Effect of Wind Energy Development on Bats

Is wind energy really as “green” as we think?

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Wind energy has gained widespread attention as a solution to reduce greenhouse gases. By 2020, it is expected that 12% of this country’s energy will be produced by wind turbines. [1] While this may seem like a step in the right direction, there are environmental consequences. Bats, which play an enormous and often underappreciated role in our ecosystems, are being killed by wind turbines in alarming numbers. Researchers predict that up to 111,000 bats will die due to wind turbines in 2020 in just the Mid-Atlantic Highlands region of the US. [2] These deaths would not only pose an ecological problem, but would also prove to be an economic loss. In light of the economic and ecological value of bats and the growing popularity of wind energy, identifying ways to minimize bat fatalities on wind farms is essential.

Why Should Humans Care?

Although bats have a bad reputation for sucking blood, this misconception couldn’t be farther from the truth. Out of approximately 1,100 bat species, only three are known to feed on blood. Bats exhibit enormous diversity in diet and consequently provide varied ecological services, such as pollination, seed dispersal, and pest control. Nectar-eating bats encourage floral reproduction by transporting pollen on their bodies. Fruit-eating bats consume fruit and excrete the seeds, playing a significant role in promoting plant dispersal. Should bats fail to promote plant dispersal and reproduction, animals of higher trophic levels would starve. Insect-eating bats, which are of particular interest to us, are essential in regulating crop pests.

Three of the most affected bat species by wind turbines, from left to right - the Silver-haired bat, Hoary bat, and Eastern Red bat.

Photos by J. Scott Altenbach.

Farmers rely on these bats to help increase crop yields. Researchers in Texas estimated the economic value of the pest-control service that bats provide to these farmers. According to their study, a lactating female bat can consume up to two-thirds of her body weight in insects in a single night.[3] Considering that more than 100 million Brazilian free-tailed bats forage every night in Texas, the implications are enormous. Bats provide an economic service to farmers in two ways: first, they increase crop yield by reducing the number of pests, and second, they decrease the number of pesticide applications needed. Without these services, Texan farmers in the eight-county Winter Garden area would lose 13.5% of their annual income from the lost cotton production (worth an estimated $5.5 million/year).[4] Moreover, pesticide use not only costs money, but also has its own environmental impacts. Increased crop pests make the possibility of organic farming less attainable. This analysis only accounts for the losses to part of Texas. On a national level, the economic losses due to decreases in bat populations would be devastating.

Why are Wind Turbines Killing So Many Bats?

Researchers currently do not understand why bat deaths occur in such large numbers near wind turbines. Hypotheses range from the poor placement of turbines to the idea that bats are attracted to wind turbines.[2] One hypothesis proposes that clearing land to construct turbines may create a favorable foraging environment for bats by attracting insects to open areas. Another suggests that as the wind energy industry develops, taller turbines will expand into airspace that was previously occupied only by high-flying species of bats. Bats may be evolutionarily wired to seek out the largest tree on the horizon to serve as a potential roost and mating location. Thus, it is possible that bats mistake the large turbines for roost trees and fly toward them, only to be killed by the rotating turbine blades or the negative pressure that they create, which causes their lungs to rupture. Additionally, scientists believe that bats find the heat or sounds produced by spinning turbines attractive or disorienting. Despite these hypotheses, there is an urgent need for further research into the factors that influence bat fatalities on wind farms.

For such small animals, bats have unusually low reproductive rates, with an average mother producing only one or two young each year. At this rate, it could take decades to reverse dramatic losses to bat populations.[4] The hoary bat, one of the most commonly killed species by wind turbines in North America, may not be able to sustain anticipated losses to its population within the next ten years.[2]

Finding a Solution

All too often, people are excited by the prospect of a new source of “clean” energy that they fail to recognize its negative externalities. Extracting wind energy where wind turbines do not conflict with migratory habits of bats could prevent significant fatalities. Knowledge about which factors are associated with increased bat fatalities could make it possible to improve wind turbine design and operations.

Research has shown that bats are more active on autumn nights characterized by low wind speed, low barometric pressures, and high cloud cover.[5] During these nights, there are two methods that can be used to stop turbine rotation. First, turbines can be programmed to start moving once a threshold wind speed, or cut-in speed, has been passed. Second, in a method called feathering, the blades can be oriented so they don't catch the wind. One study suggests that increasing the cut-in speed of wind turbines or feathering the turbine blades under these conditions can reduce bat fatalities up to 60%, while causing only a small loss in electrical power generation.[6] The industry's primary objection to such operational mitigation is loss of revenue. However, in the long run, if the wind energy industry fails to make such adjustments in their operations, a large decline in bat populations could be far more devastating economically and ecologically.

Other research findings present the possibility for further reductions in bat fatalities. Capping the height of turbines could also help prevent the exponential increase in deaths associated with increasing height.[7] Another study suggests that painting turbines with non-UV-reflective paints could decrease turbine visibility at night and prevent bats from mistaking turbines for roost trees.[8] Additionally, bats may be less likely to travel through an area with an induced electromagnetic field.[9] Further research is needed to determine the effectiveness and feasibility of these potential mitigation methods.

In a major Federal court decision in December 2009, a judge in Maryland ruled to stop the expansion of a $300 million wind farm on the basis that it would kill endangered Indiana bats.[10] This ruling would require the wind energy company to obtain a permit from the US Fish and Wildlife Service before constructing additional turbines. The permit would restrict the operation of wind turbines during peak periods of migration. Rulings like this serve as a reminder that renewable energy is not always synonymous with environmental sustainability.

As ongoing research reveals new solutions to solve the ecological problems associated with wind energy facilities, they should be implemented. Scientists at universities and various non-government organizations, such as the Bats and Wind Energy Cooperative and Cornell University's Laboratory of Ornithology, are at the forefront of this research and are taking a stance by recommending changes in policies and operational mitigation. Bat fatalities caused by wind turbines will result in ecological discord and simultaneously harm the economic interests of farmers. We need policy changes to help realize the public benefit of bats. These changes need to ensure that wind energy is both environmentally and ecologically sustainable, while still being economically viable.

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