Indiana Bat Fatalities at Wind Energy Facilities

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Updated August 2022

Wind energy is one of the fastest growing sources of renewable energy in the United States. The U.S. Fish and Wildlife Service is committed to working collaboratively with the wind industry and other partners to encourage responsible development of wind energy while protecting and enhancing the Nation's natural resources. One particular challenge has been an unforeseen byproduct of wind energy development … large-scale fatalities of bats at wind energy facilities. Much of the emphasis of early wind energy-wildlife research was on bird impacts. However, the results of more recent studies indicate that, generally, far more bats than birds are killed, particularly in the Midwest and Eastern United States. Increasingly monitoring efforts have focused on bat fatalities, and research to understand bat interactions with turbines is providing new insights into this problem.

Migratory tree-roosting bats including hoary bats, eastern red bats, and silver-haired bats (shown above) make up a large proportion of the bats killed by wind turbines but are not protected under Federal law.
Photo by Dr. R.W. VanDevender

Bat Fatalities

Studies of bat fatalities have shown that turbines have been consistently associated with fatalities of some species of bats in many different areas of the continent. Specifically, migratory tree-roosting bats including hoary bats (*Lasiurus cinereus*), eastern red bats (*L. borealis*), and silver-haired bats *(Lasionycteris noctivagans*) make up a large proportion of the bats killed. These species are not protected by the Endangered Species Act (ESA) and there is no international treaty, comparable to the Migratory Bird Treaty Act, to protect migratory bats. The number of bats of these species being killed at wind facilities far exceeds any other documented natural or human-caused sources of mortality.[1] Basic demographic information for these species is lacking, making it difficult to assess population-level impacts. However, recent modeling suggests that hoary bat population viability may be threatened by wind turbine fatalities.[2] Further, empirical evidence of decline in the hoary bat population in the Pacific Northwest over the period 2003–2018 has been reported.[3] Results of a study in Ontario, Canada strongly suggest decreased abundance of bats in the airspace over wind facilities over a seven year period (2010-2017), a finding consistent with other recent evidence of declining bat abundance (Davy et al. 2020).[4]

Some of the Indiana bat fatalities occurred at wind facilities located in open agricultural areas. The bats were likely migrating from summer to winter areas. Photo by National Renewable Energy Lab

Indiana Bat

The Indiana bat is a federally endangered species that ranges throughout 22 states in the eastern U.S. While there has long been concern that Indiana bats may be vulnerable to wind turbines, the first known fatality of an Indiana bat occurred in northern Indiana in September 2009, and a second fatality was documented at the same site in September 2010. Since then, there have been many additional fatalities of Indiana bats reported from wind facilities throughout the range of the species (Table 1 and Figure 1). To put these fatalities in context, it is important to understand that monitoring of bat fatalities at wind facilities is expensive and difficult. Not all facilities conduct fatality monitoring, and even when monitoring is conducted only a small proportion of dead bats are found. It is likely that additional Indiana bat mortality has occurred at these facilities and at other wind facilities throughout the range of the species.

These fatalities have heightened the awareness that Indiana bats are at risk from wind turbines and we urge operators of wind energy facilities within the range of the species to coordinate with the Service in assessing potential impacts to Indiana bats. The Service recommends that wind facility operators evaluate ESA prohibitions against take of endangered species, and work with the Service to minimize risk of violating those prohibitions.

USFWS's Endangered Species Act Responsibilities

As the principal federal partner responsible for administering the ESA, the Service takes the lead in recovering and conserving our Nation's imperiled species. As we work in partnership with others to conserve bats, our two major goals are to: 1) Protect endangered and threatened species and pursue their recovery; and 2) Conserve candidate species and species-at-risk so that listing under the ESA is not necessary. We also promote the voluntary conservation of other vulnerable wildlife. With reference specifically to wind energy development, our statutory authority and responsibility under ESA mandate that we work with the wind industry to address impacts to listed species, including the Indiana bat. Some facilities address those impacts through the development of Habitat Conservation Plans (HCPs) to provide for limited take of Indiana bats (associated with the wind facility) within the context of a species conservation plan. The Service is also working to raise awareness of the impacts of wind energy development on non-listed bats, particularly migratory tree bats, and promote measures that will reduce fatalities of all species of

bats. Such measures are in the best interest of bat conservation and are also in the best interest of industry if these measures preclude the need for future listings of species of migratory tree bats.

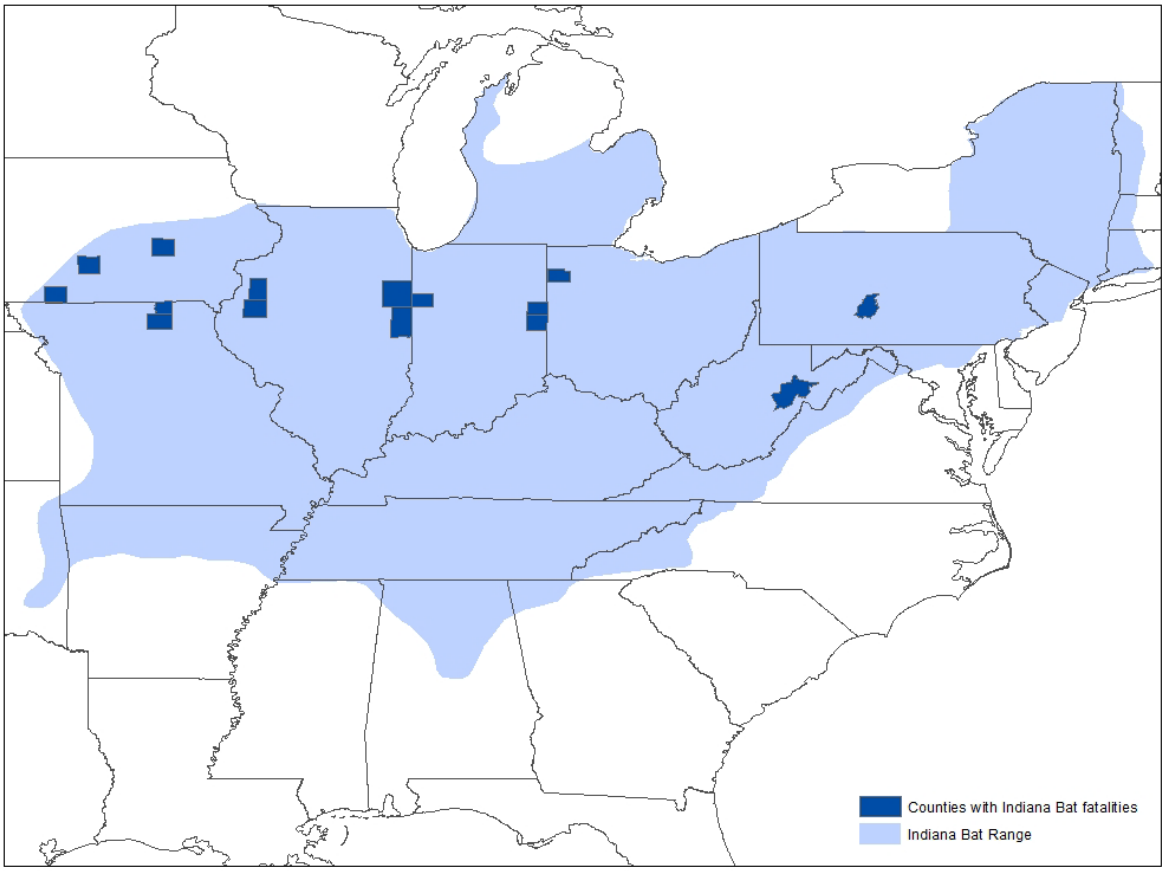

Figure 1 Location of documented Indiana bat fatalities at wind energy facilities relative to the range of the species.

Service Field Offices throughout the range of the Indiana bat are working with the wind industry to address impacts to Indiana bats, through HCPs and in some cases Section 7 consultations. Teams within the Service have been working to provide biologists with tools and information needed to effectively coordinate these projects, and to provide recommendations to the wind energy industry on mechanisms to comply with the ESA. One of these teams developed Service guidance for use in assessing the effects of wind energy projects on Indiana bats . Another initiative in the Midwest Region is the development of a short-term low effect HCP template available for wind facilities. This HCP provides conservation benefits to listed bats, while accommodating wind development where risk to Indiana and northern long-eared bats is expected to be low. Information on completed HCPs in the Midwest is available through our Environmental Conservation Online System.

In 2015 the wind energy industry endorsed a practice to reduce bat fatality at wind turbines; specifically, to feather turbines blades during the late summer and fall (fall bat migration season),

when wind speeds are below the manufacturer's cut-in speed. AWEA (2015) projected that this voluntary protocol could reduce bat fatalities by as much as 30 percent[5]; however, the extent to which the wind energy industry has adopted this practice is not known.

Summary

Solutions to the problem of reducing bat fatalities at wind turbines are not easy, but too much is at stake not to seek those solutions. These challenges come at a time when populations of many bat species, including the Indiana bat, are already threatened by white-nose syndrome, a disease that has killed more than 6 million bats. There is tremendous concern about declining bat populations and the accompanying decline in ecosystem services that bats provide. A paper published in Science estimates that bats typically save farmers $74 per acre, and that the value of bats to agriculture in the continental United States is roughly $22.9 billion annually.[6] Other ecosystem services provided by bats are just beginning to be evaluated, let alone quantified.

Above and beyond the services that can be assigned an economic value, bats provide cultural benefits ... well known to those who enjoy watching the silhouette of a bat against the night sky. The challenge before us is to work with the wind industry and other partners to provide for both sustainable wind energy development and sustainable bat populations.

The U.S. Fish and Wildlife Service is working with the wind energy industry to minimize mortality of Indiana bats, an endangered species.
Photo by USFWS

Table 1 Documented Indiana bat fatalities at wind energy facilities.

State	Estimated Date of Death	Sex	Age	Habitat Description
Indiana	September 8-9, 2009	Female	Adult	93% agricultural land use; less than 1% forest
Indiana	September 17, 2010	Female	Adult	93% agricultural land use; less than 1% forest
Pennsylvania	September 25, 2011	Female	Young of Year	Primarily forested area
West Virginia	July 7, 2012	Male	Adult	Forested Ridgeline with a few wetland resources (small streams and wetlands along the ridgeline)
Ohio	October 2-3, 2012	Female	Adult	Crop land and developed land are 98% of project area
Ohio	October 7-9, 2013	unknown	Adult	Crop land and developed land are 98% of project area
Ohio	April 13-14, 2014	Female	Adult	Crop land and developed land are 98% of project area
Indiana	August 23, 2015	unknown	unknown	88% agricultural land use; 6% forest
Iowa	July 13, 2016	unknown	unknown	89% agricultural land use; 5% forest
Illinois	September 23, 2016	unknown	unknown	Crop land and developed land are 92% of project area
Indiana	July 2017*	unknown	unknown	88% agricultural land use; 6% forest
Indiana	May 1, 2018	unknown	unknown	87.5% agricultural land use; 6.5% forest; 5% developed
Indiana	September 17, 2018	Male	unknown	87.5% agricultural land use; 6.5% forest; 5% developed
Indiana	September 18, 2019	unknown	unknown	88% agricultural land use; 6% forest
Iowa	September 1, 2020	Male	Adult	corn/soybean agriculture
Iowa	September 10, 2020	unknown	unknown	corn/soybean agriculture
Missouri	October 2, 2020	Male	unknown	79% agricultural/pasture; 21% forest
Indiana	October 9, 2020	unknown	unknown	88% agricultural land use; 6% forest
Ohio	October 13, 2020	unknown	unknown	Crop land and developed land are 98% of project area
Missouri	April 15, 2021	Female	Adult	79% agricultural/pasture; 21% forest
Missouri	May 28-June 2, 2021	Female	Adult	79% agricultural/pasture; 21% forest

Missouri	May 28-June 3, 2021	Male	Adult	79% agricultural/pasture; 21% forest
Missouri	May 28-June 2, 2021	Female	Adult	79% agricultural/pasture; 21% forest
Iowa	May 31, 2021	unknown	unknown	agriculture
Missouri	June 4-June 8, 2021	Female	Adult	79% agricultural/pasture; 21% forest
Missouri	June 10-June 14, 2021	Male	Adult	79% agricultural/pasture; 21% forest
Missouri	June 10-June 14, 2021	Male	Adult	79% agricultural/pasture; 21% forest
Missouri	June 17-June 21, 2021	unknown	Adult	79% agricultural/pasture; 21% forest
Indiana	August 3, 2021	Female	Adult	88% agricultural land use, 6% forest
Illinois	August 22, 2021	Male	unknown	Agricultural
Indiana	August 23, 2021	unknown	unknown	82% agricultural land use; 8% forest; 5% developed
Indiana	August 25, 2021	Male	Adult	88% agricultural land use; 7% forest
Illinois	September 9, 2021	unknown	unknown	Agriculture
Indiana	September 10, 2021	Male	Adult	88% agricultural land use; 6% forest
Indiana	September 14, 2021	Female	Adult	88% agricultural land use; 6% forest
Illinois	September 16, 2021	unknown	unknown	Agriculture
Indiana	September 20, 2021	Male	Adult	88% agricultural land use; 6% forest
Ohio	September 30, 2021	unknown	unknown	Crop land and developed land are 98% of project area
Illinois	August 7, 2022	Male	unknown	agriculture

**high uncertainty in estimated date of death; advanced decomposition of carcass when found on August 10*

[1] O'Shea, T.J., P. Cryan, D. Hayman, R. Plowright, D. Streicker. 2016. Multiple mortality events in bats: a global review. Mammal Review. DOI: 10.1111/mam.12064. Available at: http://onlinelibrary.wiley.com/doi/10.1111/mam.12064/full

[2] Frick W.F. et al. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. Biological Conservation 209:172-177.

[3] Rodhouse, T.J., R.M. Rodriguez, K.M. Banner, P.C. Ormsbee, J. Barnett, K.M. Irvine. 2019. Evidence of region-wide bat population decline from long-term monitoring and Bayesian occupancy models with empirically informed priors. Ecology and Evolution. DOI: 10.1002/ece3.5612.

[4] Davy, C,M., K. Squires, R. Zimmerling. 2020. Estimation of spatiotemporal trends in bat abundance from mortality data collected at wind turbines. Conservation Biology. https://doi.org/10.1111/cobi.13554

[5] Wind Energy Association (AWEA). 2015. Wind energy industry announces new voluntary practice to reduce overall impacts on bats by 30 percent.

[6] Boyles, J.G., P.M. Cryan, F.F. McCracken, and T.H. Kunz. 2011. Economic importance of bats in agriculture. Science 332:41-42. Available at: https://science.sciencemag.org/content/332/6025/41