



THE WILDLIFE SOCIETY

FACT SHEET

Impacts of Wind Energy Development on Wildlife



A turbine at the Dillon Wind Power Project in California. The landscape level planning process required to construct this project and others is designed to prevent and mitigate damage to wildlife and habitat (Credit: Iberdrola Renewables, Inc.)

Wind energy is one of several renewable energy options that can replace traditional fossil fuel energy sources and greenhouse gas emissions. Wind turbines can also cause direct and indirect impacts to wildlife through collisions, construction activity, and habitat loss and fragmentation. Managers can reduce the impact on wildlife through planning, mitigation efforts, monitoring, and research before and after construction.

The Wind Energy Boom

Wind energy is an increasingly important sector of the renewable energy industry. U.S. wind power capacity increased from 25,000 Megawatts (MW) in 2008 to 61,000 MW at the end of 2013.¹ Capacity has ballooned globally from 121,000 MW to 318,000 MW in the same time period.² Wind power now constitutes 4.1% of all electrical generation in the U.S., up from 1.8% in 2009.³ A burgeoning wind industry has positive implications for global greenhouse gas emissions, but the turbines and infrastructure surrounding them can have serious effects on wildlife and their habitat.

Migratory, tree-roosting species have been found to be especially vulnerable to wind turbines, particularly in the U.S. where facilities are sited on eastern, wooded ridges.⁶ Estimates of mortality rates in the eastern U.S. range from 20.8 to 69.6 fatalities per turbine.⁶ Researchers suspect that bat populations are severely impacted by these losses.⁶

Songbirds are also susceptible to collisions, but fatalities are usually not high enough to impact healthy populations.^{7,8,9} Migratory and resident species that are declining or of special concern can be further threatened by wind turbine related mortality if turbines are sited in high concentration areas or critical habitat.¹⁰

Methods that Reduce Impact of Wind Energy and Wildlife

Wind energy developers can employ numerous strategies to mitigate or prevent damage to wildlife or habitat. Strategies include turning off the turbines during migration, low wind, and warm weather, clustering construction around already fragmented, and siting turbines in low bird abundance areas.

Threats to Wildlife

Collisions

Fast moving turbine blades have proved lethal for several species of birds and mammals. Early studies in California found that raptors experienced high mortality rates, especially when compared to their low-reproductive rates and population sizes.^{3,4} Several studies have shown high mortality rates at specific wind farms that use old technology, are sited along migration corridors, and/or are in areas with high bird populations.^{3,4,5}

More recent studies have focused on bat fatalities at wind energy facilities.



The eastern red bat (*Lasiurus borealis*) is one of several migratory bat species most affected by wind turbines. Thousands of insectivorous bats are killed every year as they migrate south over turbine-lined ridges to their winter ranges.⁶ (Credit: Merlin D. Tuttle/BCI)

Habitat Degradation

The total amount of habitat permanently altered by wind energy can be small compared to other forms of land use.¹¹ However, surrounding habitat is still degraded in the near and long term by construction, roads, noise, human presence, and fragmentation.¹⁰ Studies have found that grassland birds and some mammals, including mule deer and elk, tend to avoid turbine pads, especially during construction.^{12,13,14} Species that rely on unfragmented, congruent habitat or specifically avoid anthropogenic activity are especially vulnerable.¹⁵ Entire wind farms, including a significant buffer around them, become unsuitable for species that avoid roads, buildings, and power lines such as prairie grouse.^{16,17,18}



Habitat destruction and fragmentation from the construction of wind turbines, roads, and other infrastructure along an Appalachian ridge in West Virginia. The loss of habitat and related degradation can have consequences for many wildlife species. (Credit: John Terry).

Opportunities to Reduce Threats

Avoiding Collision

Research has found that bat species most threatened by wind turbines tend to be most active in low wind weather, before and after storms, and during fall migration.^{19,20} One study found nearly 90% of fatalities occur from mid-July to late September during fall migration²⁰ while others found that most bats are killed on low wind nights.^{21,22} Bat mortality can be substantially reduced if wind turbines are turned off at these

high risk times.²³ Turbines can be placed in areas of lower abundance outside migratory pathways to avoid high bird mortality rates. Raptor mortality was much lower at certain wind farms with lower abundance of birds than at farms with large populations.^{3, 24, 25}



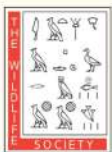
Mule deer overlook a wind farm in Columbia Hills, WA. Wildlife can be displaced by the noise, construction, and human activity associated with wind energy development. (Credit: Mike Schroeder).

Avoiding Habitat Degradation

Landscape level planning is essential to reduce the impact of wind energy development on wildlife. Wind farms can be placed to avoid critical habitat such as sage grouse leks or migratory pathways.¹⁰ Developers can also find ways to build turbines using the least amount of roads, transmission lines, and other infrastructure as possible to reduce fragmentation effects.⁹ The best option is often to site turbines on land that is already developed to make use of existing infrastructure and avoid disturbing intact habitat areas.⁹

1 American Wind Energy Association. 2014. U.S. wind industry annual market report year ending 2013. American Wind Energy Association, Washington, D.C., USA.
2 Global Wind Energy Council. 2014. Global wind report 2013 – Annual market update. Global Wind Energy Council headquarters, Brussels, Belgium.
3 Smallwood, K. S., and C. G. Thelander. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final report to the California Energy Commission, PIER-EA contact No. 500-01-019, Sacramento, California, USA.
4 Hunt, W. G. 2002. Golden eagles in a perilous landscape: predicting the effects of mitigation for wind turbine blade-strike mortality. California Energy Commission Report, Sacramento, California, USA.
5 Thelander, C. G., and L. Ruggie. 2000. Avian risk behavior and fatalities at the Altamont Wind Resource Area. Prepared for the National Renewable Energy Laboratory, subcontract no. TAT-8-19209-01, NREL/SR-500-27545, Golden, Colorado.
6 Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kearns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, and R. D. Tankersley. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management* 72: 61-78.
7 Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young Jr., K. J. Sernka, and R. E. Good. 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, Washington, D.C., USA.
8 Strickland, M. D., W. P. Erickson, G. Johnson, D. Young, and R. Good. 2001. Risk reduction avian studies at the Foote Creek Rim Wind Plant in Wyoming. Proceedings of the National Avian-Wind Power Planning Meeting IV. National Wind Coordinating Committee, Washington, D.C., USA.
9 Kuvlesky, W. P., L. A. Brennan, M. L. Morrison, K. K. Boydston, B. M. Ballard, and F. C. Bryant. 2007. Wind Energy Development and Wildlife Conservation: Challenges and Opportunities. *Journal of Wildlife Management* 71: 2487-2498.
10 Arnett, E. B., D. B. Inkley, D. H. Johnson, R. P. Larkin, S. Manes, A. M. Manville, R. Mason, M. Morrison, M. D. Strickland, R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. The Wildlife Society Technical Report 07-2. The Wildlife Society, Bethesda, Maryland, USA.
11 Bureau of Land Management. 2005. Final Programmatic Environmental Impact Statement on wind energy development on BLM administered land in the western United States. U.S. Department of Interior, Washington, D.C., USA.
12 Leddy, K. L. 1996. Effects of wind turbines on non-game birds in Conservation Reserve Program grasslands in south-western Minnesota. Thesis. South Dakota State University, Brookings, South Dakota, USA.

13 Leddy, K. L., K. F. Higgins, and D. E. Naugle. 1999. Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. *Wilson Bulletin* 111: 100-104.
14 Johnson, G. D., D. P. Young Jr., C. E. Derby, W. P. Erickson, M. D. Strickland, and J. Kern. 2000. Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming, 1995-1999. Technical report prepared for SeaWest Energy Corporation and Bureau of Land Management. Western Ecosystems Technology, Inc., Cheyenne, Wyoming, USA.
15 Johnson, D. H. 2001. Habitat fragmentation effects on birds in grasslands and wetlands: a critique of our knowledge. *Great Plains Research* 11: 211-231.
16 Braun, C. E., O. O. Oedekoven, and C. L. Aldridge. 2002. Oil and gas development in western North America: effects on sagebrush steppe avifauna with particular emphasis on sage grouse. *Transactions of the North American Wildlife and Natural Resources Conference* 67: 337-349.
17 Robel, R. J., J. A. Harrington Jr., C. H. Hagen, J. C. Pittman, and R. R. Reker. 2004. Effect of energy development and human activity on the use of sand sagebrush habitat by lesser prairie-chickens in southwestern Kansas. *Transactions of the North American Wildlife and Natural Resources Conference* 69: 251-266.
18 Pitman, J. C., C. A. Hagen, R. J. Robel, T. M. Loughlin, and R. D. Applegate. 2005. Location and success of lesser prairie-chicken nests in relation to vegetation and human disturbance. *Journal of Wildlife Management* 69: 1259-1269.
19 Reynolds, D. S. 2006. Monitoring the potential impact of a wind development site on bats in the northeast. *Journal of Wildlife Management* 70: 1219-1227.
20 Johnson, G. D. 2005. A review of bat mortality at wind energy developments in the United States. *Bat Research News* 46: 45-49.
21 Fiedler, J. K. 2004. Assessment of bat mortality and activity at Buffalo Mountain wind facility, eastern Tennessee. Thesis. University of Tennessee, Knoxville, Tennessee, USA.
22 Horn, J., T. H. Kunz, and E. B. Arnett. 2008. Interactions of bats with wind turbines based on thermal infrared imaging. *Journal of Wildlife Management* 72: 123-132.
23 Baerwald, E. F., J. Edworthy, M. Holder, and R. M. R. Barclay. 2009. A large-scale mitigation experiment to reduce bat fatalities at wind energy facilities. *Journal of Wildlife Management* 73: 1077-1081.
24 Anderson, R., N. Neumann, J. Tom, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2004. Avian monitoring and risk assessment at the Tehachapi Pass Wind Resource Area. NREL/SR-500-36416. National Renewable Energy Laboratory, Golden, Colorado, USA.
25 Anderson, R., J. Tom, N. Neumann, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2005. Avian monitoring and risk assessment at the San Geronimo Wind Resource Area. NREL/SE-500-38054. National Renewable Energy Laboratory, Golden, Colorado, USA.



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