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How Ecofriendly Are Wind Farms?

JEFFREY P. COHN



Despite producing clean renewable energy, wind farms, according to critics, disrupt the environment, alter habitat, and affect where some wildlife can live. Lesser prairie chickens in the Great Plains, for example, avoid nesting within 300 yards of tall structures, even if the habitat is otherwise suitable. This wind energy farm is at Foote Creek Rim in Wyoming. Photograph: © Ed Arnett, Bat Conservation International.

Paul Cryan was surprised and curious. Cryan had been studying bats since 1990, but only in 2003 did he learn that bats were being killed at wind energy farms. Cryan wanted to know why the bats, whose visual and echolocation abilities allow them to find and catch flying insects at night and avoid obstacles in the dark, run into or otherwise are killed by rotating turbine blades. Why would bats be around wind turbines in the first place? And which species were most at risk?

"It took all of us by surprise," says Cryan, a research biologist at the US Geological Survey's Fort Collins Science Center in Colorado. Cryan was speaking of the bat community's reaction to news that hundreds of the flying mammals had died one night at Mountaineer Wind Energy Center in Thomas, West Virginia, and, later, at other wind farms throughout the United States, Canada, and Europe. "The researchers [at Mountaineer] were looking for birds, not bats. It was so strange. We had not seen bats

killed before in substantial numbers at any human structures."

Not just bats but also birds are killed at wind farms, which have been touted as more environmentally friendly energy sources than coal, oil, and gas. After all, wind turbines produce no air, water, or thermal pollutants, and emit no greenhouse gases. "If we don't do wind, we'll wind up doing coal," warns Robert Thresher, director of the National Wind Technology Center at the US Department of Energy's National Renewable



Eastern red, hoary, and silver-haired bats are 3 of the 11 North American species that have been most often killed by wind turbines. All three are migratory, insect-eating, and tree-roosting species. Wildlife biologist Joseph Szewczak of Humboldt State University thinks the tall turbine towers attract tree-roosting bats, but the blades move too fast for even echolocating bats to detect and avoid once they get too close. Szewczak also found bats can be deterred from wind turbines, especially in the West, by use of ultrasound, although the high attenuation rate of ultrasound transmissions may limit their usefulness. Photographs: © Merlin D. Tuttle, Bat Conservation International.

Energy Laboratory in Golden, Colorado. Wind farms may fragment the environment, however, and make it unusable for some birds.

The toll

The amount of energy derived from wind farms has grown from 10 megawatts (MW) in 1981 to 1848 MW in 1998 to 18,308 MW in 2008, according to the Department of Energy. Some predict it will reach 100,000 MW by 2020. Today, wind generates less than 2 percent of all electricity in the United States, but that could reach 7 percent by 2020 and perhaps as much as 20 percent by midcentury.

Hints that wind farms might harm wildlife first surfaced at the Altamont Pass Wind Area, the oldest commercial wind farm in the United States, located about 50 miles east of San Francisco. Researchers found dead birds there in the late 1980s. Shawn Smallwood, an independent ecologist who studied birds at Altamont from 1999 to 2007, estimates that perhaps 10,000 birds are killed annually at the site. About 10 percent are golden eagles, red-tailed hawks, American kestrels, and burrowing owls, the latter a California species of special concern.

Most bird deaths occur at three California wind farms, all built in the early 1980s: Altamont (where dozens of people were injured and one person killed at a Rolling Stones concert in 1969), Tehachapi, and San Geronio (just west of Palm Springs). Although they appear to move slowly, turbine blades can hit speeds of 180 miles an hour at their tips, which means they're moving so fast that birds or bats can't see them. The turbine blades on newer wind farms, which are larger and reach higher into the sky, rotate slower and are farther off the ground, allowing raptors to fly under them. But larger blades have raised concerns for migrating passerines, says Michael Fry, the American Bird Conservancy's director of conservation advocacy.

Fry estimates that between 3 and 11 birds are killed by each turbine each year, amounting to as many as 100,000 birds nationwide. If wind energy grows to 20 percent of electricity generated over the next couple of decades, the number of birds killed could jump 30-fold. "That's a significant number in anybody's book," he says.

By comparison, about 50 million birds die each year in collisions with communications towers, 80 million are killed by cars, and 3.5 million strike windows, says

Dale Strickland, president and chief executive officer for Western Ecosystems Technology, Inc., a consulting company in Cheyenne, Wyoming. Those figures may make the number of birds killed by wind farms seem trivial, but wildlife biologists point to the cumulative effect of all human-related causes of bird deaths, Strickland says. "We need to do everything we can to prevent any mortality," Fry adds.

Estimating bat deaths at wind farms is far trickier. No one knows how many are killed each year, says Edward Arnett, conservation scientist at Bat Conservation International in Austin, Texas. One reason: injured bats, smaller and harder to find than birds, can easily hide under fallen leaves or other debris. Scientists have to start early every morning to beat scavengers to carcasses. And researchers usually assume they miss many dead bats.

"We just don't have any good data," says Robert Barclay, a professor of biological sciences at the University of Calgary in Alberta, Canada, who has studied bat deaths at wind farms. What data have been generated often come from the wind energy industry, whose information is proprietary and often unpublished, Arnett adds. "It may take us several years to get the data we need," he says. A

For more information, visit these sites:

www.batcon.org

www.fws.gov/habitatconservation/wind.htm

www.eoearth.org/article/Altamont_Pass_California

2007 Wildlife Society report estimates that more than 50 bats are killed per turbine each year at some wind farms, almost five times the high estimate for birds. One New York study found three dead bats for every bird killed, said Alexander Hoar, a US Fish and Wildlife Service biologist.

Possible causes

Whatever the number, bats from 11 of the 45 North American species have been killed at wind farms. None are endangered or threatened species. About three-fourths of the deaths come from just three species: eastern red, hoary, and silver-haired bats. All are tree-roosting species, although cave-roosting Mexican free-tailed bats have been killed too. Most deaths occur in August and September, when bats are migrating, especially on low-wind nights when they are most active.

Whether the number of dead bats is significant is unclear. Although the number of cave-roosting bats can be estimated, there are no good population figures for any tree-roosting species, nor is it known how many migrate through any area, says Thomas Kunz, director of Boston University's Center for Ecology and Conservation Biology. "We know so little about what goes on [biologically] above the earth's surface," Kunz states.

Also unclear is why birds and bats fly into wind turbines. Fry thinks raptors are so focused on prey and dive in such a straight line that they do not see the rotating blades or consider them a danger. Smallwood says the birds cannot see the moving turbines when they get within

30 feet of them. He also says most of the dead raptors are young, inexperienced birds.

Citing a phenomenon called motion smear, William Hodos, professor emeritus of psychology at the University of Maryland, says objects approaching close to our eyes appear to move across the retina so quickly that we see them as a transparent blur. On the other hand, objects far away seem to move slowly. Think of a high-flying airplane moving across the sky. "It hardly appears to be moving," Hodos says. "The eye cannot process the information once the bird gets close enough to rapidly moving blades. They become transparent."

Bats represent a different problem. One possibility, Cryan says, is that they may be drawn to rotating blades, which they sometimes chase. He theorizes that bats are naturally attracted to the largest trees in their habitat as potential places to get food, roost, or find mates. In many habitats, the tallest "trees" are the poles on which wind turbine blades are mounted. Cryan thinks red and hoary bats form leks, or mating arenas, and so gather around the poles.

As they fly past, some bats are hit by the rotating blades. But 70 percent of dead bats found on the ground at some sites have no broken wings, crushed skulls or other physical injuries from being hit, Kunz says. Rather, they have ruptured lungs similar to those seen in scuba divers who surface too quickly. Perhaps the bats were killed after being caught in the wind vortex created by the turbines.

What to do?

"We recognized the problem and have taken steps to address it," answered Laurie Jodziewicz, manager for siting at the American Wind Energy Association. Jodziewicz says the industry has built new solid-structure poles with fewer places for birds to perch, redesigned the tops of turbines to discourage birds from alighting, tested acoustic and other means of deterring birds and bats from flying around wind turbines, and funded studies to learn how many bats die and the causes of their death. One wind energy company even moved a proposed wind farm at Foote Creek Rim in Wyoming more than 150 feet to avoid an area where raptors often flew, Strickland says.

Positive steps, yes, but not all wind industry critics have been won over. Kunz, for one, wants wind farms to feather their blades, turning blade edges into the wind so they do not operate during periods of bat migration and low winds. He also wants the US Fish and Wildlife Service and other federal and state agencies to regulate where wind farms can be located and how they are operated; he suggests using pilot projects until the effects of wind farms on wildlife are better understood. Others have proposed a "green certification" program to encourage environmentally friendly wind farms.

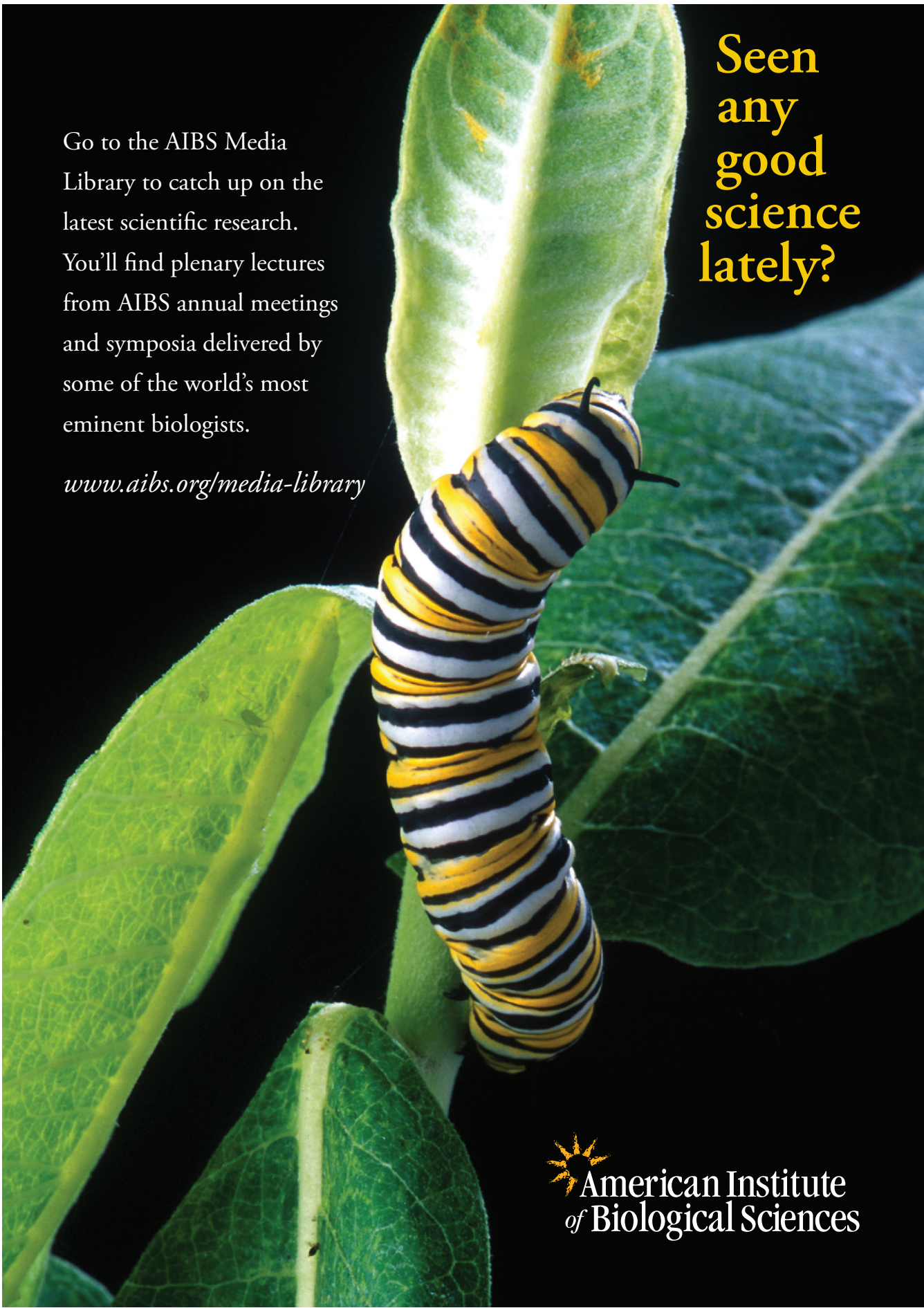
"We want these alternative energy technologies [like wind power] to go ahead," says Michael Hutchins, executive director and chief executive officer of the Wildlife Society, "but in ways that minimize the impact on wildlife."

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