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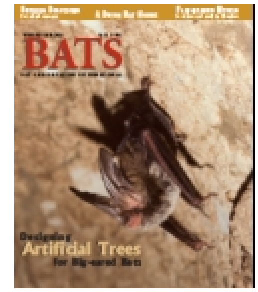

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Seeking Solutions for Wind Energy
Scientists explore strategies
Ed Arnett

This much is clear: Wind-energy facilities across North America are killing alarming numbers of bats. That is now well documented. Preventing those bat kills is a more difficult challenge. The Bats and Wind Energy Cooperative (BWEC), led by BCI, is busily testing hypotheses and exploring promising new directions, including a major effort to identify wind-energy sites that are least risky for wildlife. Scientists are also conducting pioneering research on possible acoustic deterrents that might steer bats away from danger.

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Research by BWEC and others has documented bat fatalities at all wind-energy facilities studied across North America and Europe, many with kill rates that scientists suspect could put entire species at risk. Our study of the Mountaineer Wind Energy Center in West Virginia concluded that its 44 turbines on a forested ridge top killed between 1,364 and 1,980 bats in just one six-week period of 2004. And while mounting evidence suggests that forested ridges in the eastern United States are high-risk sites, a recent report of high bat kills at a wind farm in Alberta, Canada, is especially disturbing because it is located on open prairie, which had been considered relatively safe for bats.

Meanwhile, industry estimates indicate wind-energy installations could increase by 50 percent in 2008 and by 150 percent by 2010. Unless real solutions are found quickly, this could prove a disaster for bats. The industry's response has been mixed.

Almost immediately after the Cooperative reported the tremendous progress made during the 2004 field season, which confirmed the extent of bat kills, permission was withdrawn for BWEC scientists to continue their critical research at the Mountaineer (West Virginia) and Meyersdale (Pennsylvania) Wind Energy Centers (*BATS*, Fall 2005).

That setback forced me, as coordinator of the Cooperative, to completely refocus and redesign our research program on very short notice. One major new direction is pre-siting risk assessment: a systematic attempt to identify potential wind-energy sites that pose minimal hazards to bats. The challenge of accurately gauging risk requires extensive tests of the techniques and tools to study bat behavior at specific sites and to correlate that data with bats' often-fatal interactions with wind turbines.

Fortunately, some "green-energy" companies recognize the value of working with scientists to understand and solve wind-energy threats to bats. PPM Energy, a Scottish firm with U.S.

headquarters in Portland, Oregon, has offered its full cooperation for BWEC to study several proposed wind sites in the eastern United States. With the help of PPM Energy's Sam Enfield and Andy Linehan, I was able to quickly design and implement the most extensive study ever conducted to evaluate the use of acoustic detectors to predict bat kills at a proposed wind farm.

So our bat detectors, placed up to 144 feet (44 meters) above a forested ridge in south-central Pennsylvania, were listening when a lone little brown myotis (*Myotis lucifugus*) emerged from its roost under the loose bark of a dead oak tree. The detectors heard the foraging bat send its ultrasonic hunting beeps into the evening in search of its insect prey. Suddenly, the beeps became a buzz. The bat homed in on a moth, dove at it and scooped up the hapless insect. Then the bat flew off in search of its next victim.
This little drama – along with thousands of others – was recorded and is being analyzed and correlated with mounds of other data. That hungry little brown myotis may well have contributed to its own future safety and that of countless other bats in Pennsylvania and around the country.

This unprecedented study of bat activity was developed in partnership with ecologist John Hayes, formerly of Oregon State University and now with the University of Florida, and statistician Manuela Huso of Oregon State University. The goals are to precisely document the levels and patterns of activity of bats at the site before construction begins and to correlate activity with weather and other environmental variables. Then we will determine if (and how) pre-construction monitoring of bat activity can predict post-construction fatalities at this and other proposed wind facilities.

We attached Anabat II acoustic detectors on meteorological towers that are used by energy developers to record such weather variables as wind speed and direction, temperature and barometric pressure. The "met" towers allowed us to record bat calls as high as the lower sweep of the turbine rotors (144 feet [44 meters]). We also used 72-foot (22-meter) portable, telescoping towers to deploy a vertical array of detectors for acoustic sampling. We monitored planned turbine locations on a forested ridge and an open-country ridge.

We detected nearly 10,000 echolocation calls from August 1 to October 31 in 2005, and were back at the site from April through October this year. Bat activity was highest from mid-August through mid-September with brief peaks in October. An intriguing observation: This pattern of rising and falling activity over time is similar to that seen in bat kills recorded at existing wind farms.

The study found that activity patterns differ among species groups. Bats that emit echolocation calls at frequencies greater than 35 kilohertz, such as the little brown myotis, tended to be detected more often near ground level. Lower-frequency echolocators, such as the hoary bat (*Lasiurus cinereus*), were more often found higher up. The two species groups showed roughly the same activity at an altitude of 72 feet (22 meters).
Different species of bats sharing the same environment have been shown to forage at different altitudes, a strategy that probably helps them partition food resources. Scientists are finding similar patterns at additional facilities.
Researchers also correlated bat activity with a number of weather variables. For example, total bat activity increased with rising nighttime temperatures up to about 66 to 70 degrees F (19 to 21° C), after which activity began to decline. However, this temperature-related difference in bat activity generally de-clines with altitude up to 144 feet (44 meters), where it has no observable impact. The temperature correlation is similar for both species groups

and in both forested and open habitats.
Two seasons into this five-year study, we have a great deal of important data awaiting intensive analysis. At this very preliminary stage, some intriguing observations are emerging, but their importance for wind-energy siting decisions is not yet clear. Much work remains.

Our team will be back at the Pennsylvania site next year to collect acoustic data while the facility is being built. Then bat activity and kills will be monitored from April through October in 2008 and 2009. When our analyses are complete, we will know if acoustic surveys can predict the risk of bat kills at proposed turbine sites.

Until we learn to identify where turbines can be safely placed – or develop devices or strategies for keeping bats away from the spinning blades – wind energy will continue to kill bats at rates that could ultimately threaten their survival and the health of ecosystems they support.

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