

# On a Wing and Low Air: The Surprising Way Wind Turbines Kill Bats

*It is the pressure change--not the blades--that wipe out thousands of bats annually at wind farms*

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By David Biello, Scientific American



**BAT KILLER:** The zone of low pressure behind wind turbine blades seems to be responsible for killing migrating bats--though it remains unclear what is attracting the bats to the wind turbines in the first place.

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Scientists have known since 2004 that wind farms kill bats, just as they kill birds, even though the flying mammals should be able to avoid them. Many biologists thought that the bats, like their avian counterparts, might be falling victim to the fast-spinning turbine blades. But an examination of 188 hoary and silver-haired bats killed at a wind farm in southwestern Alberta in Canada between July and September in 2007 showed that nearly half showed no external injuries—as would be expected if the giant blades had smashed the flying mammals to the ground.

Instead, 90 percent of the 75 bats the researchers ultimately dissected had been killed by burst blood vessels in their lungs, according to results presented in *Current Biology*—suggesting that the air pressure difference created by the spinning windmills had terminated them, not contact with the blades.

"As turbine height increases, bat deaths increase exponentially," says ecologist Erin Baerwald of the University of Calgary in Alberta, who led research into the deaths as part of her master's project. "What we found is a lot of internal hemorrhaging."

As the wind moves through a wind turbine's blades, pressure drops behind them by five to 10 kilopascals (a pascal is a unit of pressure), and any bat unlucky enough to blunder into such an undetectable low pressure zone would find its lungs and blood vessels rapidly expanding and, quickly, bursting under the new conditions.

The Summerview wind farm, which Baerwald studied, kills hundreds of bats every year, particularly during the fall migration period that has just begun. But bats that find their way via sonar should have no trouble detecting fast-moving objects like the 200-foot- (60-meter-) long blades on the 300-foot- (90-meter-) tall turbines that spin as quickly as 160 miles (255 kilometers) per hour. And before the installation of these new, taller turbines bat kills had been practically nonexistent.

Pressure drops of as low as 4.4 kilopascals kill common lab rats and all the bats autopsied showed internal damage and bleeding consistent with this type of death, known as barotrauma. "If bats have a lungful of air as they fly through the air-pressure change, there's nowhere for the air to go," Baerwald explains. "The small blood vessels around the lungs burst and fill the lungs with fluid and blood."

This may also explain why, although some birds are killed by wind farms, the majority of casualties are bats. Birds' lungs are much more rigid and their capillaries are stronger, making them capable of withstanding extreme pressure changes, according to Baerwald. Those birds that are killed typically show damage from being struck by the actual turbine blade. "This offers an explanation of why bats, once they come across these turbines, are so likely to end up dead," says research biologist Paul Cryan of the U.S. Geological Survey, who has studied the issue but was not involved in this study. But "we don't have a satisfying explanation for why we're seeing such large numbers of bats. It seems they're being attracted to turbines."

Wind farm owners are well aware of the problem—and the potential hit to their environmental credibility. The corporation that owns Summerview, TransAlta Wind, along with ENMAX, Suncor Energy, Alberta Wind Energy and even Shell Canada teamed with Austin, Tex.–based Bat Conservation International to fund this study led by Baerwald. (TransAlta did not return calls for comment.)

It is unclear what measures, if any, can be taken to eliminate this pressure problem other than stopping turbines from spinning during times of lighter winds at night when bats tend to be most active. Of course, that would also curtail their electricity production: An experiment in August 2007 that stopped 19 of Summerview's turbines when winds fell below 18 feet (5.5 meters) per second cost TransAlta at least \$50,000 in lost electricity production.

In the future, bat conservationists suggest, wind farms should be built away from known bat migration flight paths. The problem is: bat migrations are poorly understood at best. "We don't even know if they use migratory routes," Baerwald says, though she plans to begin looking for them in September.

"We don't have a clear idea of what a bad site for wind turbines is in terms of bat fatalities," Cryan adds. "We're not to the point yet where we can suggest solutions."

The full impact of these bat-killing pressure zones extends far beyond the wind farm, however. Such migrating bats travel from Canada as far as Mexico, eating thousands of insects en route, including crop pests such as moths and beetles. "They are one of the only things that fly around at night and eat bugs," Baerwald notes. "Bats killed in Canada could have a detrimental impact in America or Mexico. It's not local. It's an ecosystem-wide issue."

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