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Fungus is killing bats at an alarming rate

A mysterious white fungus is appearing in populations throughout the Northeast. Can bats be saved?

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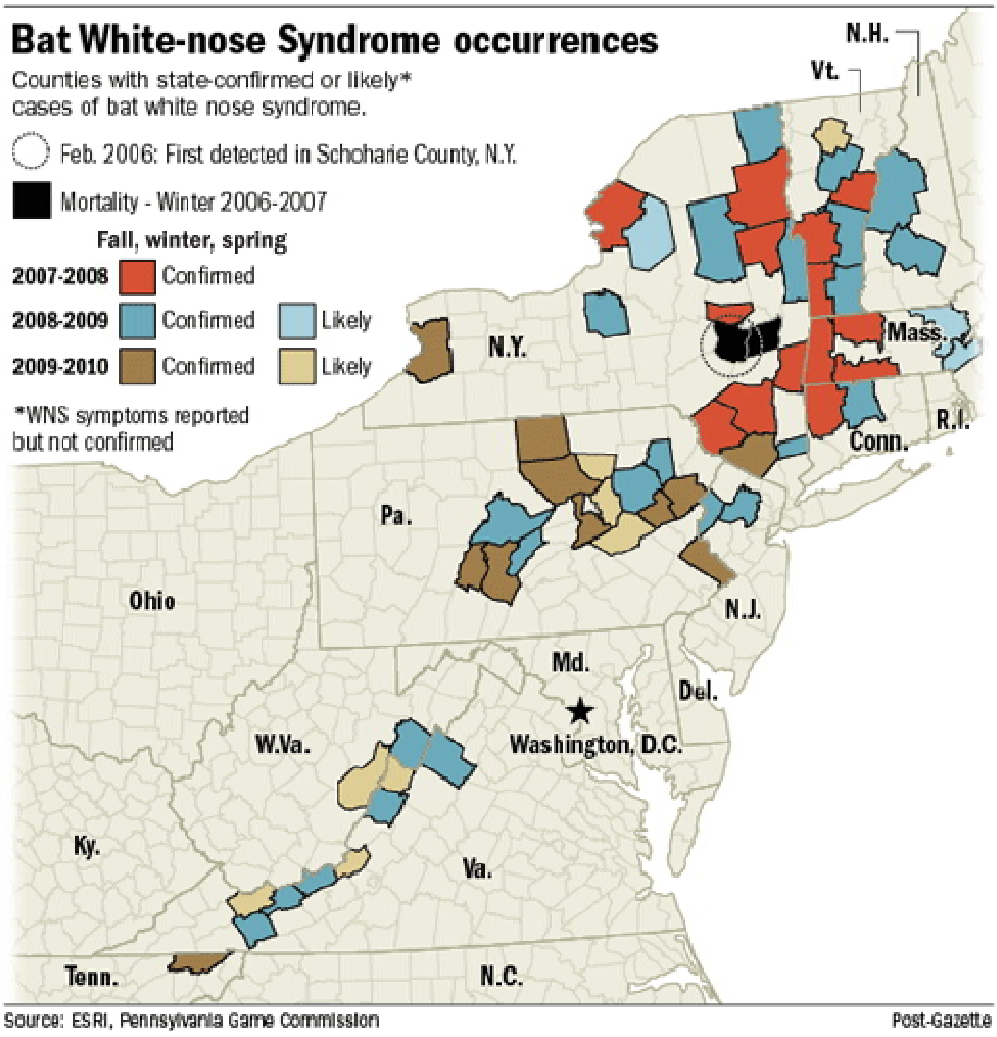
Darrell Sapp/Post-Gazette
A little brown bat wakes up inside Atkins Cave near Milroy in Mifflin County.

MILROY, Pa. -- Deep in a cramped cave gouging into a Mifflin County hillside, three young biologists crawled and twisted through a narrow passage, lifting their head lamps toward a sloped stone ceiling that should have been carpeted with hibernating bats.

Illuminated in fidgety circles of light, a few bats dangled alone, while others hung in small clusters. Many were dead -- rock-hard lumps stuck to the stone or littering the cave floor. Light and heat from the head lamps slowly awakened the living. Tiny eyes blinked, wings slowly unfolded and teeth bared at the intruders. Most had tell-tale white mustaches of fungus, unmistakable clues in a biological mystery unfolding throughout the Northeast.

Four years ago, folks near Albany, N.Y., reported bats lying dead in the snow or flying around on winter days when they should have been hibernating. Biologists exploring

nearby caves discovered hundreds of bats that had died in hibernation with a curious white fungus on their mouths and noses.



Following an otherwise normal spring and summer, bats were again found dead in hibernation, dusted with the same unidentified fungus, in a range that had spread northeast to New England and south into eastern Pennsylvania and New Jersey. In well-known hibernation sites that had been studied for decades, researchers found dead bats by the thousands -- in some caves, mortality rates were 80 to 90 percent.

The outbreak was given a name: White-nose Syndrome.

"For a lot of people, bats are creepy," said DeeAnn Reeder, a biology professor at Bucknell University in Lewisburg, in central Pennsylvania, where much of the research into White-nose is taking place.

"They're like little flying mice and [people] are afraid they'll get in their hair. But bats play a vital role in the environment. Without them our lives would be quite different."

Bats eat bugs. In summer, female bats of some species can eat their body weight in insects in a single night. No one knows the actual number of bats or bugs, but most of the night-flying insects eaten by bats are pests of forests, agriculture and gardens, and some carry diseases infectious to humans. Without the vital buffer of bats in the food chain, insect populations could soar.

At a strategy conference in Austin, Texas, last year, the small cadre of scientists researching the syndrome agreed that much about the abrupt mass deaths remained a mystery. The previously unknown cold-climate fungus -- it was named Geomyces destructans because of what it's doing to bats -- is similar to fungi common in Europe; it may have existed naturally but undiscovered in North American caverns.

It is not dangerous to humans, pets or farm animals, but has impacted six nonmigratory species: big brown, little brown, small-footed, northern long-eared, eastern pipistrel and the federally protected Indiana bat. Migratory, tree-roosting bats are rarely affected.

The bats appear to die of starvation during hibernation, but scientists still cannot confirm that the fungus is the primary cause of death. What they know: White-nose Syndrome is spreading fast, but not uniformly. It leapfrogs from affected areas to popular recreational caving sites, leading researchers to suspect that microscopic fungal spores get onto clothing worn by cavers, who unintentionally carry it to new sites. Some researchers speculate that European cavers may have innocently brought the spores to America, where native bats have no natural resistance. Others suspect spread of the fungus is more likely a naturally occurring anomaly.

In three years since the onset of the outbreak, more than a million bats have died in the Northeast. They would have eaten 694 tons of insects, and scientists are worried about the impact of the sudden break in the food chain. In a report released at the conclusion of last year's conference in Austin, scientists described White-nose Syndrome as "devastating," responsible for "the most precipitous decline of North American wildlife in recorded history."

"The truth is bats are dying off so fast we might not be able to save them," said Dr. Reeder, who participated in last year's conference. "The little brown bat, the most common bat in North America, could be extinct and other species endangered in seven to 30 years.

"Our work here may save them farther west, but we are not going to be able to save the bats in Pennsylvania. What that means to us we don't know, but it can't be good."

The bat cave

To avoid putting undue stress on the vulnerable mammals, the nonprofit wildlife group The Nature Conservancy has banned entry to all of its caverns including Aitkin Cave, a well-known hibernation site in a 43-acre preserve in Mifflin County. One exploration was

permitted for several hours this year, and in January a small team of researchers -- hard hats and head lamps in place -- descended into the dark, cramped cavern.

Just outside the entrance, recording devices had been set up by the Pennsylvania Game Commission and Bat Conservation International to monitor the high-frequency chirp of bats flying out of the cave at a time when millennia of evolution should be telling them to hibernate. The acoustic study, duplicated at a site in Kentucky, will illuminate researchers about the unnatural exodus. Inside the narrow opening's iron gate, 4-foot icicles dripped from the stone ceiling. A few yards in, a little brown bat hung motionlessly from the ceiling. Nearby, more huddled together in hibernation. Clearly visible on their noses, mouths and the thin membranes of their wings was a dusting of white.

"Dead," said Dr. Reeder to a pair of graduate students accompanying her. "Here's one that's barely alive."

The cave, which cuts more than a mile under hilly farmland, maintains a constant chilly temperature inside. Curiously, many little brown bats were clustered near the colder, less protected entrance.

Deeper inside, endangered mammal specialist Greg Turner and biologist Nathan Havens of the Game Commission, and forest ecologist Dr. Scott Bearer of The Nature Conservancy, counted bats.

"We were here about the same time last year when the site was just getting White-nose," said Mr. Turner, crouching against the cavern wall. "Typically, there'd be about 2,000 to 3,000 bats in this area. So far, we've counted about 500 and a lot of them are dead."

Most of the bats should have roosted in deeper cave rooms, but one of the mysteries of White-nose is the tendency of affected bats to move closer to the colder entrance. Like all hibernating mammals, bats have a routine arousal pattern, waking from hibernation about every 14 days. A huge amount of energy is burned by raising the body temperature from the ambient 44 degrees of the rock surface to the bat's normal 100 degrees, and then cooling again into hibernation.

"When they get White-nose, what we're seeing from our data is they're arousing much more often -- every three to seven days," Mr. Turner said. "What's going on may be the fungus is irritating them, waking them up too frequently. ... They deplete their energy stores and die."

In laboratory tests, he said, bats hibernating in colder temperatures arouse less frequently, only once every 20 days. That could prove to be a key finding.

"We think [White-nose] bats may recognize they don't have the energy stores to arouse more frequently," Mr. Turner said, "so they're relocating to colder areas near the front where they won't awaken as often."

Back at the entrance, while her grad students bagged samples, Dr. Reeder crawled outside.

"Sometimes we find dead bats in a ring around trees," she said, pointing to the forest. "We're not sure exactly, but I think their body fat gets so lean they wake up and think it's spring and it must be time to go out and feed, but they don't find any food. Or their brain is telling them, you're about to starve to death -- go look for something to eat. So the bats have flown out, not found insects in the winter, roosted in a tree, died and fell straight down. Give us another month and the ground here will be littered with carcasses."

That doesn't mean, said Misty Edgecomb, a media manager for The Nature Conservancy, that all the bats in the world are dying.

"We don't want to sound alarmist," she said, "but it is possible that populations and even species could be really struggling. ... Such a population decline as we're seeing will take bats a long time to recover from."

"You try not to over-interpret, but at the same time I won't sugarcoat it," Dr. Reeder said. "We're seeing 80, 90, 95 percent mortality in some of these caves. We come back the next year -- another 90 percent mortality. I mean, how long can that go on?"

Back at the lab

The scientific method is a slow, deliberate process of calculated research, peer review and publication of results. But because of the urgency to stop or at least slow the wildfire spread of White-nose, researchers are speeding the process.

To prevent duplication of work, independent facilities quickly forge new partnerships and share information that would ordinarily be considered proprietary. Some lab tests are rushed into the field, risking unintended consequences for other species. By normal scientific standards the research is fast and loose. The closest thing it has to a coordinator is Jeremy Coleman of the U.S. Fish and Wildlife Service.

"I would say this [outbreak] is extremely serious, other times I've called it an ecological disaster," he said in a phone interview from Washington, D.C. "It's a real problem, chiefly because there's no end in sight and we have no way to stop it. I'd like to think we're making good progress, but I suspect sadly that's not true."

Back at Bucknell, Dr. Reeder hurried across campus, overseeing her own experiments and those of grad students. In a former storage room on campus, she stepped gingerly through a dark, fenced, temperature-controlled flyway observing bats in an artificial habitat that mimics the real thing.

White-nose Syndrome, she said, has changed her life. Dr. Reeder grew up in Northern California immersed in nature -- hiking, watching and learning about everything. After graduating from the University of California at Berkeley, she worked at the Smithsonian

Institution co-authoring a two-volume book, "Mammal Species of the World: A Taxonomic and Geographic Reference" (Johns Hopkins). She earned her doctorate at the University of California at Davis, returned briefly to the Smithsonian and in 2006 took a job as a biology professor at Bucknell.

"In my lab we were doing a lot of field work, looking at immune responses in hibernating bats," she said. "All hibernators do these periodic arousals, and we don't know why. One of the leading hypotheses is it's an immuno-surveillance system. They have to warm up, see if there's any [diseases] they have to fight off, and then go cold again. Those warm-ups, we think, are about periodically booting up all their physiological systems."

Soon after she began her research, she got calls in the same week from the Fish and Wildlife Service, the Game Commission and a former college adviser about a mysterious new threat to bats marked by an unusual fungus.

"I was right in the middle of it, geographically and through my research," she said. "Then, literally, everything shifted. My lab with the flight cage is uniquely suited to study artificial hibernation and do some of these temperature manipulations. This has been good for my career, in a very, very sad paradoxical way."

But the scientist soon found that the breakneck research put a lot of stress on her and her family. She is married and the mother of two children, one with special needs.

Dr. Reeder's travel to White-nose related meetings has interfered with her teaching responsibilities.

"I have to ask colleagues to pick up some of my lectures," she said. "Last year Fish and Wildlife bought out one of my classes so I'd have more time for the research. I feel like I have two jobs. I'm chronically sleep deprived. I chew a lot of Tums. I take a lot of Advil."

Hidden answers

Despite strong evidence that human caving activity spreads the fungus, government edicts can't prevent people from legally entering caves and mines located on private property. In hopes of slowing the spread of the syndrome, caving has been banned at sites managed by the National Park Service, the U.S. Department of Agriculture Forest Service and The Nature Conservancy, and on public lands in states including Pennsylvania, New York, Vermont and Tennessee, where White-nose was confirmed several weeks ago.

As a precaution, spelunking is prohibited on public land in Missouri and other Midwest states. Weeks ago, the Tuscon, Ariz.-based Center for Biological Diversity, which works to save endangered species and lands, petitioned the U.S. government to close all caves and mines under federal jurisdiction.

The National Speleological Society has cooperated, posting news updates for its 12,000 cavers, launching a drive for research funding and providing instructions on decontaminating caving gear.

"But there's a whole other community out there -- I call them the 'yahoos' -- who aren't going to listen to this," Dr. Reeder said. "Two of our field sites -- one here, one in Michigan -- were broken into. They tampered with equipment [and] pushed all the buttons on the telemetry receiver boxes."

Researchers talk of a potential worst-case scenario in which a Pennsylvania caver innocently crawls into a Colorado cavern, opening a second front for White-nose.

Scientists also are looking at compounds that could kill the fungus. Terbinafine, the active ingredient in the athlete's foot treatment Lamisil, has shown promise. Dr. Reeder said she has successfully tested a natural product in the lab and has begun field trials. In New York, researchers are considering launching field tests of another product in infected caves.

Dr. Reeder said she's concerned about the speed at which new antifungal products are rushed to the field but she's also worried they're not being introduced fast enough to stop White-nose. Scientists hope to set up firebreaks to stop the biological wildfire -- find something that works and get it to key sites to keep the syndrome from spreading west.

Despite concerns that White-nose would spread to Western Pennsylvania by last year, there's no sign of it so far. Barton Cave, a well-known hibernation site near Uniontown, Fayette County, has been closed to cavers and researchers are monitoring bat arousal patterns in the cave.

What the research really needs, Dr. Reeder said, is money. Today, the entire White-nose Syndrome research community in academia, wildlife agencies and nonprofit organizations includes fewer than 100 people. Funding to hire personnel, she said, is hard to get when you're talking about creepy, crawly bats.

A few years ago, when Colony Collapse Syndrome was found to be disrupting the pollination habits of honey bees, government agencies, environmental foundations and the general public quickly made the connection to agriculture and produce prices. While scientists still haven't stopped Colony Collapse, the research is better funded.

White-nose Syndrome is a harder sell.

"The consequences are serious, but they're three or four steps down the line before it starts impacting people. It's hard to see that direct link," Dr. Reeder said. "White-nose Syndrome is moving faster than we can. We might have the answer after it's all said and done."