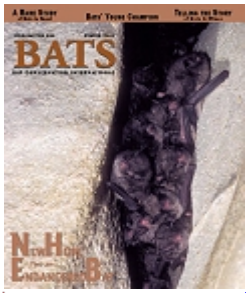

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New Hope for the Indiana Myotis
A better Strategy
Merlin D. Tuttle & Jim Kennedy

Indiana myotis once were among the most abundant mammals in eastern North America. Millions hibernated each winter in individual caves, mostly in Kentucky and Indiana. One such refuge is known today as Saltpetre Cave. About the time of the American Revolution, it probably housed hundreds of thousands of hibernating Indiana myotis. By 1983, that number was 13.

Although declared endangered in 1967, the species continued to decline – just 380,000 survived in 2001. But research led by Bat Conservation International points the way to saving these bats, and Saltpetre Cave may prove the point. Simply protecting important Indiana myotis (Myotis sodalis) hibernation caves from human disturbance clearly is not enough. Numbers have -contin-ued to fall in many "protected" populations. In some cases, the wrong caves are being protected.

Our research has demonstrated that many once-crowded hibernation caves have been altered for mining or commercialization, often centuries ago, in ways that changed temperatures enough to make them unsuitable for Indiana myotis. We now know that this endangered species cannot recover until we find once-key caves, identify historic changes and re-establish conditions the bats require. Protection must also be ensured.

Cave restoration will now become the primary focus of Indiana myotis recovery efforts. On March 16, 2005, BCI Founder Merlin Tuttle presented 10 years of data to 70 scientists, conservation biologists and managers at a meeting sponsored by the U.S. Fish and Wildlife Service to discuss the recovery program. Going into the meeting, about 70 percent of participants felt the number-one goal of recovery efforts should be protecting summer habitat. But after seeing our data, 94 percent voted to make restoration of hibernation caves the top priority.

BCI is doing exactly that at Saltpetre Cave. Our project there is providing a model for identifying, assessing and restoring altered caves that once provided winter refuges for these endangered bats.

The story of Saltpetre Cave begins with the War of 1812 between the U.S. and Great Britain. Guano beneath the roosts of cave bats is rich in saltpeter, an essential ingredient in gunpowder until late in the 19th century. So, especially in times of war, miners poured into bat caves to extract saltpeter. In Kentucky alone, 133 caves and 6 rock shelters were tapped as saltpeter mines during that war. Demand for gunpowder was even greater when the Civil War began 49 years later.

Miners not only disturbed hibernating bats, but they altered their caves, -creating new entrances and passages and blocking old ones. Such changes were often devastating for the Indiana myotis.

This is a bat that requires a narrow range of stable temperatures for hibernation. Scientists collaborating with BCI are currently monitoring temperature and humidity at 19 Indiana myotis hibernation caves in 10 states, and data from more than 40 caves have been collected over the past decade. We have clearly documented that populations thrived in hibernation caves where midwinter temperatures were 37 - 43 degrees F (3 - 6 degrees C). The most rapid declines in Indiana myotis populations were linked to sites where

temperatures were farthest from this preferred range.

The caves that historically sheltered the largest populations of hibernating Indiana my-otis were, with-out ex-cep-tion, those with the greatest volume and structural diversity and with multiple en-trances at different elevations. These caves also include chim-ney-effect airflow be-tween entrances to draw cool air into the cave in winter. Complex structures and large volumes trap the cool air and maintain the temperature range required for safe hibernation.

Changing the topography of a cave typically reroutes the movement of air and alters temperatures. A change of just a few degrees can drive Indiana myotis from a cave. In fact, BCI Student Scholar Christin Dzurick of Missouri State University is conducting laboratory tests this winter that indicate Indiana myotis' energy requirements double when faced with a temperature rise from 41 degrees F (5 degrees C) to just 44.6 degrees F (7 degrees C).

A big part of the problem is determining which caves to protect and restore. In Kentucky's Carter Caves State Resort Park, Bat Cave, with about 28,000 bats, has for 20 years been designated a critical habitat – protected and gated as the region's primary Indiana myotis hibernation site. The cave, however, provides only marginal temperatures and is subject to occasional flooding. Its Indiana myotis population has declined.

Nearby Saltpetre Cave, which was not considered a significant hibernation site, is also in the state park. It never floods and provides far more appropriate and stable temperatures, but it was open to year-round commercial tours.

In 1998, we, along with Carter Caves Naturalist John Tierney, discovered extensive roost stains on the ceilings. The stains, overlooked in the past because of heavy soot from torches and lanterns and widespread graffiti, clearly documented past use by hundreds of thousands of Indiana myotis. (Stains and etching, long-lived marks left on cave ceilings or walls by many years of roosting bats, typically provide the best evidence of previous bat use. Such markings allow estimates of how many bats the cave once supported.)

Most of Saltpetre Cave's bats apparently were driven off during the War of 1812, when the cave was altered by saltpeter miners. Some of these displaced bats apparently survived, in dwindling numbers, in Bat Cave.

Saltpetre, not Bat Cave, has the po-tential to support great numbers of hibernating Indiana myotis. The primary hibernation cave was unprotected. Based on BCI's findings, winter tours of Saltpetre Cave were halted in the winter of 1998-99, and Indiana myotis numbers have climbed steadily ever since. By January 1999, 475 Indiana myotis were counted. The count reached 1,225 in 2001, 3,100 in 2003 and 6,088 in 2005. We also are gradually restoring former temperature conditions at the cave and expect this population to continue its rapid growth.

To accomplish this, we first contracted with Australian cave microclimatologist Neville Michie in 2000-01 to evaluate how Saltpetre Cave had been altered and to recommend how it could best be restored. The cave was extensively modified by those long-ago miners: Passages were changed or dug out, floors were lowered and piles of mining debris blocked some areas. Tourism led to more alterations in the 1930s and '40s, with a partially blocked entrance, concrete stairs and strings of electric lights. All of these changes altered airflow through the 9,860-foot (3,005-meter) cave, which produced, in turn, temperatures that edged above those considered ideal for re-establishing large numbers of hibernating Indiana myotis.

In an ambitious restoration to reduce the average temperature in the cave by approximately 5.5 degrees F (3 degrees C), we hope to bring temperatures back within the ideal range for

restoring the large population that once used the cave.
Significant improvements are being made each year. An inappropriate gate at the main entrance was replaced with a bat-friendly structure, and a temporary wooden wall, complete with a door to allow continued summer tours, was built to restore historic air paths. Air input during winter was improved by reopening two sinkhole entrances near the main entrance. This involved removing debris, then stabilizing and gating the openings. Passages linking those openings with the main entrance were enlarged.
In August 2004, a team of cavers raised the levels of the sinkhole entrances by dry-stacking rock walls around the downslope sides. A radio transmitter was set up inside the cave, and a direction-finding receiver was used on the surface to precisely locate the site of another entrance that had collapsed many years ago. It is being laboriously reopened to re-establish airflow and humidity in a major part of the cave not currently used by Indiana myotis.

We also plan to replace the concrete entry stairs with an open design and remove debris. The stairs act as a dam, blocking incoming air that could help lower overall cave temperatures in winter. Progress, while incomplete, is encouraging.
The story of the Indiana myotis is far from over. It remains critically endangered. But our research shows that restoring -previously ideal conditions to the most vital hibernation caves of the past can dramatically improve these bats' odds of survival. And more high-potential caves are awaiting discovery. In just two weeks of recent survey work in Kentucky, a BCI field team identified past cave roosts for over two million Indiana myotis, caves that had escaped notice because their bats were lost long ago.

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