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In Fragmented Forests, Rapid Mammal Extinctions

By CARL ZIMMER

In 1987, the government of Thailand launched a huge, unplanned experiment. They built a dam across the Khlong Saeng river, creating a 60-square-mile reservoir. As the Chiew Larn reservoir rose, it drowned the river valley, transforming 150 forested hilltops into islands, each with its own isolated menagerie of wildlife.

Conservation biologists have long known that fragmenting wilderness can put species at risk of extinction. But it's been hard to gauge how long it takes for those species to disappear. Chiew Larn has given biologists the opportunity to measure the speed of mammal extinctions. "It's a rare thing to come by in ecological studies," said Luke Gibson, a biologist at the National University of Singapore.

Over two decades, Dr. Gibson and his colleagues have tracked the diversity of mammals on the islands. In Friday's issue of the journal *Science*, they [report that the extinctions](#) have turned out to be distressingly fast.

"Our results should be a warning," said Dr. Gibson. "This is the trend that the world is going in."

Tropical forests are regularly cleared for logging, farming and cities. In most cases, the only original tree cover is reduced to isolated patches. Many of the original species of plants and animals may still survive in those fragments, but they experience new stresses. The edges of the fragments are no longer dim and humid, for example.

The small size of the surviving populations also creates problems. Over the course of a few generations, a small population can accumulate harmful mutations that make them less fertile or more vulnerable to diseases.

Scientists have hypothesized that many species will gradually decline in forest fragments until they become extinct. Reducing a vast carpet of jungle to isolated patches thus creates a so-called "extinction debt" that nature will sooner or later collect.

After the Khlong Saeng river was dammed, [David Woodruff](#) of the University of California at San Diego recognized that the islands in the reservoir would be good places to study how quickly nature calls in that debt. The islands were all formed at the same time, they were all isolated by water and they were surrounded by a vast forest preserve that was still brimming with biological diversity.

Between 1992 and 1994, Woodruff's team visited a dozen islands, setting a 150-yard line of traps on each one. Each day for a week they visited the traps, tagged any mammals they found and released the animals. The researchers also set the same traps in the forests surrounding the reservoir.

Just five years after the dam was built, they could see a difference. Several species were more rare on the islands than on the mainland.

Dr. Gibson returned to the same 12 islands in 2012 and repeated the survey. He started on a 25-acre island. The first survey had found seven species of mammals. Dr. Gibson spent a week checking traps on the island and found only a single species: the Malayan field rat.

This was a startling find for two reasons. One was the drastic crash in diversity. The other was that the Malayan field rat wasn't on the islands when they first formed. Malayan field rats thrive around villages and farms and other disturbed habitats. The rats Dr. Gibson trapped must have come from the surrounding rain forests, where they still remain scarce. When they swam to the islands, they found fragmented forests that they could dominate.

"I thought, 'Wow, what if this trend holds?'" said Dr. Gibson. "And it did."

On most of the islands, all the native species were gone, replaced by the rats. Only on a few islands did some species still cling to existence. Dr. Gibson surveyed an additional four islands and found they also had just one or two species, suggesting that all the islands were suffering massive extinctions in about 20 years.

"No one expected to see such rapid extinctions," said Dr. Gibson.

Dr. Gibson suspects that the small size of the island forests makes them particularly vulnerable to invasion by the rats. The diversity of mammals he trapped in the mainland forests was the same as in the first surveys in the 1990s.

"This study confirms for mammals what we've long known for birds," said Stuart L. Pimm, the president of [Saving Species](#) and a professor at Duke. In 2003, Dr. Pimm and his colleagues studied records of birds from forest fragments in the Amazon and found species going extinct at a comparable rate.

Dr. Pimm and Dr. Gibson agreed that the fast pace of extinction in forest fragments gives an urgency to conserving the large swaths of tropical forest that still remain. "Our study shows we may need to do that very quickly," said Dr. Gibson.