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Giant Bats Face a Shrinking Forest

Conserving Livingstone's flying foxes on the Comoros Islands

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“There’s one!” Daoud cried, shielding his eyes from the sun. I jerked my binoculars up and followed the dark shape as it circled and rose from the valley below. With jet-black wings larger than any hawk I’d seen and distinctive black-and-rust fur, Daoud’s find was unmistakable. We had just caught sight of a soaring Livingstone’s flying fox (*Pteropus livingstonii*) – one of the largest, rarest, and most unusual bats in the world.

We were on an archipelago between northern Madagascar and mainland Africa in the western Indian Ocean. Eleventh-century Arabic explorers called these islands the Comoros Islands – Islands of the Moon – because of their barren rock fields, cooled lava from a still-active volcano. The mountains of these islands are covered with lush rain forests, where Livingstone’s flying foxes fly among the treetops in search of their favorite foods: nectar and fruit.

But that search is becoming more difficult. The bats’ rain-forest habitat is shrinking at an alarming pace. Fewer than 1,500 of these great bats exist, all of them on two small Comoros islands: Anjouan and Mohéli. The deforestation rate here is one of the world’s highest – nearly half the forest vanished in the last decade. The World Conservation Union lists these bats as critically endangered.

With the forests disappearing, the survival of Livingstone’s flying fox depends on the rapid conservation of its most critical habitat. But which habitat is most critical? What forest areas and which tree species should we protect first? Until now, little has been known of the bats’ foraging ecology – how the bats search for food, where they go to feed, and what they eat. This critical problem has vexed the Comorian government and conservation groups. And it was the motivation for my visit to the Comoros Islands. With support from a Bat Conservation International scholarship and help from my Comorian field assistant, Daoud Attoumane, I investigated the bats’ foraging ecology on the island of Anjouan.

Daoud understands why the forest is retreating up the mountainsides. He lives with his wife and two children on Anjouan, farming small fields near the village of Sangani. “When I moved to Sangani 12 years ago, I wanted to plant cassava and Angola peas, but all the land close to town was taken. So I cleared land up here,” he said. “Then more people came to Sangani. They put in their fields above mine.”

The bat we were watching soared high above the valley, slipped out of its column of warm rising air, and began gliding toward the far hillside. As it flew just above the forest canopy, its wings beating slowly, Daoud and I watched carefully for the bat to reveal its destination. Suddenly, the bat banked to the right, circled twice about a treetop, and just after skimming over a branch, grabbed on tightly with its feet. It swung in a half-circle around the branch to a hanging position as the branch sagged from its weight. The bat had just completed its first flight of the day, unaware that it had given us a valuable clue to understanding its foraging ecology.

The next morning, we hiked across the valley floor and up the opposite hillside, searching for the tree where the bat landed. Daoud and I climbed side by side to avoid the rocks that loosened under our steps and tumbled downhill. The tree we sought was an enormous

giant-leafed fig (*Ficus lutea*) rooted in another steep slope. The fig's waxy green leaves, each the shape and size of a flattened football, filled the canopy nearly 50 feet (15 meters) overhead and spread more than 30 feet (9 meters) from the trunk in all directions. Its branches were festooned with bunches of marble-sized, purple-speckled yellow figs.

Did the bat land here to eat these figs? Do Livingstone's flying foxes prefer figs to other kinds of fruit? To find out, we hung tarps of porous cloth to capture fruit and any other items dropped by flying foxes. We repeated the process at other sites, until dozens of white tarps dotted the landscape. We left the tarps open through the next foraging bout, which for Livingstone's flying fox – one of the few partially diurnal bats in the world – begins in late afternoon and continues for half the night.

When we inspected the tarps the next day, Daoud plucked a fruit from the first tarp. "Teeth marks," he said, pointing at a hole in one side. In another tarp, we found a different clue: a walnut-sized object we call an ejecta pellet. When a bat eats fruit, it chews and then presses the fruit against its palate with its tongue, squeezing out the juices. Eventually, it spits out as much of the dry, fibrous pulp as possible.

This pellet, yellow-brown with a grainy texture, was formed of the fruit of a giant-leafed fig tree. Daoud measured teeth imprints in the pellets and found them so large that only a Livingstone's flying fox could have made them. One mystery was solved: Livingstone's flying foxes do eat giant-leafed figs.

Because pellets of this type were commonly found, despite the relative rarity of giant-leafed figs in the habitat, it became clear that these are a preferred food. The small, black seeds embedded in the pellets showed that bats return the favor by carrying seeds away from the tree. As Daoud put it, "I knew people planted coconut and mango trees, but I never knew who planted forest trees until I started watching the bats."

Through investigations like this, we identified several tree species that apparently are most important for Livingstone's flying foxes, as well as the islands' two other fruit-eating bats: the Seychelles yellow-headed flying fox (*Pteropus seychellensis comorensis*) and the Comoros rousette (*Rousettus obliviosus*). While these last two bats sometimes eat fruit from trees planted by people, Livingstone's flying fox relies almost completely on a few native forest trees. That means its fate will remain tightly linked to that of the rapidly disappearing forest. But it also suggests ways to help this bat survive.

A common agricultural practice on the islands is to retain some trees as forage for cattle, erosion control, and shade. So, at least for the short term, farmers can reduce the impact of deforestation on bats by simply retaining the "bat trees" that we've identified. For the long haul, our findings should help identify for conservation those areas of remaining forests that provide the most critical habitat for Livingstone's flying fox.

These and other ideas from my research are being directly applied to conservation. The Comorian government, local and international conservation groups, and rural Comorians are united by a common interest in Livingstone's flying fox, and together we are developing a plan to protect the species. This conservation plan emphasizes habitat protection, environmental education, research and monitoring, captive breeding, and sustainable development.

The plan is to be implemented mostly by rural community groups and Co-morian non-governmental organizations, with the support of the government and international groups. We have presented this five-year plan to the Comorian government, with the hope

that it will be set in motion in the near future.

Success will depend upon the engagement of rural Comorians, who unfortunately face a host of other problems – from poverty and poor health to declining soil fertility – which demand their attention. Yet these very issues have convinced many Comorians of the need to protect Livingstone’s flying fox. “We need the forest for wood to build, roots for medicines, and streams for drinking water. And the trees need bats,” one villager said during a meeting on the conservation plan. “How can we exist without the forest? Without bats? Conservation may be difficult, but it is our only choice.”

Back on our ridge-top perch the next day, as Daoud and I tracked the flight of a pair of Livingstone’s flying foxes, I puzzled over still-unanswered questions. Why do the bats prefer the fruits they do? How much forest must be protected to sustain the bats? What is the best way to meet the needs of both bats and people?

We had already learned a great deal, but there was much more to learn about the bats’ foraging ecology and how best to protect them. As the Livingstone’s flying foxes embarked again on their daily search for food, we were ready to follow wherever they led us.

BCI’s Student Scholarship program supported Brent Sewall in this important research. To find out more about the scholarships and how you can help prepare new generations of bat conservationists, please turn to the back of this issue of *BATS*.

BRENT J. SEWALL conducted this research and coordinated the development of the Comorian national Livingstone’s Flying Fox Conservation Action Plan as a graduate student in Conservation Biology at the University of Minnesota. He is currently studying the ecology and conservation of tropical forests at the University of California at Davis. His research was partially funded by BCI.

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