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VOLUME 26, NO. 2 Summer 2008

Restoring Lost Rainforests
Artificial bat roosts attract seed-dispersing bats
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Vast stretches of the worldâ€™s rainforests continually fall victim to logging and agriculture. Bats, by dispersing seeds over wide areas, often play a crucial role in restoring these denuded landscapes. In hopes of boosting that natural regenerative process, we installed low-cost artificial roosts to attract bats to cleared areas in Costa Rica. Not only did bats move quickly into most of the roosts, we demonstrated that seed dispersal was significantly enhanced around the artificial homes. And many of the seeds scattered by bats are of â€œpioneer plants,â€ the first to grow in cleared areas, providing shelter that is essential for other plants to take root.

In Neotropical forests, up to 90 percent of all canopy trees, as well as almost all shrubs and understory trees, are adapted for seed dispersal by animals, primarily fruit-eating bats and birds. Fruit bats especially are indispensable for dispersing seeds into open habitats. They frequently cover large distances while foraging and are more willing than birds to cross open areas. Bats are also much more likely to defecate in flight, spreading far more seeds over open areas than birds, which typically drop theirs beneath perches.

Forests are harvested for timber and cleared for plantations, small farms and cattle pasture. Tropical soils, however, are often poorly suited for long-term agriculture, so the cleared cropland is abandoned fairly quickly. Reforestation is becoming especially critical now to stem global losses of biodiversity and to preserve the forestsâ€™ role as carbon sinks that help slow climate change.

In some areas, forests are being replanted, but extensive tree planting is prohibitively expensive. At the same time, natural regeneration, especially seed dispersal, is often hampered because bats and birds have little incentive to enter deforested areas with scant food, shelter or protection. I suspected that a lack of suitable day roosts might be keeping bats out of cleared areas. Bats in Neotropical lowland rainforests generally roost in hollows and crevices of large, old-growth trees â€“ prime targets in timber harvests.

In a project financed in part by a Bat Conservation International Student Research Scholarship, I worked with Kerstin Wiesner and Otto von Helversen from the University of Erlangen, Germany, to determine whether artificial roosts would attract seed-dispersing bats into forest fragments and patches of vegetation in agricultural areas. In Costa Rica, we built and installed artificial roosts in small forest remnants and under clusters of remnant trees amid a matrix of pastures. For comparison, we also installed the roosts in a protected primary forest in the Atlantic lowlands. Roosts were always installed in the shade of vegetation to prevent overheating.

The main criteria for our artificial-roost design were that they be inexpensive, maintenance-free, easy to build and durable enough to withstand the tropical climate and ubiquitous termites for years. The roosts were designed to approximate the characteristics of large, hollow trees, the preferred roosts of fruit-eating, understory bat species in lowland rainforests. They were simple boxes, roughly 61?2 feet (2 meters) tall and 2 feet (60

centimeters) wide, and made of sawdust/concrete slabs. Plastic netting attached to the ceiling provided a roosting surface.

We were astonished at how rapidly bats colonized our artificial roosts. The first bats usually took up residence within a few weeks of installation, sometimes within days, and colonization was mostly permanent.

So far, 10 bat species have colonized the roosts, five of which are fruit or nectar feeders. The dominant species is Sebaâ€™s short-tailed bat (Carollia perspicillata), a common disperser of pioneer plants in the Neotropics. Other frequent occupants of the roosts are nectar-feeding long-tongued bats of the genus Glossophaga, insectivorous common big-eared bats (Micronycteris microtis) and the frog-eating fringe-lipped bat (Trachops cirrhosus).

Since the project began in 2000, we have installed 70 artificial roosts of varied designs. Roosts of different materials and sizes attracted bats, but the sawdust/concrete slabs seem to best withstand the elements and termites.

To estimate the batsâ€™ impact on seed dispersal, we collected nocturnal seed rain (seeds dropped by flying bats) in traps â€“ fine nylon mesh stretched across simple wooden frames, about 10 square feet (1 square meter), that were mounted on stilts. We placed the seed traps in a grid around roosts and at control sites away from roosts, then collected seeds and bat droppings every morning.

Significantly more seeds were dispersed around artificial roosts than at control sites. The bats dispersed seeds of more than 60 plant species, and their preferred fruits were those of pioneer plants, such as pepper and nightshade, which, because they grow rapidly in open areas, are important for natural reforestation. Shrubby pioneer vegetation quickly creates shelter and a suitable microclimate for tree seedlings to germinate. This initial vegetation may also provide shelter and food for other seed dispersers, including birds, that transport different seeds into an area.

Meanwhile, nectar-feeding bats that also use the artificial roosts are responsible for pollinating an estimated 1,000 Neotropical plant species.

We always contacted local landowners before installing roosts to thoroughly explain the project and the beneficial roles of bats, which still have an undeservedly bad reputation in much of Central and South America. We installed all roosts on privately owned land and encountered widespread acceptance and interest after our explanations.

Our project demonstrated that artificial bat roosts can attract fruit-eating bats into fragmented forests and increase seed dispersal around the roosts. Future research is needed to examine the revegetation process, beginning with seed dispersal by bats, to assess how different plant species germinate and survive in varied landscapes.

We plan to produce a manual soon so that people unfamiliar with bats will still be able to successfully install our artificial roosts to enhance the restoration of lost forests. Humans have left deep and often destructive footprints on the rainforest landscapes. We hope these artificial roosts can help in the long process of erasing some of those footprints.

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