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Urban Bats of Brazil
How bats survive when cities invade the forest
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Bats around the world are losing habitat to ever-expanding cities. Urbanization is more complete and irreversible than other encroachments, such as agriculture, and causes some of the greatest local extinction rates. Not only is natural habitat reduced to small, often tiny, remnant patches, but native plants are replaced with often-invasive nonnatives. The result is an ecosystem that becomes increasingly fragmented and homogenized as you move from rural areas to the urban center.

Some bat species adapt and survive in an urbanized environment, roosting in buildings, for instance, and foraging at streetlights. Others, especially those with specialized behaviors, do not.

Tropical forests are not immune to urban sprawl. The great Atlantic Forest that stretches along much of Brazilâ€™s eastern coast is a â€œbiodiversity hot spotâ€□ that once covered 476,000 square miles (1.2 million square kilometers). Today, just 8 percent â€“ about 38,600 square miles (99,900 square kilometers) â€“ remains intact. What once was forest is home now to about 70 percent of Brazilâ€™s 169 million people.

The southeastern state of EspÃ-rito Santo, where little is known of local bat diversity and ecology, is growing so rapidly that we must increase our knowledge of native bats in order to create and implement conservation and management plans before it is too late. The capital city of VitÃ³ria was founded in 1551 on an offshore island, but urbanization was insignificant until the 1940s. In the â€™60s, the city spread onto the mainland as industrialization expanded. Its population is estimated at 1.8 million people, and the city is listed as a high-priority site for biodiversity conservation.

I chose VitÃ³ria to study the complex relationship between urbanization and biodiversity and the general urban ecology of bats. I examined habitat uses and needs of various species and batsâ€™ use of urban parklands and wooded and non-wooded streets. The research was supported in part by a BCI Student Research Scholarship funded by the U.S. Forest Service International Programs.

The city has eight municipal parks where forest remnants can provide a refuge for wildlife. For our study, we chose three parks ranging in size from about 5.5 acres (2.3 hectares) to 25 acres (10 hectares) for sampling. We also sampled three wooded streets (bordered by trees and other plants) and three non-wooded streets. Researchers have reported that wooded thoroughfares can serve as corridors along which birds move from park to park in an urban landscape. Do these streets also serve as pathways for bats?

We conducted a total of 31 netting sessions between August 2006 and July 2007. At each session, we monitored mist nets at all sampling sites for four hours beginning at sunset. We recorded each captured bat by species, sex, age, reproductive status, weight and dimensions. Fecal samples were collected for later analysis, and each bat was banded before release.

We captured a total of 172 bats representing 10 species in four families. By far the most common species was the great fruit bat (Artibeus lituratus), with 114 captures. This was the only species netted along non-wooded streets. We also observed several bats of the Noctilionidae family (known as bulldog bats) feeding over a small parkland lake and under a bridge, but captured none.

Urban parks, despite their modest size and visitation by people, were the overwhelmingly favored habitat. All 10 species and 71 percent of the bats in our sample were netted at the parks, which typically offer native trees (although usually with nonnatives, as well), small lakes and other resources.

Only two species, 40 great fruit bats and six white-lined broad-nosed bats (Platyrrhinus lineatus), were captured along wooded streets for 27 percent of the total. Barren streets produced only three great fruit bats.

We also identified several day roosts of these two species in trees on the campus of the Federal University of EspÃ-rito Santo, near the sampling areas.

Fruit-eating bats completely dominated our sample with 81 percent of captures. These included great fruit bats, white-lined broad-nosed bats and big-nosed tent-making bats (Uroderma magnirostrum). Flying insect-eating bats, gleaning insectivores, nectar-eating bats and omnivores each accounted for 6 percent or less.

It is quite possible that flying insectivores, such as those often reported around streetlights, are underrepresented because of the limitations of mist netting. Insect-eating bats frequently fly at higher altitudes than other bats and their especially sophisticated echolocation makes them better able to avoid the nets. The relative scarcity of these bats may also reflect our sampling locations and foraging preferences of urbanized insectivores.

The diversity I found in VitÃ³ria clearly falls well short of that in the intact forests of EspÃ-rito Santo, in which 36 species have been recorded. Comparing bat diversity of forests and urban areas is difficult, however, because so few forest areas have been systematically sampled. My previous research at EspÃ-rito Santoâ€™s Paulo Cesar Vinha State Park recorded a total of 15 species.

These results confirm previous studies that find sharply decreased species richness and abundance in urban landscapes compared to less-disturbed areas. It also appears unlikely that wooded streets offer bats the same park-connecting corridors as reported for birds. The VitÃ³ria sample indicates that for bats, tree-lined streets are, statistically, much more similar to non-wooded streets than to urban parks. Only two bat species used them, both in low numbers.

These data also suggest that the amount and complexity of vegetation likely play a large role in maintaining the abundance and diversity of bats.

This urban bat population, like others reported elsewhere, is dominated by a single species, the great fruit bat, which apparently has a high tolerance for urbanization and a strong ability to adapt to changing conditions.

We also reported the first observation (published in Biota Neotropica) of this species feeding on Maclura tinctoria (fustec wood) fruits, which adds a new item to the known diet of this important seed-dispersing species. These fruits have large seeds that are not

swallowed by the bats, which instead eat the pulp and discard the seeds. A diet of fruits with large, uneaten seeds may indicate an important resource that is not detected in traditional diet studies that evaluate fecal samples.

The only species in our study that had not previously been reported in urban areas of Brazil is the silver-tipped myotis (Myotis albescens). I hope this contribution to the knowledge base of urban ecology can help conservation efforts in the cityscapes where increasing numbers of bats find themselves forced to adapt or die. Sound ecological principles, such as preserving remnant natural habitat, restoring native plant species to modified habitats and using native trees and more of them along streets and boulevards, can help at least some bats and other wildlife to survive the growth of cities.

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