

# Bats fertilize tropical trees: A win-win situation in the rainforest

**Bats in tropical regions are fertilizing trees with their excretions. An international team of scientists recently discovered that seeds of a tropical tree species, which regularly hosts bats in large hollows, contain nutrients from bat excreta. The study has now been published in the scientific journal “Biotropica”.**

Many tropical ecosystems are low in nutrients. Especially phosphorus and nitrogen are essential for plant growth and their availability limits the productivity of plants. Past studies showed that plants in nutrient-poor environments use animal-derived nutrients on a large-scale basis. It has yet been unknown if trees also take up nutrients from bat excretions. Bats depend strongly on tree hollows as daytime roosts. While roosting they also defecate into the cavities. The so-called bat guano is rich in nutrients, its specific composition depends on the bats' feeding habits.

Christian Voigt from the German Leibniz Institute for Zoo and Wildlife Research (IZW) and scientists from the University of Tel Aviv and the Doñana Biological Station in Sevilla tested in their study if tropical trees benefit from hosting bats in large cavities at the base of trunks. They investigated large, hollowed mountain almond trees (*Dipteryx panamensis*) in an Atlantic lowland rainforest in Costa Rica. These trees are frequently used by fruit-eating, insect-eating and blood-licking bat species as daytime roosts. To test if the trees profit from the presence of bats by incorporating nutrients from bat excreta into their seeds, the researchers analysed a specific form of nitrogen, the stable isotope  $^{15}\text{N}$ . This form of nitrogen is more abundant in animal tissues and excreta than in plants. The analysis revealed that the seeds of bat-hosting trees were more enriched in  $^{15}\text{N}$  than the seeds of trees without bat roosts. “Thus, we were able to track nitrogen from bat guano into the seeds of *Dipteryx* trees”, explains IZW scientist Christian Voigt. “Nitrogen may be assimilated by the fine mesh of roots that we found in all natural tree cavities.”

Furthermore, the study results indicate that larger bat colonies may provide more nutrients for the trees than small colonies. Also the species composition of bats seems to play a role: Colonies with vampire bats, feeding on other animal's blood, supply more nitrogen to the trees than those without vampire bats.

Many of the bat species that occupy the examined tree hollows during the day forage outside of the forest, for example in pastures. Consequently, they may transfer nutrients from nearby areas to the tropical trees, acting as mobile nutrient links in tropical ecosystems.

Previous reports already demonstrated that tropical plants use animal-derived nutrients, for example nitrogen from bat excreta. The present study is the first to show that this also occurs in trees. The bat-originated nitrogen is incorporated into the seeds of the trees and thus allocated to reproduction.

## **Publication:**

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