Animals essential to seed dispersal are the first to disappear owing to deforestation

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The Brown howler monkey (Alouatta guariba) is a key species for seed dispersal and hence for perpetuation of the Atlantic Rainforest. Credit: Gisela Sobral/USP

Trees of the species Pouteria bullata, which is endemic to Brazil and whose common name is guapeva-vermelha, are found solely in the

Atlantic Rainforest biome and produce sweet succulent fruit.

Their seeds are relatively large (about 2 cm) and cannot be swallowed by birds or small mammals, so they depend on primates like the Brown howler (Alouatta guariba) and Southern muriqui (Brachyteles arachnoides), as well as the South American Tapir (Tapirus terrestris), to disperse their genetic material and perpetuate the species.

Where these animals have disappeared, so has P. boullata, which is indexed as "vulnerable" on the IUCN Red List of Endangered Species. Indeed, the animals most important to seed dispersal are the first to disappear as a result of the destruction of the Atlantic Rainforest, according to a paper published in the journal *Biotropica*.

"Seed dispersal is a complex process involving many types of vertebrates at the same time. Deforestation leads to the extinction of animals, which lose food, and plants, which can no longer disperse their seeds," said Lisieux Fuzessy, first author of the paper.

The study was supported by FAPESP while Fuzessy was doing postdoctoral research at São Paulo State University's Institute of Biosciences (IB-UNESP) in Rio Claro, Brazil, and was part of the project "The effect of fragmentation on the ecological functions of primates", also funded by FAPESP. The principal investigator for the project was Laurence Culot, a professor at IB-UNESP.

Fuzessy conducted part of the research during an internship at Doñana Biological Station (EBD-CSIC) in Spain, with a scholarship from FAPESP and collaboration by Professor Pedro Jordano.

"We set out initially to investigate the role of primates in seed dispersal, but it soon became evident that we needed to analyze the roles played by all vertebrates," Fuzessy explained.

Besides primates, the investigation encompassed seed dispersal by birds, bats, carnivores, marsupials, rodents and ungulates (deer, tapirs and peccaries, among others). The study thus became an unusually wide-ranging analysis of the animal-plant interactions that maintain biodiversity.

Conserved areas and fragments

To understand the impact of the disappearance of animals from forests, the researchers compared animal-plant interactions in two forest areas of the state of São Paulo.

One was Serra de Paranapiacaba, a highly conserved Atlantic Rainforest area, with more than 120,000 hectares including both parks or reserves and private properties. The mountain range (or serra in Portuguese) is home to such highly endangered mammals as the Jaguar (Panthera onca), Bush dog (Speothos venaticus) and White-lipped peccary (Tayassu pecari), as well as the already mentioned tapir and muriqui. Serra de Paranapiacaba is also the most important refuge for the Black-fronted piping guan (Pipile jacutinga), a large frugivorous bird that is extinct in most Atlantic Rainforest remnants.

The other study area was Reserva de Santa Genebra, a 250-hectare fragment surrounded by urban sprawl and farmland, like most remnants of the biome. Its plant cover was steadily destroyed until 1984 when it acquired protected status. Very few large vertebrates live in the area, which is home mainly to small birds and medium-size mammals such as the Spotted paca (Cuniculus paca), Large American opossum (Didelphis spp.) and Brazilian squirrel (Guerlinguetus brasiliensis). A few large frugivores (fruit eaters) also live there, including A. guariba and the Dusky-legged guan (Penelope obscura). Even so, interaction levels were lower than in the conserved area.

The researchers recorded 1,588 interactions between 133 animals and 315 plants in Serra de Paranapiacaba; and 221 interactions between 54 animals and 58 plants in Reserva de Santa Genebra.

"The difference was highly significant. Key species such as muriquis and tapirs eat a far greater diversity of fruit than birds, for example," Fuzessy said. "In addition to their strong demand for calories, they have a wide gape or gullet, which enables them to swallow large fruit and disperse plants that without them simply disappear in a cascade effect."

This is yet another study that demonstrates the importance of conserving not just species but also functional diversity—animal-plant interactions that enable the forest to thrive—and hence serve as a basis for conservation and reforestation projects.

More information: Lisieux Fuzessy et al, Functional roles of frugivores and plants shape hyper-diverse mutualistic interactions under two antagonistic conservation scenarios, *Biotropica* (2022). DOI: 10.1111/btp.13065

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