

## Conservation of primates and arboreal mammals in the Atlantic Forest

By Rodrigo Costa-Araújo, 26th April 2021

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More than 60% of all known primate species are threatened with extinction and nearly all the primates' populations are declining. Many primates are found in highly diverse tropical forests areas known as hotspots, the majority of which are unsustainably exploited, with some almost entirely converted to agricultural land and urban landscapes.

The Atlantic Forest is an emblematic example of a hotspot. Located in South America, it has lost more than 80% of its original cover and harbours c. 65% of Brazil's 200 million inhabitants. Although the remaining Atlantic Forest comprises fragments that are mostly small (< 100 ha), isolated and degraded, it remains the home of 22 endemic primate species, 16 of which are threatened with extinction.



Black-handed titi monkey. Photo: R. Costa-Araújo

Beyond clear cutting, forests remnants are undergoing further degradation in the Brazilian Atlantic

Forest and in other tropical forest hotspots. As large fragments are few, isolated and located on private lands, the traditional conservation strategy of creating large connected protected areas is impractical. How do we ensure the protection of these primates in the remaining small and degraded forest fragments?

In our [study](#) we provide insights to help address this question and to share novel data on the ecology of our model species, the black-handed titi monkey *Callicebus melanochir*, endemic to the Atlantic Forest. This species is known as the ghost of the forest because it is difficult to observe as a result of its shy and cryptic behaviour, and consequently it is largely unstudied.

We investigated how area, quality and connectivity of forest fragments affect the occurrence of black-handed titi monkeys as a study model for arboreal mammals in tropical forest hotspots. These issues have not previously been evaluated for this species and are of great interest for the study and conservation of arboreal mammals.



Once covered by natural ecosystems, the Atlantic Forest is now reduced to less than 16% of its original extent as a result of conversion of forest into cities, cattle ranches and cropping lands. Photos: R. Costa-Araújo

We surveyed 38 Atlantic Forest fragments scattered along the margins of the Jequitinhonha River, Bahia, Brazil, over 2 years, using playback of the long-calls of the black-handed titi monkeys. In the absence of a standardized method for surveying of titi monkeys, we adapted the traditional playback protocol used in primate surveys to increase detection and visualization rates under conditions of variable forest density and, therefore, of unequal sound propagation.

In addition to the area of the forest fragments, which is known to have a positive influence on a mammals' occurrence, we investigated the effect of habitat quality--an issue seldom addressed because of the inherent difficulties of collecting, analysing and comparing species-specific proxies of habitat quality (such as the abundance of feeding trees). We extracted a vegetation index from satellite images to estimate vegetative biomass production as a proxy of habitat quality (well-conserved habitats have high biomass productivity).



Adult black-handed titi monkeys *Callicebus melanochir*, observed in Itapebi, Bahia, Brazil. Photo: R. Costa-Araújo

This approach has proven useful to overcome difficulties of collecting data on habitat quality in the field and produces results comparable across sites and species. Moreover, this method is time- and cost-effective as all data collection and analysis can be done remotely. Habitat quality is important in decision-making because it informs which fragments are more suitable for the occurrence of a given species, and thus should enhance the prioritization of fragments for conservation efforts.

We also assessed the effect of connectivity of forest fragments for species occurrence. We wanted to understand whether the visibility of surrounding forests, from the perspective of a titi monkey, affects its occurrence. The visibility metric was recently developed based on the assumption that the movement of arboreal mammals is mainly guided by vision. This metric is more realistic than the Euclidean distance between forest fragments at the ground level, which is the metric traditionally used to assess habitat connectivity in fragmented landscapes.

We also calculated the amount of forest cover surrounding the fragments we surveyed, when testing for habitat connectivity. Only forests within the dispersal range of our model species were considered in this case.

<https://www.oryxthejournal.org/wp-content/uploads/C-melanochir-calling.mp4>

*After the playback of a C. melanochir long-call, a group of two individuals, shyly and for a brief moment, come close and start to respond. Video: R. Costa-Araújo*

Having a robust set of metrics of fragment and landscape structure, such as those we used in our research, is paramount for designing and implementing effective, science-based conservation management. That is, populations need to be connected through migration and gene flow if we are to avoid local extinctions. So, when dealing with a multitude of small, isolated and degraded fragments in tropical forest hotspots, these metrics enable us to target fragments, landscapes and populations that need to be managed to promote the dispersal of individuals. This approach also facilitates the design of conservation actions that are necessary to guarantee remaining populations are resilient to inbreeding, genetic bottlenecks and stochastic events.

Conservationists could adopt the approach we use in our recently published [article](#) in *Oryx* to identify which fragments are more likely to harbour a given species or a set of species. Then,

validation of occurrence data in the field and selection of priority fragments can be done more cost-effectively, to optimize the use of the limited resources available for conservation. If habitat quality, visibility and connectivity are considered in conservation planning, we can expect an improvement in the effectiveness of translocations and metapopulation management, establishment of ecological corridors and habitat restoration, ultimately reducing local extinctions of arboreal mammals in tropical forest hotspots.



Part of our study area, on the margins of the Jequitinhonha River, Itapebi, Bahia, Brazil. Originally, these lands were inhabited by the Botocudo people and covered by tropical wet forests, but only a few forest fragments still remain within pastures and cattle, and the Botocudo people have long gone. Photo: R. Costa-Araújo

The open access article [Occurrence and conservation of the Vulnerable titi monkey \*Callicebus melanochir\* in fragmented landscapes of the Atlantic Forest hotspot](#) is available in *Oryx-The International Journal of Conservation*.



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