# Uncovering the effects of frontier dynamics on mammals in the tropical dry forests of South America
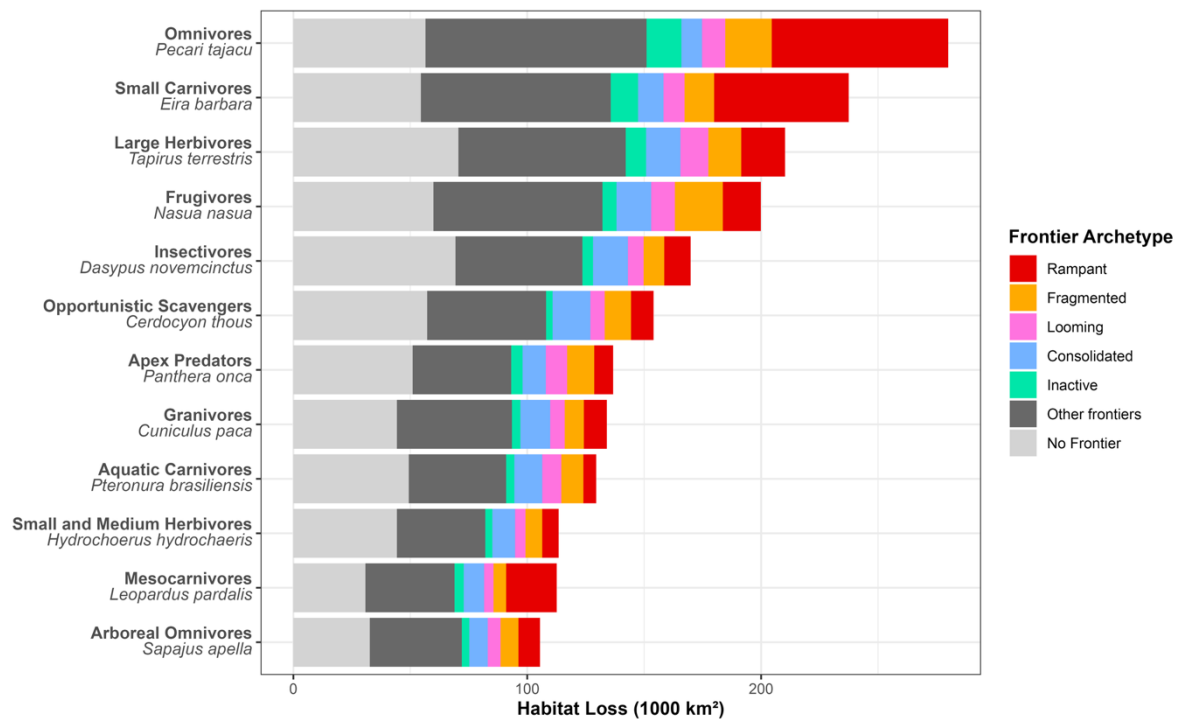
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## Abstract

Abstract: South America's tropical dry forests are among the most threatened ecosystems globally, undergoing rapid transformation driven by expanding agricultural frontiers. These landscapes host a rich and functionally diverse mammal community, much of which exists outside protected areas. Understanding how frontier dynamics affect biodiversity is therefore essential for informing conservation and land-use planning.

In this thesis, I applied a trait-based functional grouping approach to assess how different landuse dynamics influence mammal habitat. Using Factorial Analysis of Mixed Data (FAMD) followed by clustering, I identified 12 ecologically distinct mammalian functional groups. I then modeled habitat suitability for a representative species of each group in 2000 and 2020 using MaxEnt and linked changes in habitat area and condition to a typology of frontier archetypes reflecting varying intensities and histories of land-use change.
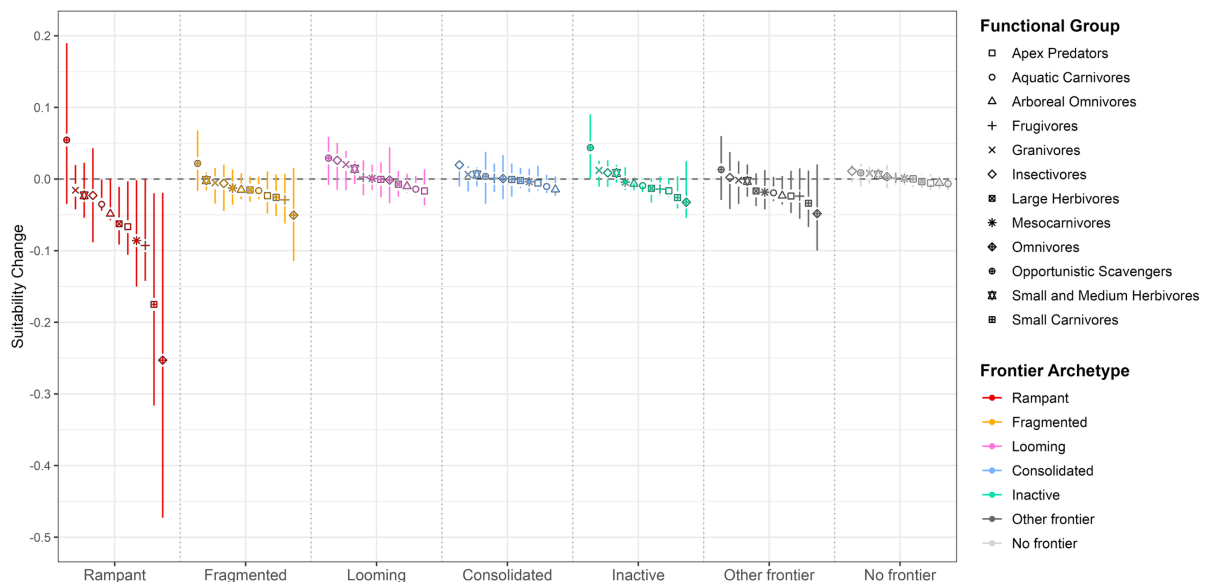
Results show that species responses were shaped by specific ecological traits. Functional groups such as Apex Predators, Aquatic Carnivores, Arboreal Omnivores and Small Carnivores experienced the steepest habitat losses (9.95–15.50%), while Insectivores, Opportunistic Scavengers, Granivores and Small and Medium Herbivores showed notable gains (6.37–11.95%).

These divergent patterns were largely driven by traits such as trophic level, reproductive rate, dietary breadth and habitat use. Rampant frontiers, characterized by rapid, large-scale land-use change, were associated with the greatest declines in habitat suitability and availability, while consolidated and looming frontiers offered comparatively favorable conditions for more resilient groups. This study underscores the value of functional grouping approaches in species-rich areas to understand biodiversity change at large scales. By identifying which groups are most vulnerable and which traits support persistence, the findings offer a practical framework to guide effective conservation planning and land-use policy in tropical dry forests under increasing pressure.

1. Distribution of habitat loss across frontier archetypes and functional mammal groups. Lost habitat was located mostly outside for all functional groups. Out of the five frontier types, Rampant and Fragmented frontiers were linked to the largest amount of habitat lost.

2. Suitability changes across frontier archetypes and functional groups. Mean suitability change from 2000 to 2020 for each functional group is visualized by the symbols, while the error bar represents the interquartile range. Rampant and Fragmented frontiers were associated with the largest decline in suitability. Consolidated and Looming frontiers showed more conservative declines and even substantial gains in suitability for some groups.



3. Pearson correlation coefficient of habitat change between 2000 and 2020 and functional traits of the focal species. Negative values represent cases where higher trait values are linked to habitat loss while positive coefficients are associated with habitat gain. Based on these results, large-bodied species with slow reproductive cycles and

carnivorous diet are more likely to experience habitat loss.