Extinção local de espécies media a perda de história evolutiva de aves de sub-bosque em ilhas florestais na Amazônia

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Species local extinction mediates the loss of evolutionary history of understory birds in Amazonian forest islands

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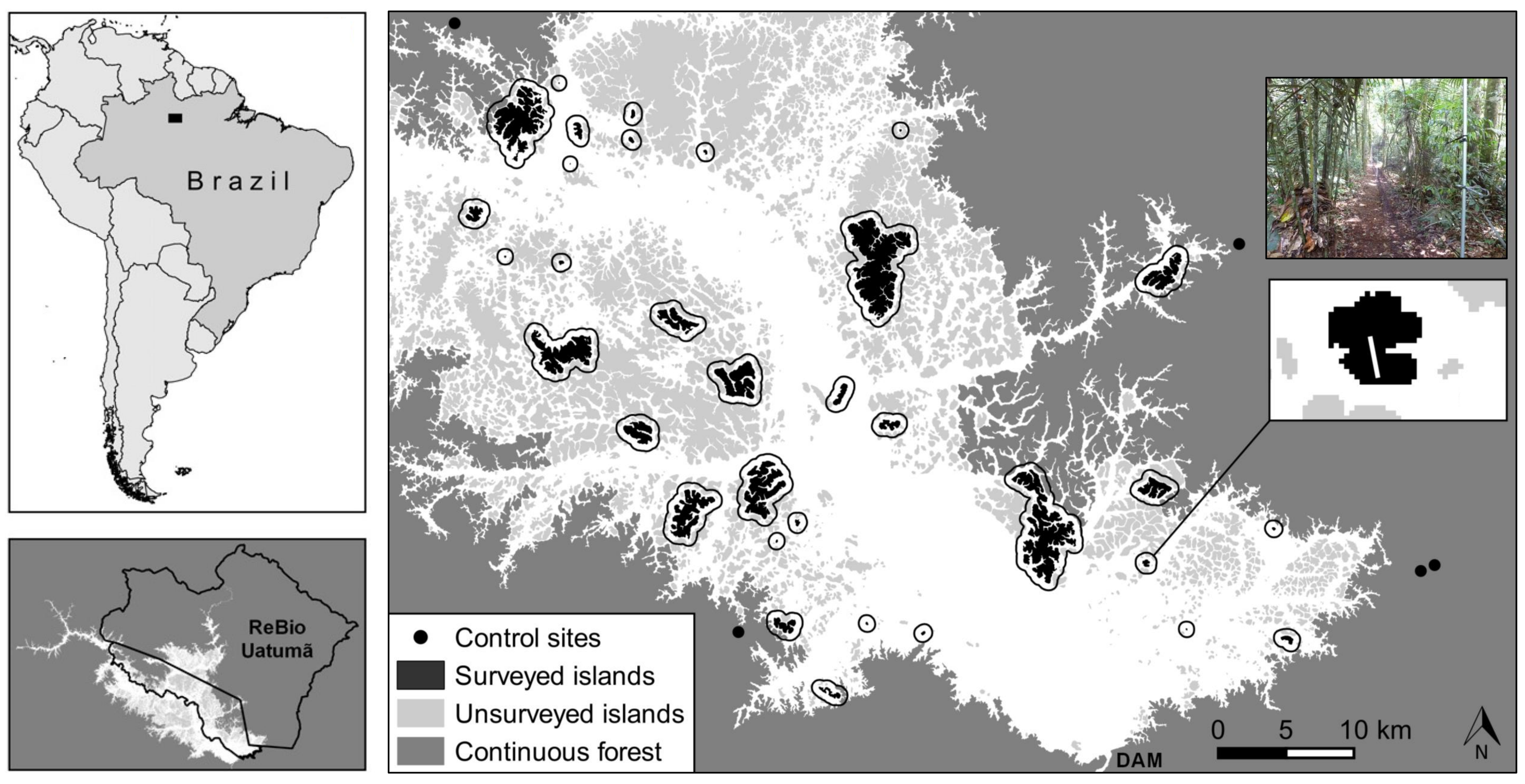
ABSTRACT

We captured 2115 birds of 130 species on 33 Amazonian forest islands induced by a mega dam and in 5 control sites located in continuous forest. We then assessed the impact of forest island size on avian phylogenetic (1) **diversity**, (2) **structure** and (3) **integrity**. We found that (1) forest island shrinkage reduces phylogenetic diversity, although this relationship was mediated by species local extinction rather than forest island size *per se*. Moreover, smaller islands tended to hold phylogenetically overdispersed assemblages, which indicates that competitive exclusion plays a role in shaping bird assemblages therein; and (3) lower phylogenetic integrity compared to control sites. Our results reveal that island-scale forest loss causes detrimental effects on the evolutionary history of avian assemblages.

CONSERVATION PROBLEM: Hydropower causing forest fragmentation

How does forest island size affect phylogenetic **diversity**, **structure** and **integrity**?



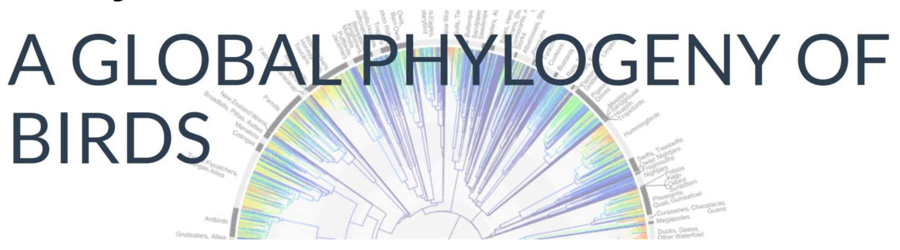
Sampling design

- 5 control sites
- 33 forest islands (0.63 - 1679 ha)

Avian surveys

- 16 mist nets (12 x 2.5 m)
- July to December 2015 and 2016
- 2 days per year
- 6:00 to 15:00
- 576 net-hours per site
- 21,888 net-hours in total

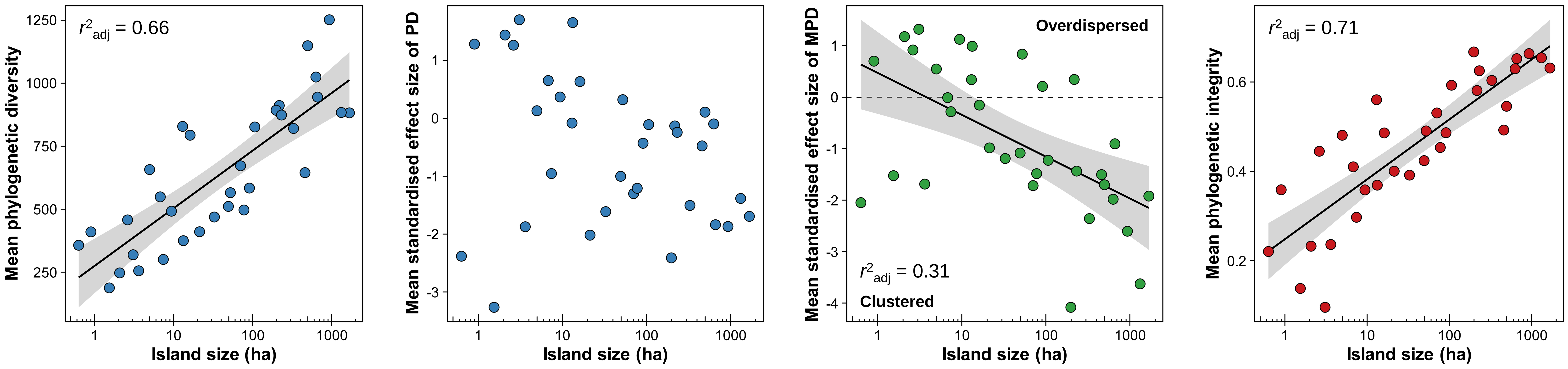
Analysis



Response variables calculated based on 1000 phylogenetic trees

- Phylogenetic diversity (PD)
- Standardised effect size of PD (sesPD)
- Standardised effect size of mean pairwise distance (sesMPD)
- Phylogenetic integrity

What did we find?



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Classifying edge tolerance in understory birds in Amazonian forest islands: a quantitative approach

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Aims

- To estimate the extent of the edge effect for understory birds (Fig. 1) in forest islands of a fragmented landscape induced by a hydroelectric dam (Fig 2).
- To quantitatively classify understory bird species into edge-associated, edge-tolerant, and edge-intolerant (Fig. 1).
- To compare our quantitative classification of species tolerance to edge habitats to the qualitative classification of a widely used bird database (Parker III et al. 1996).

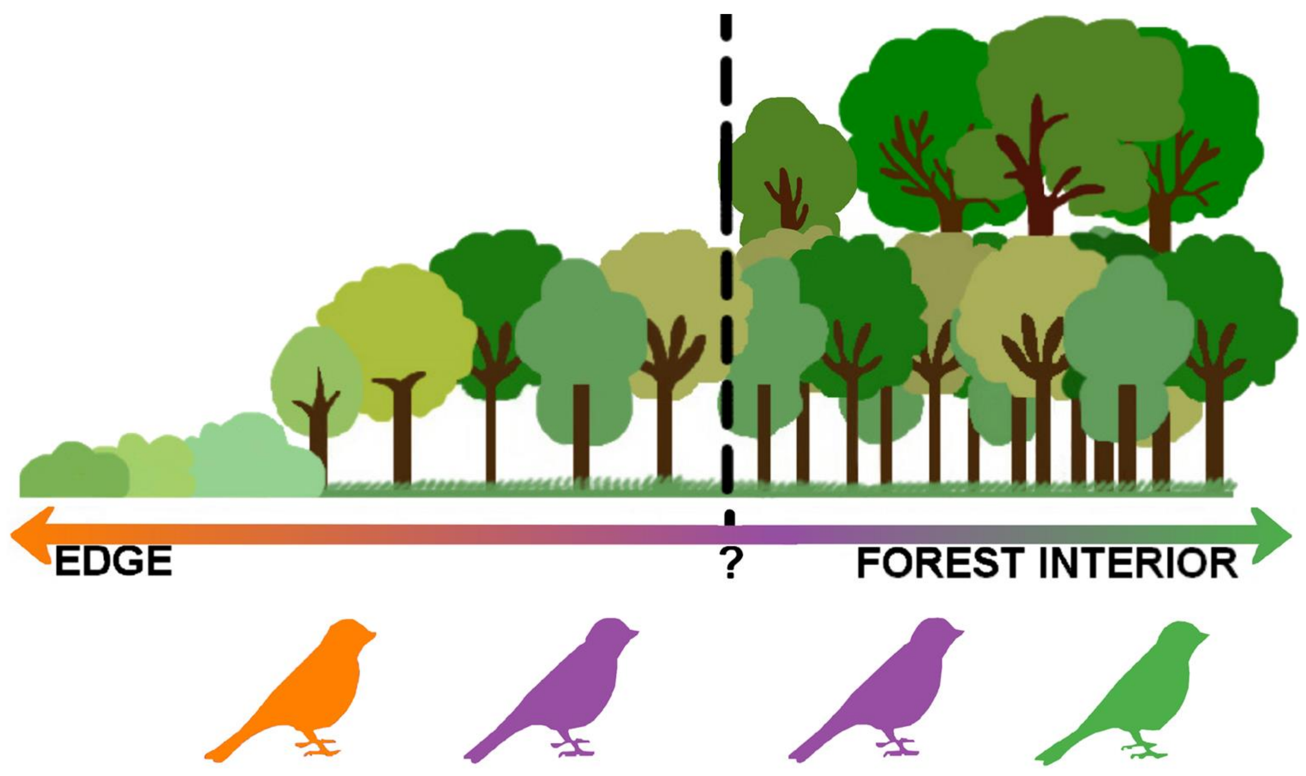

Figure 1. Representation of the extent of the edge effect for understory birds (dashed line) and the species classification into edge-associated (orange), edge-tolerant (purple), and edge-intolerant (green).

Methods

Bird surveys

- We surveyed understory birds in 38 sites (Fig. 2) at different distances from the forest edge, ranging from 15 to 3,140 m (mean ± SD = 293 ± 601 m), in five continuous forest sites and 33 forest islands at the Balbina Hydroelectric Reservoir, Brazilian Amazonia. In each site, we used 16 mist-nets (12 x 2.5 m) (Fig. 3) from 06:00 to 15:00 over two days in both 2015 and 2016 between July and December.

Data analysis

- We used a multivariate axis (NMDS) to summarize the change in species composition along the gradient of increasing distance from the forest edge.
- Habitats, where mist-net lines were placed, were categorized into edge and forest interior based on the degree of dissimilarity in species composition among sites with increasing distance from the forest edge.
- Species were classified according to their distribution between edge and forest interior habitats using a multinomial model (Chazdon et al. 2011).

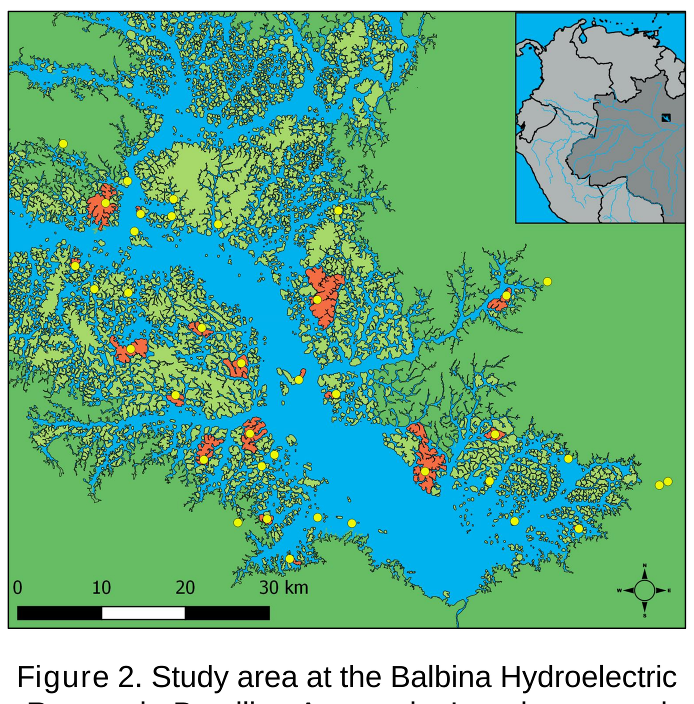

Figure 2. Study area at the Balbina Hydroelectric Reservoir, Brazilian Amazonia. In red, surveyed sites; in yellow, location of mist-net lines.

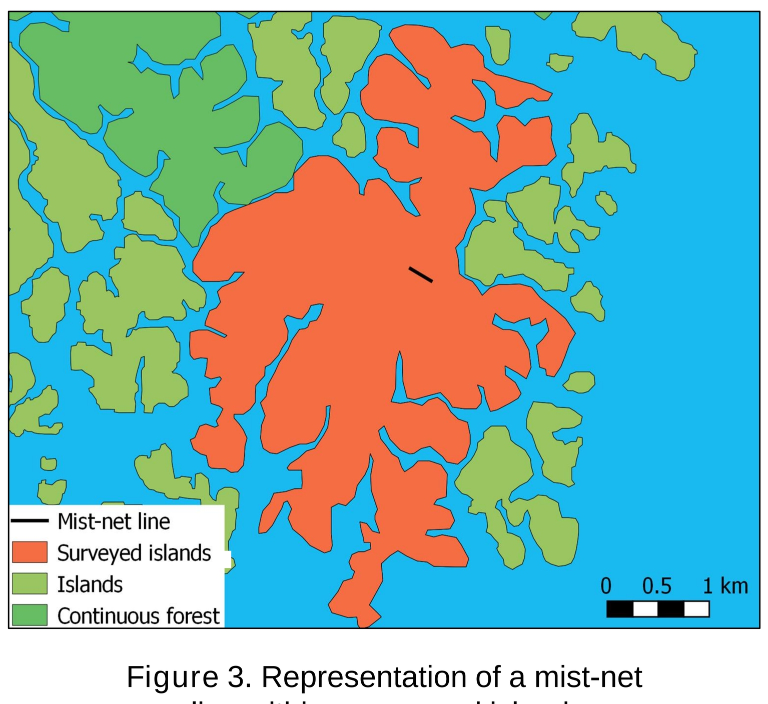

Figure 3. Representation of a mist-net line within a surveyed island.

Results

- During 21,888 net-hours, we captured 2,115 individuals of 130 species.
- Species composition was highly variable up to 100 m from the forest edge, converging into a similar pattern from this distance. (Fig. 4).
- Based on the 100-m threshold, 19 sites were on the edge and 19 in the forest interior.
- Three species were classified as edge-associated, 19 as edge-tolerant, and eight as edge-intolerant (Fig. 5), while 100 species were too rare to be classified.

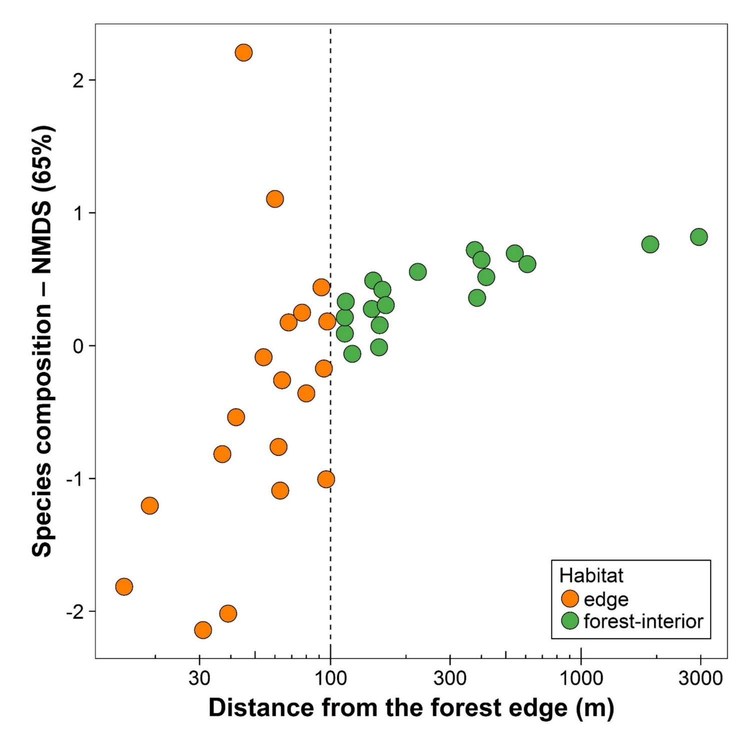

Figure 4. Effect of distance from the forest edge on the species composition.

Figure 5. Species occurrence along the gradient of distance from the forest edge.

Discussion

- Of the 30 species classified, most (n = 17) corroborated the classification in Parker III et al. (1996) (Fig. 6), apart from 13 species which were not expected to occur within edge habitats (Fig. 7).


Figure 6. On the left, edge-intolerant species (Pithys albifrons). On the right, edge-tolerant species (Hypocnemis cantator).


Figure 7. Edge-tolerant species that did not corroborate Parker III et al. (1996): Dixiphia pipra (left) Xiphorhynchus pardalotus (right).

- We conclude that, although species habitat associations assigned based on qualitative data from the literature can be generally accurate, this can be substantially improved using a quantitative approach.

Literature cited

Chazdon RL, et al. 2011. A novel statistical method for classifying habitat generalists and specialists. Ecology 92:1332–1343.

Parker III TA, et al. 1996. Ecological and Distributional Databases. In: Stotz et al. (eds) Neotropical Birds: Ecology and Conservation. The University of Chicago Press, Chicago, Illinois, USA, pp 113–436.

Acknowledgments

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