

How Threatening is the Edge Effect?

Analysing the Threat to Amphibian and Reptile Communities in Tropical Environments from Habitat Fragmentation.

William Drabble (14011738), Dr Marion Pfeifer – School of biology - C180 Biology (ecology and environmental biology) – W.E.Drabble1@newcastle.ac.uk

Introduction

Forest fragmentation in tropical regions creates edges between forest and non-forest habitats and can significantly affect forest-affiliated species, which are more likely to be threatened. Many reports state amphibians and reptiles could be key indicators of fragmentation impacts given their susceptibility to environmental change as both groups are ectotherms and hence more dependent on microclimate. I used biodiversity data across forest – edge – non-forest gradients to test, whether there is **(1) a peak in species diversity and richness within the edge ecotone, (2) that proportion of threatened individuals increases away from the edge, and (3) that landscape attributes significantly affect species diversity.**

Methods

Using species data collected in plots in forest and non-forest habitats across two landscapes - Los Tuxtlas, Mexico (2003-05) (Fig. 1a) and Jari, Brazil (2004-05), I calculated Shannon's diversity index (**SDI**) for each plot using vegan package in R.

- I plotted SDI and species richness (**SR**) against distance to nearest edge (**DNE**) and edge influence (using an in-house algorithm).
- Using environmental data for each plot, I grouped the DNEs into three ecotones – pasture (<0m), edge (0-235m) and interior (>235m) (Schneider-Maunoury et al. 2016). Species threatened under IUCN (International Union for Conservation of Nature) criteria were plotted as percentage of individuals threatened per ecotone.
- Using Google Earth to map man-made structures in Los Tuxtlas, I produced distances for each plot from nearest gravel road, tarmac road and settlement. I plotted Shannon's diversity as a function of each landscape attribute, using linear models to show a significant relationship.

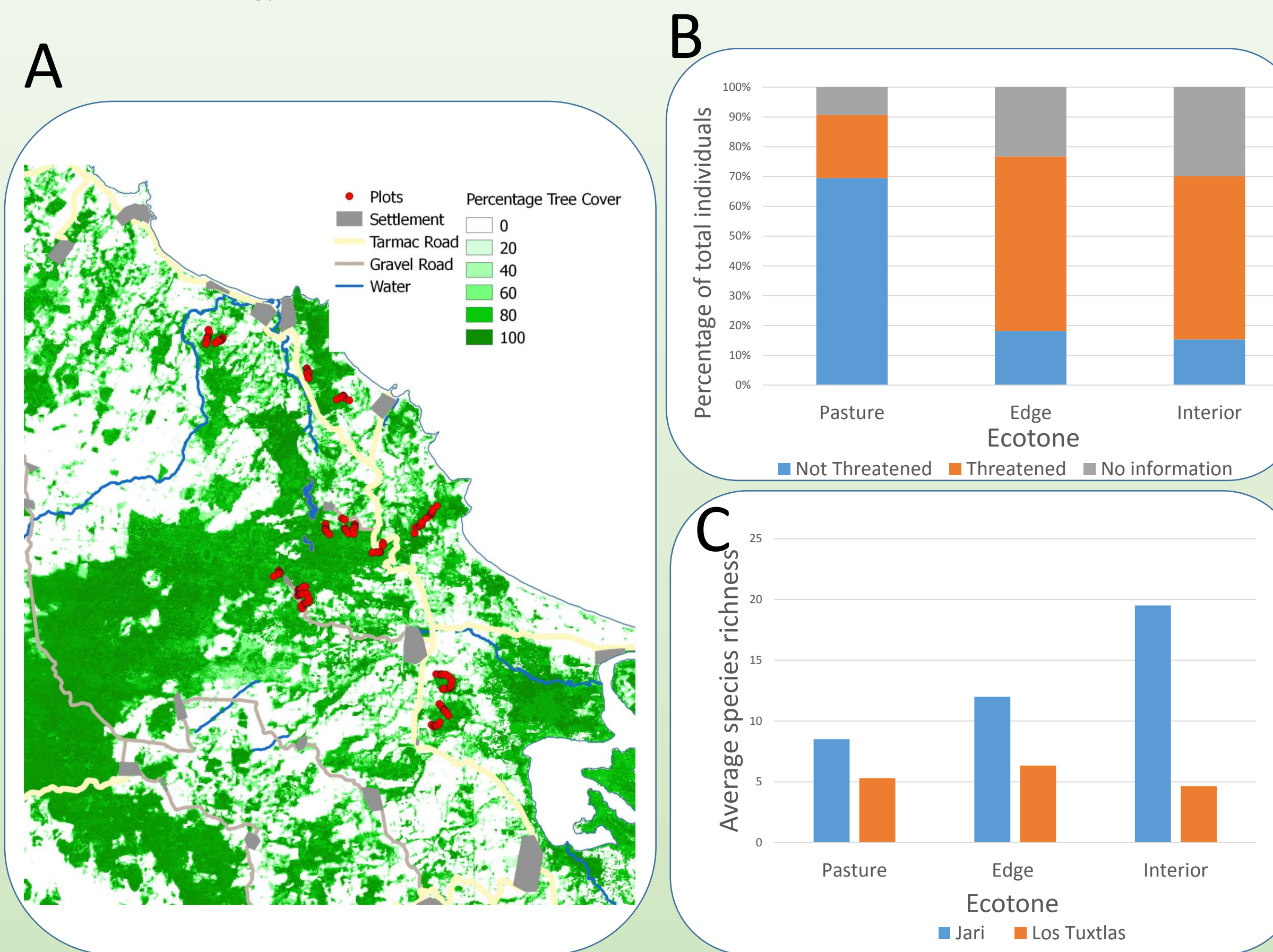


Figure 1. A) map of Los Tuxtlas area, Mexico. B) Proportion of individuals in each ecotone that are threatened. C) average species richness in each ecotone.

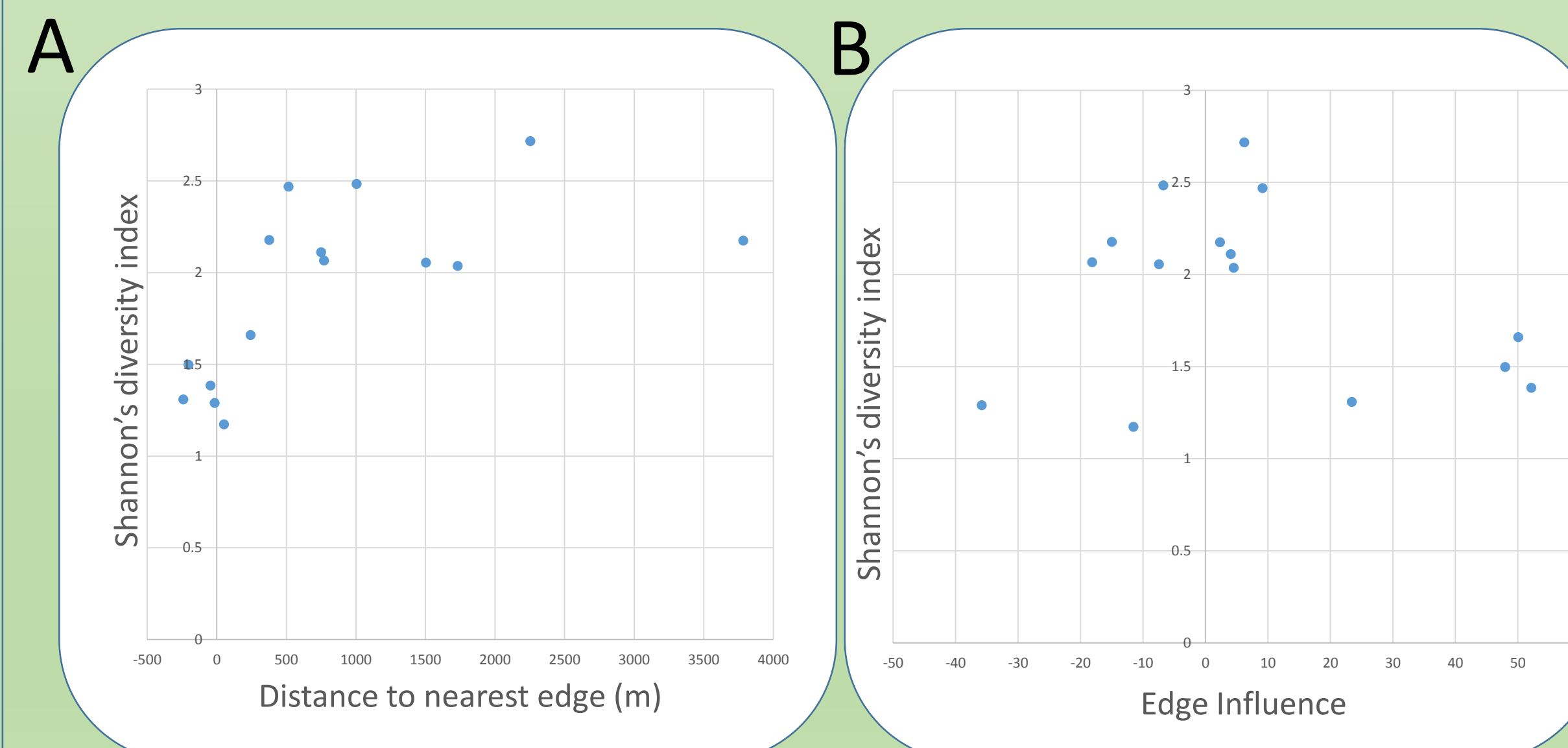


Figure 2. A) Shannon's diversity index against distance to nearest edge in Jari, Brazil. B) Shannon's diversity index against edge influence

References

Schneider-Maunoury L, Lefebvre V, Ewers R M, Medina-Rangel G F, Peres C A, Somarriba E, Urbina-Cardona N, Pfeifer M (2016) Abundance signals of amphibians and reptiles indicate strong edge effects in Neotropical fragmented forest landscapes. *Biological Conservation* 200:207-215
 Cushman S A (2005) Effects of habitat loss and fragmentation on amphibians: A review and prospectus. *Biological conservation* 128:231-240
 Rodrigues A S L, Pilgrim J D, Lamoreux J F, Hoffmann M, Brooks T M (2006) The value of the IUCN Red List for conservation. *Trends in Ecology and Evolution* 21:71-76
 Acknowledgements: I would like to thank Newcastle University for the grant and opportunity to conduct this experiment, and Dr Marion Pfeifer for her guidance and assistance

Results

- The responses of SDI and species richness to DNE and edge influence were inconsistent and significant in the Jari landscape, only (Fig. 2). However, SDI increased towards the forest interior but did not peak at the edge.
- SR peaked at the edge in Los Tuxtlas (Fig. 1C) but peaked in the forest interior in Jari. Threatened species were more abundant at the edge and in the forest interior in Los Tuxtlas (Fig. 1B) but not Jari (only 29/53 IUCN assessed in the latter).
- There was a weak negative effect of proximity to landscape attributes on SDI in Los Tuxtlas for Tarmac ($R=15.7\%$), but positive effect for Gravel and settlements ($R=10.9\%$ and 14.6%) ($P < 0.001$).

Discussion and Conclusions

- Amphibian and reptile community responses to fragmentation are inconsistent and depend on the landscape. Literature states it is the largest threat to amphibians, which should be investigated at population level (Cushman 2005)
- The assumption that threatened species may move away from the edge towards the forest interior is supported by the Mexican data only. These may be species that are adapted to forest interior conditions (e.g. denser canopies, higher humidity). Future research should focus on growing the number of species assessed (Rodrigues 2006)
- Weak correlation between biodiversity and proximity to landscape attributes show other factors are more important disruptors to biodiversity. Further study would involve investigating such anthropogenic factors.