# TESTING THE INFLUENCE OF COVERAGE ON PLANT COMMUNITY IN BRAZILIAN INSELBERGS

**Pinto Junior, H.V.[1]*; Villa, P.M.[1]; Menezes, L.F.T.[2]; Pereira, M.C.A.[3]**

**[1]Universidade Federal de Viçosa, Viçosa - MG, Brazil; [2]Universidade Federal do Espírito Santo, São Mateus - ES, Brazil;**

**[4]Universidade Federal do Espírito Santo, Alegre - ES, Brazil.**

***e-mail: herval_junior@yahoo.com.br**

### Introduction

Predicting how multiple drivers shape species richness patterns is one of the most important issues in ecology and biodiversity conservation (Lavergne *et al*., 2010). However, shifts in species richness and community composition may be driven by different processes at different spatial scales, such as selecting species from a regional species pool into a local habitat, i.e., environmental and biotic filtering processes (Kraft *et al* ., 2015). Biotic assembly rules are expected to be apparent mainly on relatively small spatial scales, i.e., effects of plant coverage on diversity, by means of analyzing dominance-mediated species interactions (Sanei *et al*., 2018a). Conversely, environmental filtering (i.e., climate variables) can be the main driver of community assembly at large spatial scales (Götzenberger *et al*., 2012). However, the relative importance of biotic and abiotic drivers on taxonomic diversity patterns in plant communities currently remains poorly understood.

### Aims

In this context, we aimed to test the effect of plant coverage on community composition and species richness on Brazilian inselbergs in the Atlantic Forest. In order to evaluate this ecological pattern at a local scale, we asked the following research questions: 1) How does plant community composition, species richness, and beta diversity (?-diversity) change between inselberg sites?

### Methods

This study was performed on four inselbergs inserted in an Atlantic Forest matrix in Espírito Santo State, southeastern Brazil. The following inselbergs were selected: Águia Branca, Pedra do Elefante, Forno Grande State Park and Pedra de Pontões. The structure of the vegetation survey was carried out by the line intersection method. Species richness in the four sampled sites was evaluated using sample-based data to estimate rarefaction and extrapolation curves. Species richness curves were constructed with the first Hill numbers, for sampled-based rarefaction and extrapolation curves. Extrapolations were made based on presence/absence data of species using the Hill number of order 0. NMDS was performed to analyze differences in species composition among different inselberg sites based on Euclidean distance considering frequency data to standardize coverage differences between plots. To assess beta diversity, we used the betadisper function in ‘vegan’, based on the applied PERMADISP. All analyses were carried out in R software (R Core Team, 2017).

### Results and Discussion

Sampled-based rarefaction and extrapolation detected similar richness pattern between sites by region without differences using sample-based rarefaction and extrapolation curves. However, the species richness curves showed marked changes between regions, for instance between northern sites (Águia Branca and Pedra do Elefante) in relation to southern sites (Forno Grande and Pedra de Pontões), with contrasting differences in shared species. Thus, sampled-based rarefaction and extrapolation curves showed higher species richness in southern sites than in northern sites. Changes in species diversity and coverage showed significant differences in species richness (Kruskal–Wallis test: ?2 = 170.4; df = 3; $p < 0.01$) and plant coverage (?2 = 120.5; df = 3; $p < 0.001$) among sites when we analyzed at the point sampling scale. Species richness and plant coverage maintained similar patterns by region, with highest values occuring in southern sites. Thus, there were no differences in plant coverage between southern sites. Changes in species composition was significantly different among sites (Permanova: F3,366 = 24.38; $p < 0.001$), forming four groups on the first axis, and the first two NMDS axes explained 55.58% of the variance in species data. We observed significant changes in beta diversity between sites (Permanova: F3,366 = 120.40; $p < 0.001$). Our results demonstrate changes in plant community composition and species richness among sites with different climate patterns. We observed that changes in species richness and species composition did not occur as expected with climate variables, although there was high beta diversity between inselbergs with contrasting differences in shared species between regions, probably due to factors that act at local and fine-scales on them (i.e., coverage), and dispersal limitation by geographical distance. The inselbergs have been compared by some researchers with the continental islands from a biological point of view, such as "terrestrial habitat island" based on the theory of island biogeography, by the fact that these geomorphological units also have a degree of isolation around (Porembski & Barthlott, 2000). This contrast is due to the fact that inselbergs also have different degrees of antiquity and generally newer, in addition to the spatial isolation is much smaller compared to the continental islands (Porembski, 2007). However, our results show that there is a marked contrast in the shared species, only in an Atlantic Forest gradient, thus revealing the phytogeographic importance of these inselbergs in their contribution to regional diversity.

### Conclusions

Coverage as a biotic filtering agent at a local scale plays an important role in explaining effects on plant community composition and species richness for these tropical inselbergs. It is necessary to construct models that compare the climatic variables with drivers that represent the local diversity, such as the coverage used in this work.

**Literature cited**

GÖTZENBERGER L.; BELLO F.; BRATHEN K.A.; DAVISON J.; DUBUIS A.; GUISAN A.; LEPS J.; LINDBORG R.; MOORA M.; PÄRTEL M.; PELLISSIER L.; POTTIER J.; VITTOZ P.; ZOBEL K.; ZOBEL M. 2012. Ecological assembly rules in plant communities approaches, patterns and prospects. Biol Rev 87: 111-127.

KRAFT N.J.B.; ADLER P.B.; GODOY O.; JAMES E.C.; FULLER S.; LEVINE J.M. 2015. Community assembly, coexistence and the environmental filtering metaphor. Func Ecol 29: 592-599.

LAVERGNE S.N.; MOUQUET W.; THUILLER O.; RONCE O. 2010. Biodiversity and climate change: Integrating evolutionary and ecological responses of species and communities. Ann Rev Ecol Evol Sys 41: 321-350.

POREMBSKI S.; BARTHLOTT W. 2000. Inselbergs: biotic diversity of isolated rock outcrops in tropical and temperate regions, 542 pp. Springer Verlag, Berlin/Heidelberg.

POREMBSKI S. 2007. Tropical inselbergs: habitat types, adaptive strategies and diversity patterns. Rev Bras Bot 30: 579-586.

R CORE TEAM. 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

SANAEI A.; CHAHOUKI M.A.Z.; ALI A.; JAFARI M.; AZARNIVA H. 2018a. Abiotic and biotic drivers of aboveground biomass in semi-steppe rangelands. Sci Total Environ 615: 895-905.

**Thanks**

(Neotropical Grassland Conservancy – NGC and CAPES)