Population genetics and functional ecology of mangroves across the Galápagos archipelago

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Funding

KELLNER & STOLL STIFTUNG FÜR KLIMA UND UMWELT
TREUHANDSTIFTUNG DER STIFTUNG DER UNIVERSITÄT BREMEN
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GEFÖRDERT VOM
FOUNDATION FOR THE SEA okeanos
Bundesministerium für Bildung und Forschung
DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service

Introduction

The volcanic Galápagos archipelago provides a perfect setting for evaluating patterns of genetic variation in an environment with minimal human impact, where the major forces shaping patterns of genetic variation consists of natural processes. While the distribution of mangrove ecosystems has been thoroughly reassessed by Moity et al. (2019), the genetic diversity and connectivity among populations remains unknown. Our project addresses this gap of knowledge by investigating patterns of genetic diversity and genetic structure across the Galápagos Islands (Fig. 1 and 2). Measures of several functional traits and environmental parameters will help deciphering potential signs of local adaption.

Project rationale

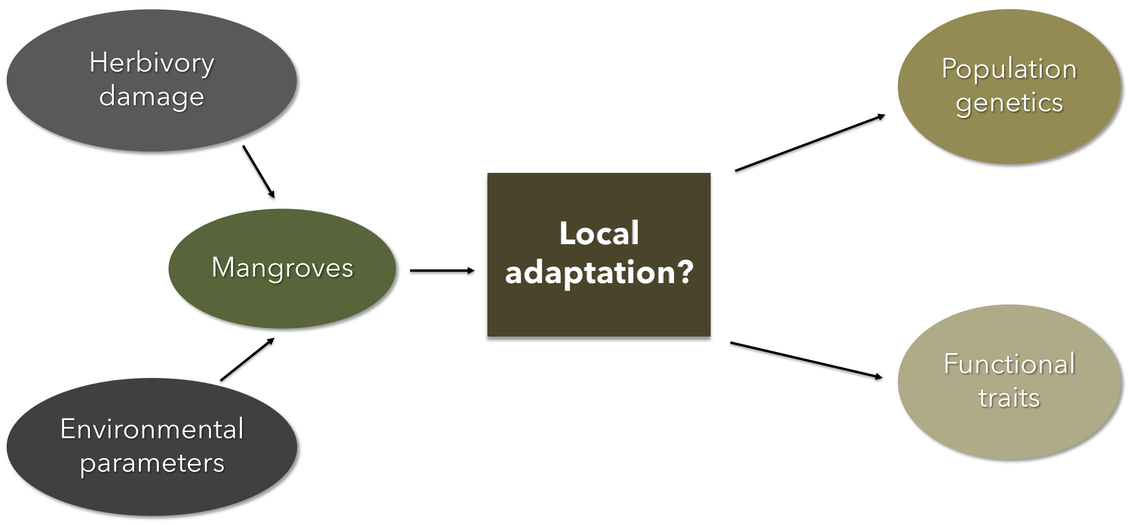

Fig.1 Summary of the project rationale: assessing biotic (herbivory damage) and abiotic conditions (environmental parameters) affecting mangroves and potentially leading to local adaptation, which will be evaluated through population genetics and functional trait analyses.

Fig.2 Map of the Galápagos archipelago showing sampling locations (basemap ESRI Satellite, created with QGIS Development Team 2023) – sampling locations 2021 used for population genetics only.

Preliminary results - Functional traits

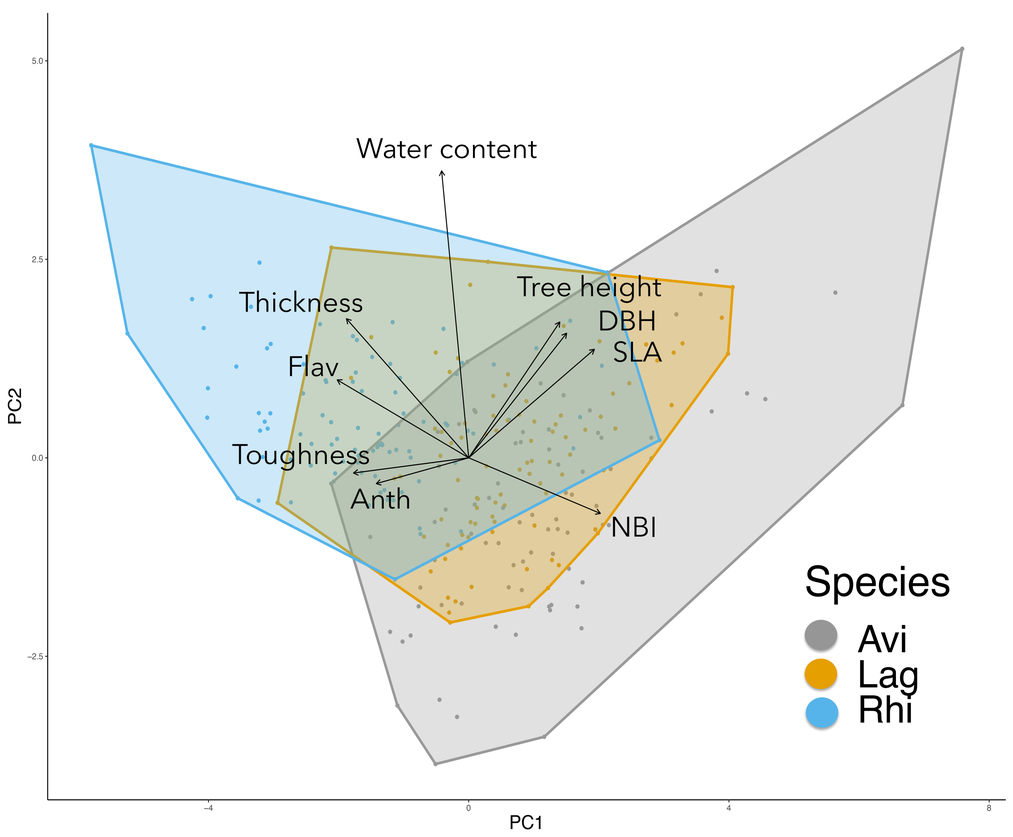

Fig.3 PCA ordination of all individual mangrove trees along PC axis 1 and 2; hull overlays used for species; functional traits are shown as arrows. Abbreviations: Avi= *Avicennia germinans*, Lag= *Laguncularia racemosa*, Rhi= *Rhizophora mangle,* Flav= Flavanol index, Anth= Anthocyanin index, NBI= Nitrogen Balance Index, DBH= Diameter at Breast Height, SLA= Specific Leaf Area.

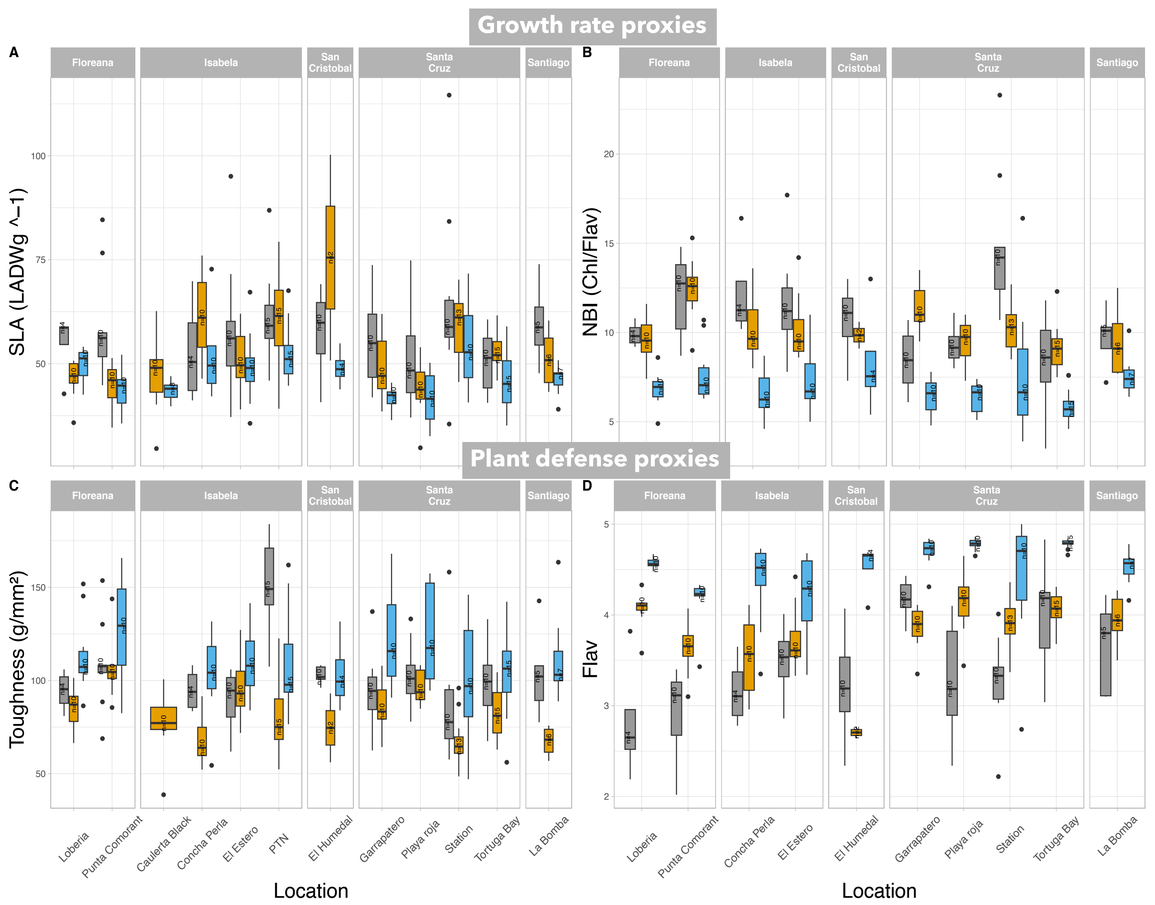

Fig.4 Distribution of selected leaf traits across species, Islands and locations. **A+B** Specific Leaf Area (SLA) and Nitrogen Balance Index (NBI) as proxies for growth rate; **C+D** Toughness and Flavonol index (Flav) as proxies of mechanical and chemical plant defense. Further abbreviations: Chl= Chlorophyll index, LA= Leaf area, DW= dry weight.

Preliminary findings

Significant differences in functional trait expression
I. across species
II. between and within Islands

Outlook

References

Moity, N., Delgado, B., & Salinas-De-León, P. (2019). Mangroves in the Galapagos islands: Distribution and dynamics. *PLoS ONE*, *14*(1). https://doi.org/10.1371/journal.pone.0209313
QGIS Development Team, 2023. QGIS Geographic Information System. Open Source Geospatial Foundation Project. http://qgis.osgeo.org
R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org

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Fundación Charles Darwin Foundation GALAPAGOS
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