A multidisciplinary framework for biodiversity prediction in the Brazilian Atlantic Forest hotspot
The Brazilian Atlantic Rainforest

- ~1,230,000 Km²
Map Diversity in Space

Methods

Species, Community Data (locality records, lists)

Describe present-day environments

Understand mechanisms of ecological response

Understand community-level responses to environmental shifts

Model diversity patterns now

Genetic/Genomic Methods

Genetic Genomic Data

Genome Dynamics

Paleoclimate (G-IG)

Predict Diversity Patterns under Future Environments

Microclimate, Climate

Topography, Forest Structure

Physiology, Phenology

Climate Dynamics

Species, Community Data (locality records, lists)
How can the incorporation of remote sensing components improve biodiversity prediction?

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Genetic

Genomic

Data

Climate Dynamics

Paleoclimate (G-IG)
Microwave data enable characterization of present-day environments for biodiversity modeling

- Species Distribution Models derived from MERRA-derived bioclimatic layers performed better than models built with WorldClim data.

- Models constructed with AMSR E-based layers had similar performance to models built with WorldClim.

Waltari et al. 2014. Meth Ecol Evol
AMSR-E Climatology enables description of day/night temperature shifts (here, LST Min; 2003-2011)

Khan et al. in prep.
Remote sensing products predict diversity patterns at larger ecological and geographical scales

Brown, Paz et al. in review.
Paz et al. in prep.
Remote sensing products predict diversity patterns at larger ecological and geographical scales

<table>
<thead>
<tr>
<th>R² Phylogenetic Diversity</th>
<th>R² Phylogenetic Endemism</th>
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<td><img src="image" alt="Butterfly" /> 0.92</td>
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<tr>
<td><img src="image" alt="Frog" /> 0.86</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Preliminary analyses based on MODIS and CHIRPS data

Conditional Autoregressive Models used to address spatial autocorrelation; probability of values at any given location is conditional on neighboring values.

Model diversity patterns now

Paz et al. in prep.
Remote sensing improves description of microclimates, which are needed to understand physiological responses to climate.

Temperature and relative humidity at multiple substrate depth

understand mechanisms of ecological response

Strangas et al. 2018 Ecography
Stranas et al. in prep.
Searching for genomic signatures of adaptation to environmental gradients

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Bertola et al. in prep.
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Species, Community Data (locality records, lists)

Stay tuned for next year’s meeting
Searching for genomic signatures of adaptation to environmental gradients

**Genomic data**
- RADseq data >20 taxa
- Population Structure and connectivity (PCA, sNMF, STRUCTURE, EEMS)

**Adaptive genomics analyses**
- Redundancy Analysis (RDA)
- Latent Factor Mixed Models (LFMM)
- Identification of adaptive SNPs

**Environmental data**
- Summarized environmental parameters
  - Contemporary (RS + BIOCLIM)
  - Historical

**Spatial patterns of adaptation**
- Community wide spatial pattern of adaptation
- Environemntal space
- Spatial pattern of adaptation per species
Environmental data:

**Contemporary:**
- Remote sensing
- BIOCLIM (DeBlauwe)
- BIOCLIM (CHELSA)

**Historical:**
- BIOCLIM LH
- BIOCLIM LGM
Genomic data:

- RADseq data
- >20 taxa
- Different ranges/environmetal space