Patterns of regional- and local- scale genetic connectivity in Eastern Atlantic mangroves

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Gene flow in mangroves is influenced by both intrinsic and extrinsic factors, of which the interaction controls the genetic connectivity between populations both close and remote. Identifying these factors and understanding the way they interact in shaping connectivity among populations at variable geographic scales allows to better understand how populations established, how coastlines have been colonized, how they might respond to climate change, and how conservation efforts can be strategized. We studied the genetic diversity of mangroves along the Cameroonian coastline to investigate the role of oceanic barriers and surface currents, tidal regime, estuarine geomorphology, and forest landscape structure in shaping the spatial distribution of genetic diversity at different spatial scales. We used a combined approach of genetic markers, mathematical modeling, and release-recapture experiments.

Our results indicate that contemporary ocean currents limit inter-regional gene flow, resulting in a clear genetic discontinuity between populations on either side of an oceanic convergence zone. Dispersal corridors created by the submergence of lowlands by historical sea levels rise have favored genetic connectivity between areas that were isolated during glacial times. Additionally, we found that the interplay of river currents and tidal patterns allow for asymmetric bidirectional dispersal along a major river, while winds and local hydrodynamics, forest structure, as well as hidden founders might contribute to among and within catchment connectivity in the most anthropized Cameroonian mangrove area - the Cameroon Estuary complex (CEC). Observed fine-scale genetic structure in these populations suggests that the vast extent of mangroves of the CEC persists due to recent re-expansion and re-colonization from micro-refugia. Genetic diversity hotspots were identified in the Rio del Rey and CEC, while populations in the southerly estuaries were less diverse.

Our findings highlight the importance of considering ocean surface current patterns and local hydrodynamics, and hence the importance of considering hydrological connectivity in formulating management practices and restoration measures for anthropized mangrove areas. Finally, our results also indicate that (climate-driven) changes in coastal geomorphology shape the distribution of genetic variability at different geographical scales.

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