

Patterns growth and herbivory in mangrove forests along latitudinal gradients and the consequences of nutrient over-enrichment

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Abstract

Mangroves are the foundation for heterogeneous ecosystems with complex differences in forest structure, biodiversity, biogeochemistry, and hydrology that vary at tidal, latitudinal, and regional scales. In addition to being under intense pressure from coastal development such as direct conversion to agriculture, aquaculture, and tourism, mangroves are threatened globally by climate change and nutrient over-enrichment. Based on a network of long-term fertilization experiments in mangrove forests that span latitudinal gradients in the Atlantic-Caribbean East Pacific (ACEP) and Indo-West Pacific (IWP), our goal is to determine if nutrient loading interacts with climatic differences to alter growth, nutrient dynamics, ecological stoichiometry, and trophic structure. We use latitude and tidal elevation as proxies for climate change and sea-level rise. Increased nutrients have significant effects on ecological processes that affect both mangroves and their fauna. Primary production is nutrient limited at all locations, but the nutrient limiting growth varies regionally and locally. Nutrient enrichment alters patterns of primary and secondary consumption in some but not all cases. Herbivory levels are comparable to values reported for other tropical forests. The fauna is characterized by endophytic specialists including miners, gallers, and borers. Latitudinal differences in herbivory emerge but are not the same for IWP vs. ACEP for all species or feeding guilds within a region. In the IWP, herbivory of *Avicennia marina* correlated significantly with latitudinal differences in air temperature, but not with nutrient availability or rainfall. In the ACEP, significant differences in feeding damage on leaves of *Rhizophora mangle* by the omnivorous mangrove tree crab, *Aratus pisonii*, across latitudinal and tidal gradients was correlated positively with crab density and forest productivity and negatively with damage imposed by herbivores. We found that a trophic cascade based on the complex size- and stage-structured population dynamics of *A. pisonii* plays a pivotal role in mangrove foodwebs in the Neotropics.

Keywords

effect size, folivory, loss of yield, shoot elongation, space-for-time substitution