Mangrove Wetlands Leaf Productivity and Expansion are Controlled by Air Temperature, Phosphorus Availability, and Salinity in Port Fourchon, Louisiana, USA

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temperate coastal regions, driven by rising air temperatures associated with climate change in the Gulf of Mexico (GOM). While the presence of the mangrove species *Avicennia germinans* has been historically documented in this area, its expansion has accelerated over the last 20 years. Given the complex factors at play in competition among wetland plants for space and resources, it is expected that temperature alone does not drive and sustain this expansion, which is regulated by bio-geomorphic feedback at local spatial scales. This study evaluates how scrub mangroves (<1.5 m height)—the currently dominant mangrove ecotype—differ from taller trees (>3 m) (fringe and intermediate ecotypes) to understand how fertility and relative elevation influence net primary productivity (NPP). This information is essential for predicting expansion rates that will change habitat structure, function, and the quality and quantity of ecosystem services in coastal wetlands. Port Fourchon, located in an abandoned delta lobe of Louisiana, contains the largest mangrove area (~811-1000 ha); thus, it serves as an ideal site to assess the relative influence of temperature (freeze events/warming) and nutrient availability on foliar productivity (NPP_L)— a major contributor to soil formation. We addressed the following questions: 1) What is the difference in litterfall NPP (foliar and total) between fringe and scrub mangrove ecotypes? 2) What is the litter residence time on the forest floor? 3) What are the leaf stoichiometric (C:N:P) differences among the ecotypes? 4) Does phosphorus (P) availability restrict mangrove growth and productivity? Litterfall samples were collected monthly in litter baskets deployed across different ecotypes from 2019 to 2024. Porewater salinity in mangrove soils (>35) exceeded that of salt marshes NPP_L rates varied from 0.2 to 2-4 gdw m^{-2} yr^{-1}, with lower values found in the fringe forest. Both inorganic nitrogen (N) and P availability are high, supporting increased productivity rates. Carbon content in senescent leaves was similar in summer and spring, with variations in the C:N ratio reflecting growth patterns and changes in nutrient demand. N:P ratios were not significantly different among ecotypes, although a difference in the C:N ratio was observed. Experimental litter baskets, adjusted for area and canopy height, yielded comparable results. The concentrations of [PO_4^-] in soil pore water (PW) were 188±23 µM, and total organic P in senescent leaves was 522±21 µg/g, indicating substantial P availability; these PW concentrations represent the highest observed in *A. germinans* monospecific mangrove forests in the GOM. Despite their low stature, the reproductive output of mangroves is high, supporting and accelerating expansion rates even in the face of natural disturbances (e.g., defoliation from hurricanes and freezes).