Florida mangroves show no evidence of thermal acclimation of leaf respiration: implications for coastal carbon cycling and future climate

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Introduction

Temperature controls of physiological processes that regulate C cycling in mangrove ecosystems are understudied. Because respiration represents the second largest C flux between vegetation and the atmosphere and 50% of plant respiration comes from leaves, studies that investigate mangrove responses to temperature could improve representation of coastal C cycling in global scale models.

In this experiment we tested the hypotheses that 1) three species of Florida mangroves would show common patterns of thermal acclimation of leaf respiration to seasonal temperature changes, 2) growth under persistent warming would result in thermal acclimation of leaf respiration that is common across species, and 3) acclimation to climate warming would mirror acclimation to seasonal temperature changes.

Materials and Methods

Plant material: 24 *Rhizophora mangle* seedlings, 12 *Avicennia germinans* seedlings, and 12 *Laguncularia racemosa* seedlings.

Treatments: Two experimental treatments (ambient, warmed). Warmed treatment imposed using passive warming chambers (see Figure).

Measurements: Plant growth, leaf mass area (LMA), short-term temperature responses of leaf respiration (R), and mean daily temperature at the experiment site in Jacksonville, FL.

Results and Discussion

Leaf mass area (LMA), leaf respiration at 25°C (R_{area}^{25}), and the temperature sensitivity of leaf R (Q_{10}) varied over time and differed among species, but did not differ between treatments (Figure 1).

Across species, we found weak positive relationships between R_{area}^{25} and mean-daily air temperature, suggesting that basal R increases slightly as seasonal temperatures increase (Figure 2). We conclude that mangroves may show little thermal acclimation of leaf R, which could accelerate the positive feedback between temperature, R, and atmospheric CO_2.

A similar experiment will be conducted with *R. mangle* and *A. germinans* seedlings from two different climates to determine if results are repeatable.

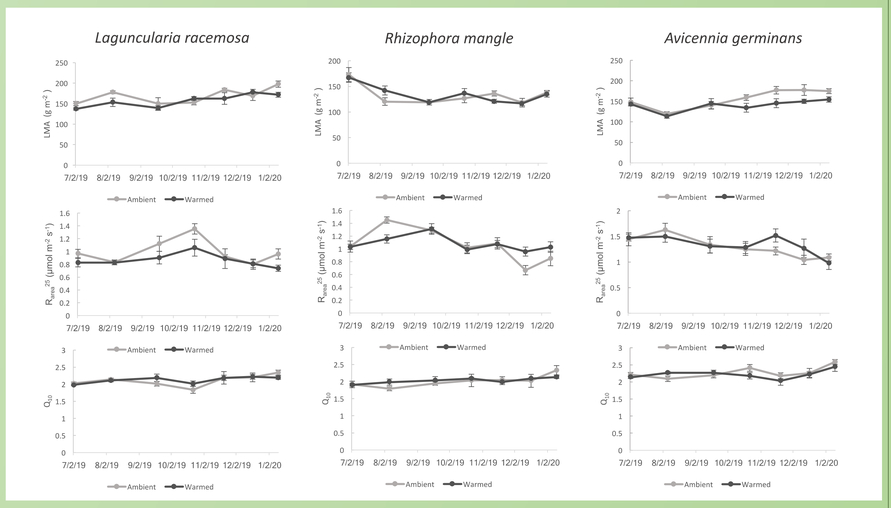

Figure 1. Leaf mass area (LMA), leaf respiration at 25°C (R_{area}^{25}), and metabolic change at a 10°C increase (Q_{10}) are represented for *Laguncularia racemosa, Rhizophora mangle,* and *Avicennia germinans* across seven time points with error bars representing standard errors of the mean values. Significant differences are inconsistent between values and species.

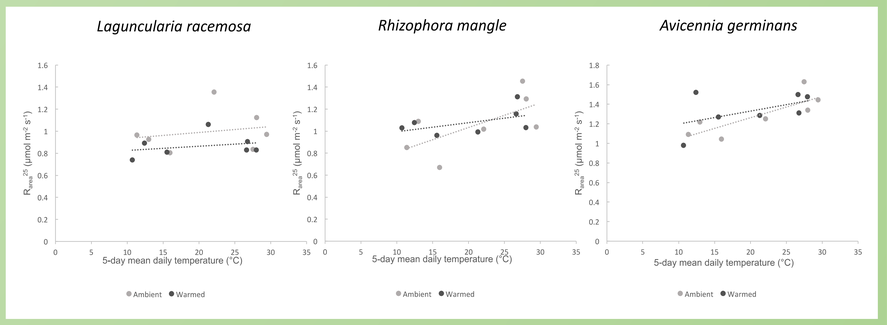

Figure 2. Leaf respiration at 25°C (R_{area}^{25}) is represented with the 5-day mean daily temperature (°C) across seven time points for *Laguncularia racemosa, Rhizophora mangle,* and *Avicennia germinans* with a linear regression line. Significant differences are inconsistent between species over time.