

**TITLE** **TEMPERATE AND TROPICAL FOREST CANOPIES ARE ALREADY FUNCTIONING BEYOND THEIR THERMAL THRESHOLDS FOR PHOTOSYNTHESIS**

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<b>KEY WORDS</b>	forest canopies, tropical forests, photosynthesis, temperature, climate change
<b>ABSTRACT</b>	<p>Tropical tree species have evolved under very narrow temperature ranges compared to temperate forest species. Studies suggest that tropical trees may be more vulnerable to continued warming compared to temperate species, as tropical trees have shown declines in growth and photosynthesis at elevated temperatures. However, regional and global vegetation models lack the data needed to accurately represent such physiological responses to increased temperatures, especially for tropical forests. To address this need, we compared instantaneous photosynthetic temperature responses of mature canopy foliage, leaf temperatures, and air temperatures across vertical canopy gradients in three forest types: tropical wet, tropical moist, and temperate deciduous. Temperatures at which maximum photosynthesis occurred were greater in the tropical forests canopies than the temperate canopy (<math>30 \pm 0.3</math> °C vs. <math>27 \pm 0.4</math> °C). However, contrary to expectations that tropical species would be functioning closer to threshold temperatures, photosynthetic temperature optima was exceeded by maximum daily leaf temperatures, resulting in sub-optimal rates of carbon assimilation for much of the day, especially in upper canopy foliage (&gt;10 m). If trees are unable to thermally acclimate to projected elevated temperatures, these forests may shift from net carbon sinks to sources, with potentially dire implications to climate feedbacks and forest community composition.</p>
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