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Plant phosphorus-use and -acquisition strategies and energy costs in Amazonia

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Phosphorus (P) is one of the main limiting nutrients for forest productivity in Amazonia. To meet P needs, plants invest resources in different strategies which may increase their P-use efficiency, e.g., by resorbing P from senescing organs, or increase their P-acquisition efficiency, e.g., by acclimating fine root traits (architectural, morphological, physiological, and symbiotic). P-acquisition strategies can be categorized into foraging strategies related to the uptake of plant-available P or mining strategies related to the mobilization and uptake of less available forms of P. However, little is known about the effects of soil P on plant P-use and -acquisition strategies in Amazonia. Therefore, we have conducted a literature review and synthesized the current knowledge on the variation of different P-use and -acquisition strategies across soil P fertility gradients and their response to P fertilization in Amazonia and other tropical forests (Reichert et al., in press). We provide a conceptual framework on the distribution of these strategies in Amazonia and propose that, at the plant community level, foraging strategies (via fine roots and arbuscular mycorrhizas) are more prevalent and may contribute most for plant P uptake in soils with intermediate to high P availability, and leaf P resorption and mining strategies (via root exudation of acid phosphatases and organic acids) in soils with intermediate to low P availability (Reichert et al., in press). Here, we suggest that the investment in different P-acquisition strategies may be partially explained by the energy cost per unit P acquired. Based on the assumption that this cost varies with strategy and the form of P and its concentration in the soil (Raven *et al.*, 2018), we have developed a stand-alone theoretical model to predict plant investments in P acquisition and test our conceptual framework. We constrain the model with field observations on forest growth and soil nutrients from sites in Amazonia and explore possible shifts in P-acquisition strategies along soil P fertility gradients.

Raven JA, Lambers H, Smith SE, Westoby M. 2018. Costs of acquiring phosphorus by vascular land plants: patterns and implications for plant coexistence. *New Phytologist* **217**(4): 1420-1427.

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