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First Results from the ForestGEO Hydraulic Trait Initiative

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The ForestGEO hydraulic trait initiative seeks to understand how hydraulic traits control forest productivity and performance in a changing climate. Functional traits explain to certain degree differences in growth rates between species and ecosystems. However, commonly measured traits (e.g., wood density, leaf mass per area or leaf thickness) have limited ability to explain species' responses to water limitation. In contrary, hydraulic traits (such as turgor loss point or percentage loss of conductance) are thought to modulate tree and forest ecosystem responses to climate change. Here we present first results from a study looking at leaf turgor loss points (ψ_{tlp}) measured for species in the ForestGEO permanent forest monitoring plots on Barro Colorado Island in Panama and in the Pasoh forest reserve in Malaysia. Both forests can be classified as tropical moist lowland forest, receiving more than 2000 mm of rainfall per year. The climate in Panama is a seasonal tropical climate with a distinct dry season from January to April, whereas the climate is aseasonal in Malaysia and rainfall is evenly distributed throughout the year. Altogether, we measured ψ_{tlp} for over 120 forest tree species using the osmometric method. In Panama, ψtlp ranged between -1.25 MPa and -2.77 MPa across all sampled species and averaged at -1.65 MPa. In Malaysia ψ_{tlp} was between -1.02 MPa and -2.46 MPa and on average -1.57 MPa. Accordingly, the forest on Barro Colorado with its natural dry season has a species pool of more drought-adapted trees species than the perhumid forest at Pasoh. Both forests have tree species well adapted to drought, but they are much more common in the seasonal climate. High diversity of tree species with a large range of tree hydraulic traits is promising a certain resilience of the forest to changes in rainfall pattern with climate change. Drought will have stronger effects on the tree species composition in aseasonal forests as they contain a higher fraction of tree species with low resistance to water limitation.