**Assessing wood functional traits through three-dimensional measurement techniques. Why?**

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The hydraulic functioning of trees is largely depending on the tree’s internal structure. So far, structural hydraulic traits have mainly been addressed in a two-dimensional way, especially in large-scale studies where populations of trees are compared in relation to prevailing environmental conditions. Some traits do however demand a three-dimensional approach, as has recently been shown for conduit clustering (Brodersen et al., 2011; Martínez-Vilalta et al., 2012). By use of X-ray Computed Tomography (CT) and high resolution CT (micro-CT), we obtained serial scans of mangrove wood volumes that we used to obtain three-dimensional visualizations of wood tissues and cells, allowing the development of three-dimensional measurement protocols for several wood functional traits (e.g. conduit clustering, phloem and parenchyma network characteristics – Robert et al., 2009). In this study, we compare two-dimensional and three-dimensional measurement techniques and discuss their necessity, advantages, disadvantages and feasibility using trees from the mangrove ecosystem as examples. Our work opens up new possibilities for feasible measurements on large sample sets of broadleaf species originating from different environments.

**References**

Brodersen, C.R. et al. (2011). Automated analysis of three-dimensional xylem networks using high-resolution computed tomography. *New Phytologist* 191:1168-1179.

Martínez-Vilalta, J. et al*.* (2012). Spatial distribution and packing of xylem conduits. *American Journal of Botany* 99: 1189–1196.

Robert, E.M.R. et al. (2011). Successive cambia: A developmental oddity or an adaptive structure? *PlosOne* 6 (1): e16558.