Functional and qualitative aspects of mangrove wood in a context of climate change – Importance and priority-setting for conservation and restoration

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The mangrove ecosystem occurs at the border between land and sea in tropical and subtropical coasts. It is of high ecological importance as well as it provides valuable ecosystem services to human coastal communities (Walters *et al.*, 2008). Mangroves also play an important role in the sequestration of carbon, as the carbon storage capacity of mangrove forests is high compared to terrestrial forests (Komiyama *et al.*, 2008; McLeod *et al.*, 2011).

Mangrove trees have developed several adaptations to cope with high variability in soil salinity and water availability, inundation, tidal current and wave action, and unstable sediments, characterizing the intertidal zone (Tomlinson, 1994). Particularly soil salinity and fluctuating water availability are demanding for the water transport system of trees. Mangroves trees have developed different strategies to adapt their hydraulic architecture to cope with these conditions (Robert *et al.*, 2009). *Avicennia marina*, for example, has a safer, but less efficient, water transport system than *Rhizophora mucronata*. The vessels of *A. marina* are smaller and more grouped vessels than those of *R. mucronata*, making the latter more vulnerable to cavitation. Nevertheless, for both species vessel grouping increases and vessel diameter decreases with increasing soil salinity. The species-specific differences in hydraulic architecture explain the differences in distribution range on a local scale. *A. marina* grows in a wider distribution range, including sites with high soil salinity where *R. mucronata* does not occur. On a global scale, the latitudinal limits of mangroves are defined by a complex interaction of temperature and humidity, which is not yet fully understood (Quisthoudt *et al.*, 2012).

We hypothesize that adaptability and sensitivity of the hydraulic architecture of mangrove trees in relation to climate and environmental conditions are major factors in the response of mangroves to global climate change. Therefore we aim to establish the quantitative relation between properties of the water transport system and the ecological success of the globally important mangrove genera *Avicennia* and *Rhizophora*. This will allow us to understand the role of climate and climate change in the current and future distribution and functioning of the mangrove ecosystem. The underlying idea is that water relations of mangrove trees are key to their ecological functioning and hence, disruption of these relations causes their disappearance. We expect this to be reflected in wood anatomy, density and carbon content and therefore related to carbon sequestration.

Stem wood samples will be collected from *Avicennia* and *Rhizophora* trees growing at their latitudinal limits and in tropical regions. For these samples the variation in wood anatomy, density and carbon content will be measured to determine and compare the range of adaptability of genera and species. These results will then be linked to local climate conditions, monitored within the mangrove forests. This will provide the necessary insights to explain the differences in current distribution between mangrove genera and species, and allow us to predict the future dynamics of mangroves in the light of climate change. We will work out guidelines for mangrove conservation and establishment by identifying critical areas of future (un)suitability.

References

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