Responses of dune forest ecosystems to changing groundwater availability: from Tropics to Mediterranean.

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Groundwater (GW) alterations are important to vegetation as can produce dramatic changes in plant communities, on physiological performance or survival of plant species. GW lowering and surface water diversions will affect vulnerable coastal dune forests, ecosystems particularly sensitive to GW limitation and inevitably affect GW-dependent species. Sand dune plant communities encompass a diverse number of species that differ widely in root depth, tolerance to drought and capacity to shift between seasonal varying water sources. The high ecological diversity of sand dune forests, characterized by sandy soils, well or poorly drained, poor in nutrients and with different levels of salinity and GW, can occur in different climatic regions of the globe. Such is the case of Tropical, Meso-mediterranen and Mediterranean areas, where future climate change is predicted to change water availability. Accordingly, the core idea of this work is to evaluate, along a climatic gradient, the responses and capacity of different coastal plant communities to adapt to changing water availability, namely GW. This large-climatic-scale study, covering Brazil, Portugal and Spain, provide an excellent experimental network to study the GW dynamics and community functioning in natural ecosystems of high ecological value.

To fulfill the main objective, suitable short-term GW limitation stress indicators, specific to this kind of stress, can be found and integrated in spatio-temporal water dynamics. For that we characterized plant functional groups water use in a GW changing situation in a climatic gradient and tried to understand the ecophysiological responses of functional groups to changing GW in different seasons. We used a stable isotope approach (leaf $d^{13}C$ and xylem $d^{18}O$) and foliar indices (Spectral Analysis) to access plant physiological performance.

We can eventually define suitable short-term stress indicators in GW changing scenarios and evaluate stress sensitivity of the functional groups to temporal/seasonal changes in water availability. Furthermore, we can assess community water use and responses under GW change scenarios through ecophysiological parameters and thus contribute to management and conservation of vulnerable communities.