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Assessing physiological responses of dune forest functional groups to changing water availability: from Tropics to Mediterranean.

Cristina Antunes (1,3), Mauro Lo Cascio (1), Otília Correia (1,2), Simone Vieira (3), Maria Cruz Diaz Barradas (4), Maria Zunzunegui (4), Margarida Ramos (1,2), Maria João Pereira (5), Cristina Máguas (1,2)

(1) Centro de Biologia Ambiental, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal. , (2) Departamento de Biologia Vegetal, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal., (3) Departamento de Biologia, Universidade Estadual de Campinas (UNICAMP), São Paulo, Brazil. , (4) Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Sevilla, Spain. , (5) Centro de Recursos Naturais e Ambiente, Instituto Superior Tecnico, Universidade Tecnica de Lisboa, Lisboa, Portugal.

Alterations in water availability are important to vegetation as can produce dramatic changes in plant communities, on physiological performance or survival of plant species. Particularly, groundwater lowering and surface water diversions will affect vulnerable coastal dune forests, ecosystems particularly sensitive to groundwater limitation. Reduction of water tables can prevent the plants from having access to one of their key water sources and inevitably affect groundwater-dependent species. The additional impact of drought due to climatic change on groundwater-dependent ecosystems has become of increasing concern since it aggravates groundwater reduction impacts with consequent uncertainties about how vegetation will respond over the short and long term. 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. Plant functional groups may be affected by water distribution and availability differently. 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, can occur in different climatic regions of the globe. Such is the case of Tropical, Meso-mediterranean and Mediterranean areas, where future climate change is predicted to change water availability. Analyses of the relative natural abundances of stable isotopes of carbon (13C/12C) and oxygen (18O/16O) have been used across a wide range of scales, contributing to our understanding of plant ecology and interactions. This approach can show important temporal and spatial changes in utilization of different water sources by vegetation.
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. This large-climatic-scale study, covering Brazil, Portugal and Spain, provide an excellent experimental network to study the water dynamics and community functioning in natural ecosystems of high ecological value.
To fulfill the main objective, a stable isotope approach (leaf δ13C and xylem+water sources δ18O) was used as a tool to assess physiological performance and water strategies integrated in spatio-temporal water dynamics. Plant functional groups' water use was characterized in a water changing situation (at different seasons) in a climatic gradient. We evaluated stress sensitivity of the functional groups to seasonal changes in water availability in different communities and tried to understand their water use strategy.