



Responses of a phreatophyte species to climatic conditions and groundwater drawdown

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In more recent years the additional impact of climatic drought on groundwater-dependent ecosystems has become of increasing concern. In result, climatic drought aggravates groundwater abstraction impacts and there is increasing concern amongst water resource managers and environmental regulators about how groundwater-dependent vegetation will respond over the short and long term. Groundwater drawdown is of obvious importance to phreatophytic vegetation as reduction of water tables may sever these plants from one of their key water sources. Despite a relatively large number of studies on riparian vegetation the reports on plant species that are dependent on groundwater resources in other ecosystems, such as dunes in the Mediterranean, are scarce and in general, poorly understood. Additionally, few studies had the possibility to use artificial lowering of groundwater levels at ecosystem scale, and the respective monitoring of the plant community response. Although changes in depth to groundwater occur naturally, anthropogenic alterations may exacerbate these fluctuations and, thus, affect vegetation reliant on groundwater. These effects include changes in physiology, structure, and community dynamics, particularly in arid regions where groundwater can be an important water source for many plants. For these reasons our study site, a mediterranean pine forest located in the western coastal region of Portugal that has been affected by the artificial lowering of groundwater, is particularly interesting. The large scale manipulation of groundwater reservoir does provide excellent experimental conditions to study the responses of phreatophyte community to changes in water availability.

In order to minimize future impacts of groundwater exploitation, it is crucial to better understand the specific water requirements, especially in phreatophyte species, and in particular when considering the limits of the plant species distribution, such as the case of *Salix repens* in this region of Portugal. Therefore, the aims of this investigation were: (i) to identify factors that are influencing the presence of an ecologically relevant phreatophyte species: *Salix repens*, within dune slacks, and (ii) to evaluate the physiological response of the species to variations in water availability, particularly groundwater.

After evaluating different factors that might be influencing the presence of the phreatophyte species and studying its physiological responses (ψ , $\Delta^{13}\text{C}$, $\delta^{18}\text{O}$) to the different factors in two contrasting climatic conditions, this study revealed that: (a) the presence of *Salix repens* is dependent of low air salinity (i.e., higher distances to the sea) and lower dune-slacks area, (b) the species is very susceptible to changes in water availability, being dependent on two water sources (precipitation in spring and groundwater in summer time), (c) the carbon isotope discrimination of leaves ($\Delta^{13}\text{C}$), decreases with stress factors such as higher dune-slack areas, higher distances to ground water and lower distances to the sea.