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The impact of Ground Water lowering conditions in a Mediterranean coastal sand dune plant community: the responsiveness of different functional groups according to season and spatial heterogeneity

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The relatively small number of studies on the responsiveness of Mediterranean sand dunes vegetation to the ground water (GW) table variability, makes this study one of the few attempts to identify the degree of usage and dependence of groundwater, as well as the understanding of basic drivers for plant functional response. One way to determine the presence of ground water ecosystems more rigorously is by using stable isotope composition of water in the soil, groundwater and xylem of vegetation. Such a combination of methods can show important temporal and spatial changes in utilization of groundwater by vegetation. Therefore we hypothesized that species with an access to GW might be less affected by seasonal drought but more susceptible to the lowering of the groundwater levels. Our results indicated that plant species response to groundwater availability varied according to the functional group and functional traits. Moreover this variation included a different response not only in time (seasonal change) but also in space (groundwater use heterogeneity). Both *M. faya* and *A. longifolia*, two understory nitrogen fixing plant species presented a large range in GW use associated with microsite GW heterogeneity. *Corema* was the only species where spatial GW use heterogeneity did not change significantly the water potential pattern, being the reasons for that change associated with other factors rather than GW use. The only phraetophyte species, *S. repens* (plants that use groundwater) was highly sensitive to changes in the hydrogeological regime. The correlations between groundwater use to maximum water potentials determined at predawn as well as to δ^{13}C presented a large variation between and within the same species. There was no correlation between δ^{13}C and drought conditions during summer in well adapted Mediterranean species Therefore, it is not surprising that correlations between bulk leaf δ^{13}C and xylem δ^{18}O tended to be stronger in spring than in summer. Accordingly, the studied plant responses and strategies integrated those variations and fluctuations, limiting the functionality and the plant distribution in the ecosystems.