Assessing the impact of groundwater lowering in coastal forest's functional groups: ecophysiological responses under Mesomediterranean and Mediterranean climate

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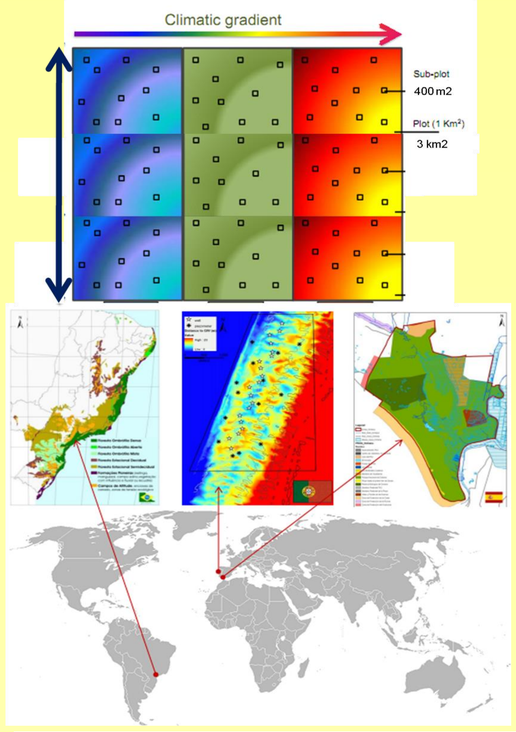
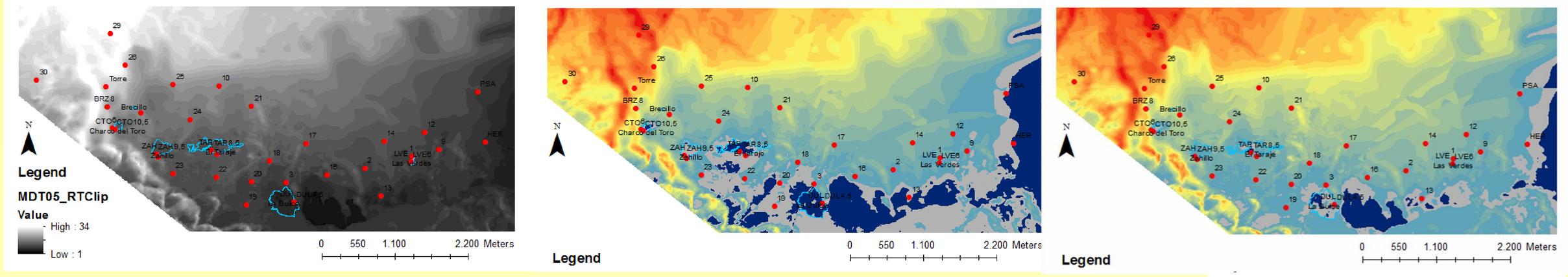
Groundwater alterations and the impact of drought will affect ecosystems sensitive to water limitations, with consequent uncertainties about how vegetation will respond over the short and long term. This is particularly important in mediterranean sites, where water availability is predicted to be reduced. Sand dune plant communities encompass a diverse number of species that differ widely in tolerance to drought and capacity to shift among water sources.
The main questions are: (1) Do dune plants with different strategies show the same responses to groundwater changes? (2) Do similar functional groups present the same response under different precipitation availability?

Groundwater stress indicators in coastal dune Forests: from Tropics to Mediterranean

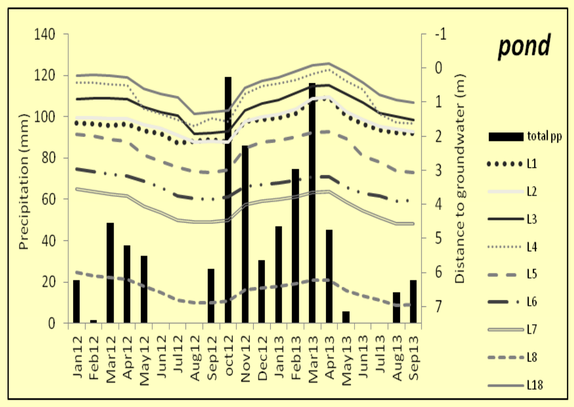


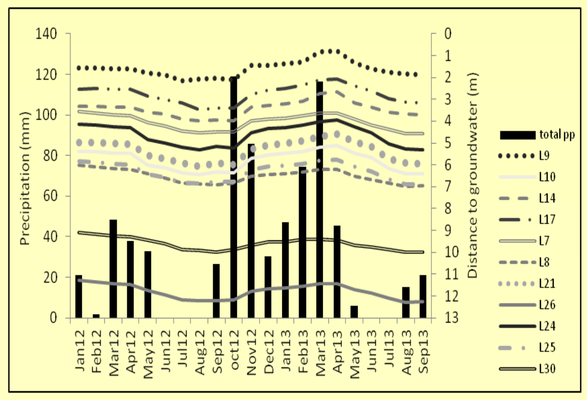
This project was developed in Mata Atlántica in Brasil (Ubatuba), coastal pine forest in Portugal (Osso da Baleia) and dune communities in Spain (Doñana National Park).
In this poster we are going to focuss on the results in both Mediterranean sites..
We analysed two hygrophyte/phreatophyte species (*Erica scoparia*, Spain, and *Salix repens* Portugal and two Pinus species (*Pinus pinea* Spain and *Pinus pinaster*, Portugal).

We recorded climatic conditions together with the dynamic of undergroundwater. To register the importance of seasonal and local changes in utilization of different water sources we selected an isotopic approach. We used $\delta^{13}C$, $\delta^{15}N$ and xylem+water sources $\delta^{18}O$ as a tool to assess physiological performance and water strategies. Groundwater modeling was developed to assess the availability of groundwater in our study areas.

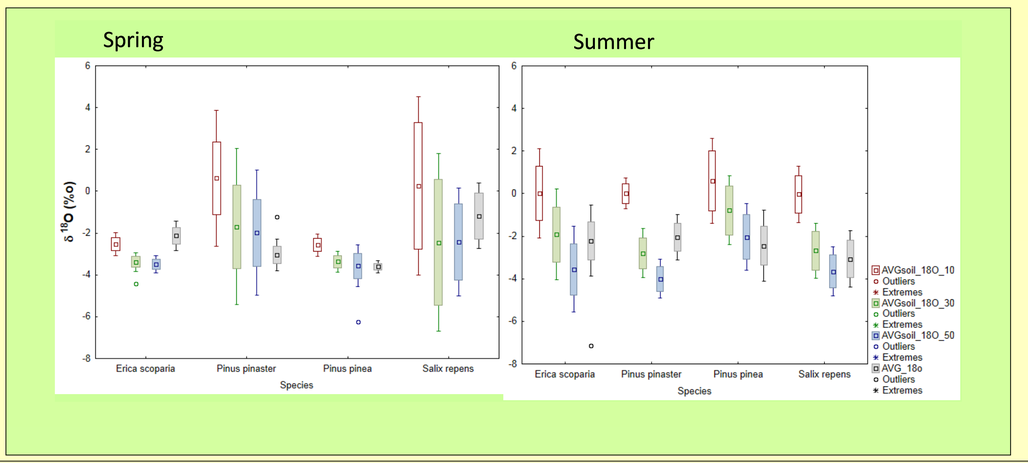


Study area in Doñana National Park, (1) digital model of topography and position of the study plots, (2) groundwater model in spring 2013, (3) groundwater imodel n summer 2013.

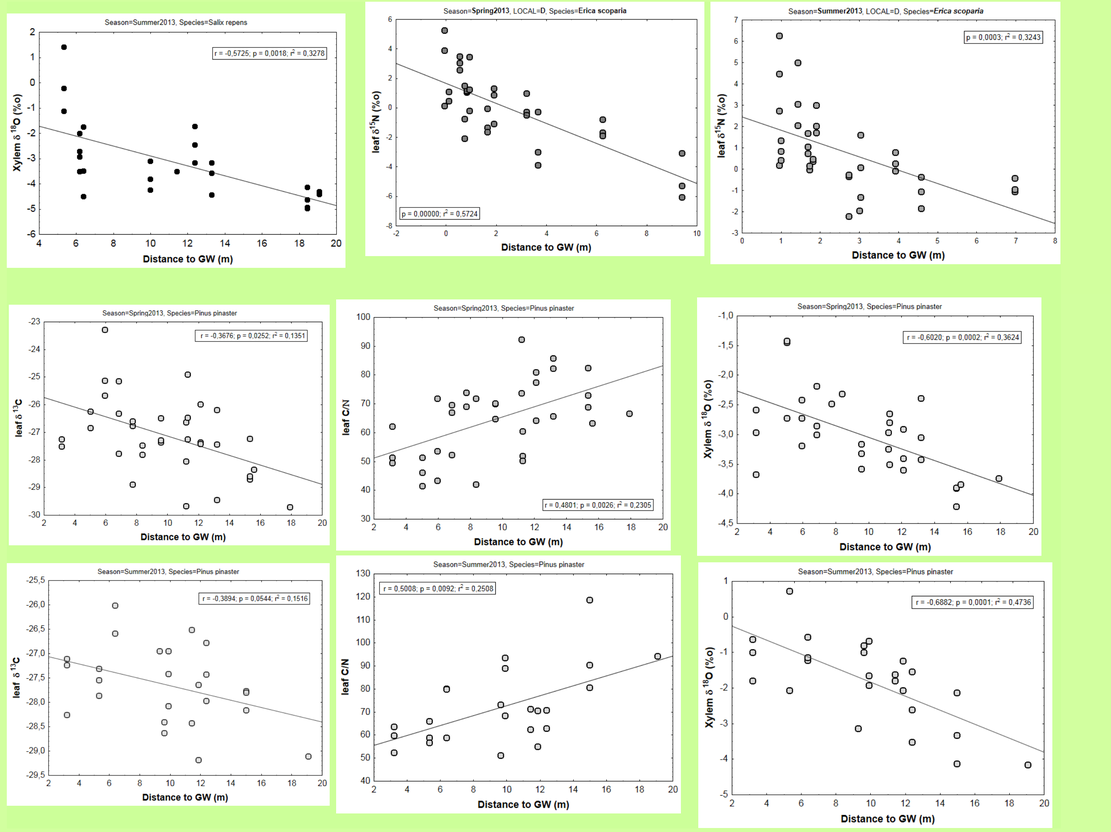




Precipitation and grounwater distance showing the recharge effect. Results of Doñana plots.



$\delta^{18}O$ (‰) values of soil water (10, 30 and 50 cm) and xylem water in the four selected study species in spring and summer.



Correlations between species isotopic and nutrient variables with distance to the ground water.

1. **The study species showed different water utilization and responded differently to groundwater availability**. *E. scoparia* exhibited similar seasonal oxygen isotopic values, which were associated to deeper soil layers in summer than in spring. *P. pinaster* moved to more enriched values in summer associated to superficial water, while *P. pinea* was always using soil water from 50 cm depth. *S. repens* moved to more depleted values in summer, but it was always using water below 30 cm.
2. The response of plant variables to groundwater distance was different among the species and seasons. Portuguese species presented negative significant correlations between $\delta^{18}O$ and distance to GW, which evidenced that plants shifted to deeper water sources associated to the lowering of groundwater. .
3. When water is close to the surface *E. scoparia* is using N from organic sources but when organic matter is not available the plant might increase the cooperation with mycirhyzas, which is evidenced by the negative correlation between $\delta^{15}N$ and GW.
4. It is not clear the meaning of the negative correlation between $\delta^{13}C$ and GW depth in *P. pinaster*. We haven't found any signifcant correlatuion in *P. pinea*.
5. These results evidence the complexity of water use strategies in mediterranean species.