

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

Cristina Antunes<sup>1,3</sup>, Mauro Lo Cascio<sup>1</sup>, Otilia Correia<sup>2</sup>, Simone Vieira<sup>3</sup>, Maria Cruz Barradas<sup>4</sup>, Maria Zunzunegui<sup>4</sup>, Maria João Pereira<sup>5</sup>, Cristina Máguas<sup>2</sup>

**1** Water alterations are important to vegetation as can produce dramatic changes in plant communities, physiological performance or survival of species. Coastal dune forests are sensitive to water changes and particularly to groundwater limitation. In this ecosystem plant functional groups may be affected by water availability and sources differently and show different capacity to cope with water changes.

**3** The **study sites** were established in Brazil, Portugal and Spain, assuring a climatic gradient (Fig.1). They all are coastal dune forests with sandy soils, well or poorly drained, poor in nutrients and have a groundwater gradient (spatial pattern).

**2** Are responses to (seasonal and spatial) changes in water availability dependent on plant water strategy? Is there a similar response regardless the climatic region? Which functional group is more affected by low water access (rain and groundwater)?

**4** Rainy season Drought period

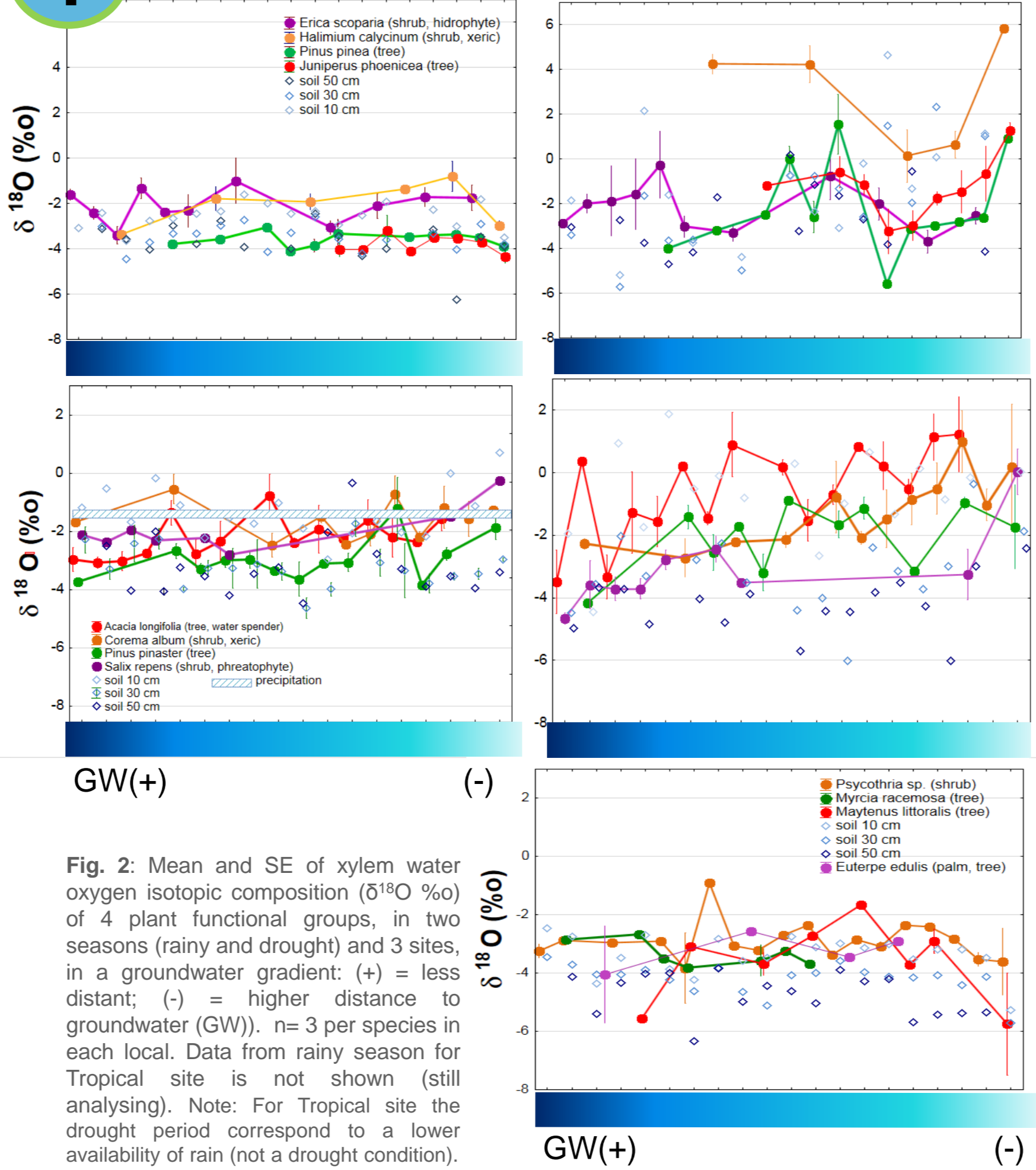


Fig. 2: Mean and SE of xylem water oxygen isotopic composition ( $\delta^{18}\text{O}$  ‰) of 4 plant functional groups, in two seasons (rainy and drought) and 3 sites, in a groundwater gradient: (+) = less distant; (-) = higher distance to groundwater (GW). n= 3 per species in each local. Data from rainy season for Tropical site is not shown (still analysing). Note: For Tropical site the drought period correspond to a lower availability of rain (not a drought condition).

Overall change of xylem water  $\delta^{18}\text{O}$  (enrichment) with **Summer drought** and **Groundwater limitation** in Mediterranean and Meso-mediterranean sites (all FG; see Fig.2 legend for details).

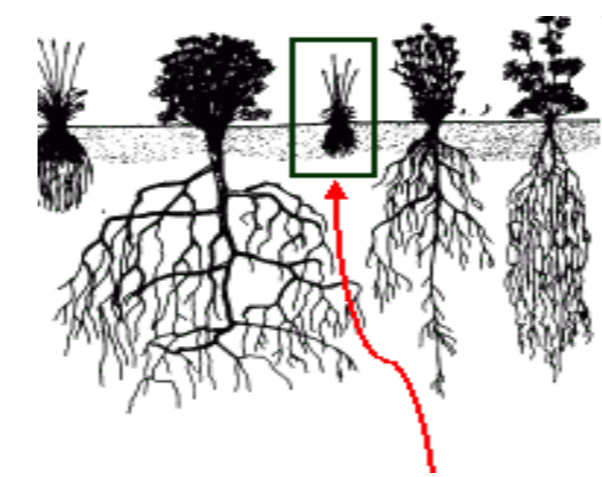
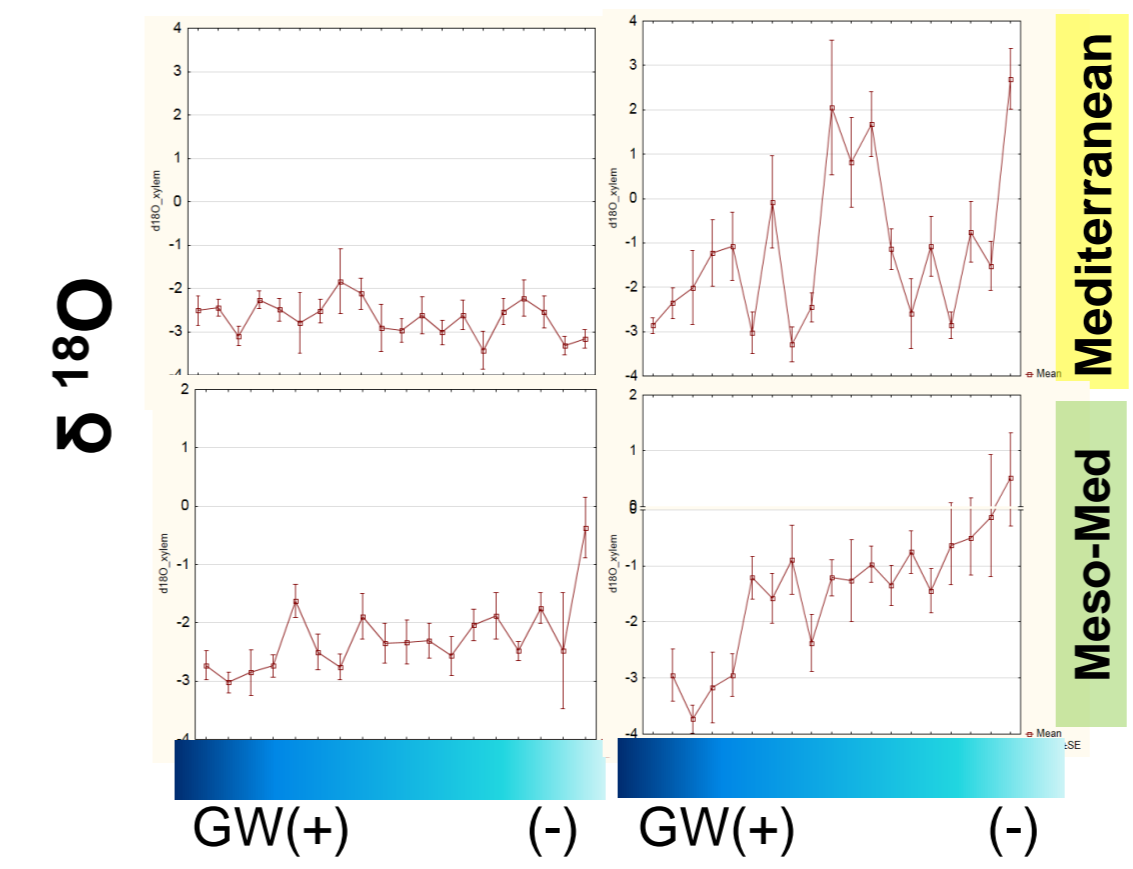
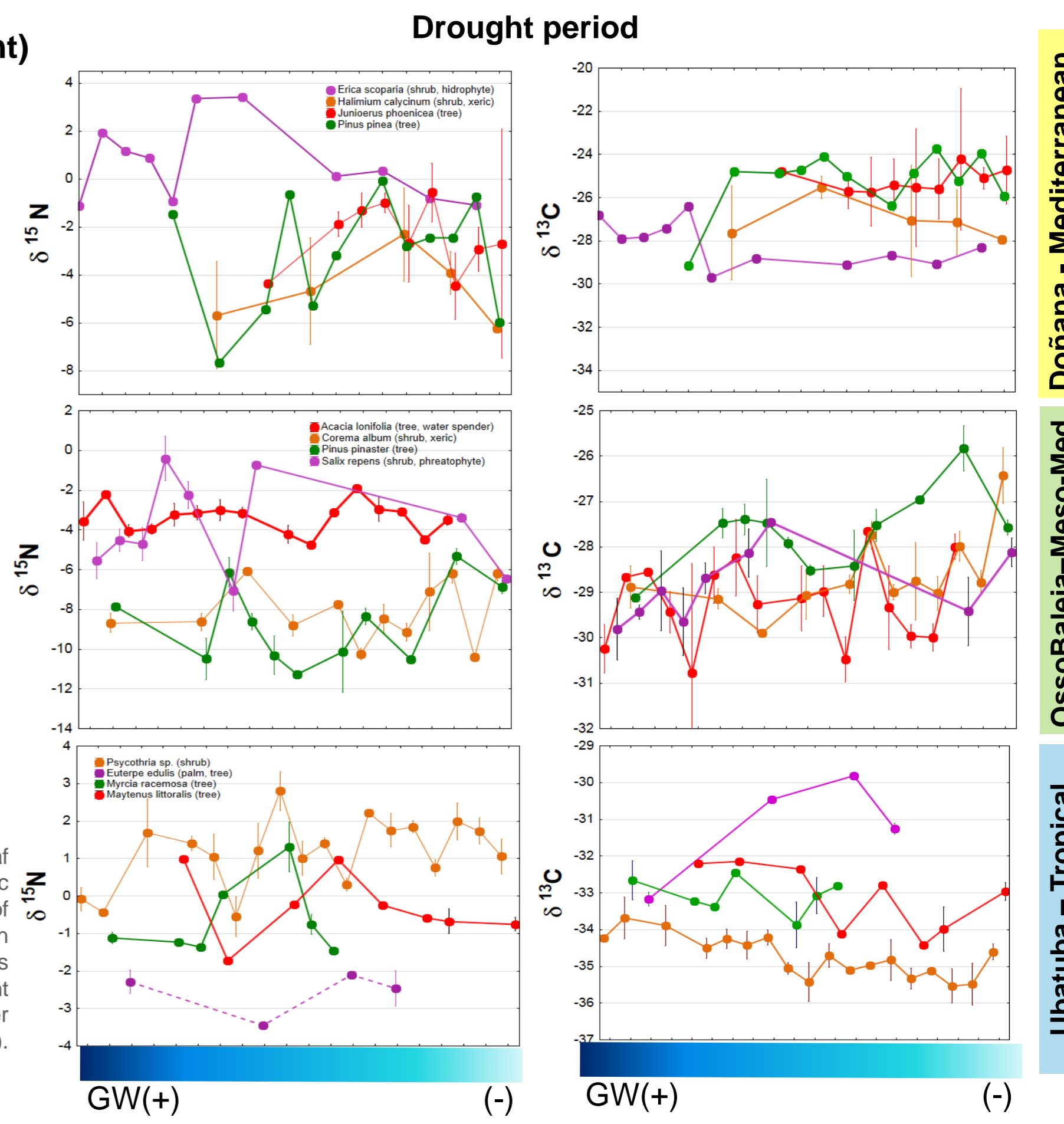


Fig. 3: Mean and SE of leaf nitrogen and carbon isotopic composition ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ , ‰) of 4 plant functional groups, in drought season, in the 3 sites and in a groundwater gradient (+)=less distant; (-) = higher distance to groundwater (GW). n= 3 per species in each local.



**5** Results indicate: (i) that **plant functional groups** are affected by water distribution and availability differently; (ii) a general pattern of xylem water  $^{18}\text{O}$  and leaf  $^{13}\text{C}$  enrichment with less water available (rain and groundwater) in **Mediterranean** sites; (iii) that deep-rooted trees and the phreatophyte (*Salix repens*) seems to be more affected by **(ground)water limitation**.

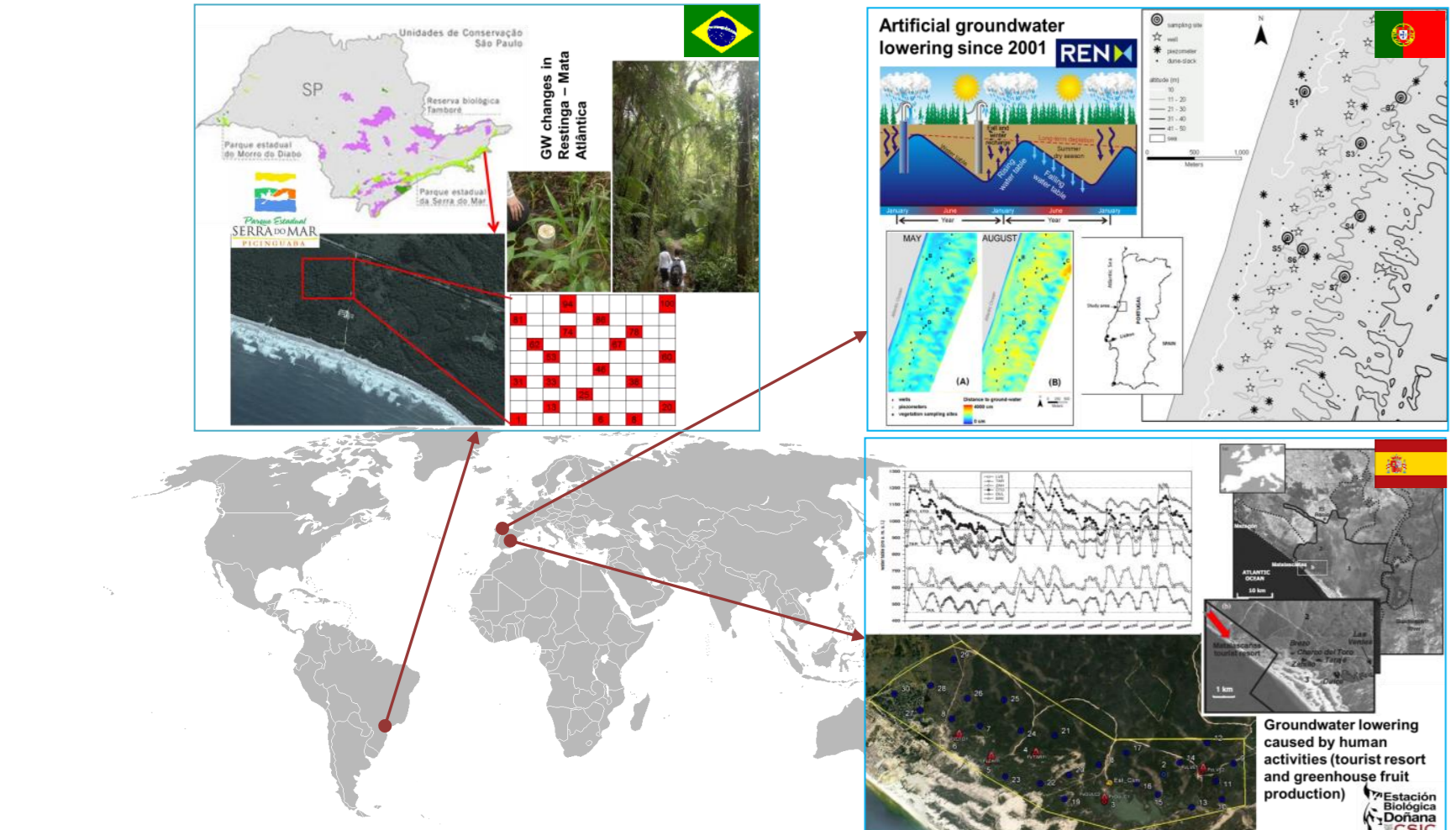


Fig. 1: Study sites in Tropical (Brazil), Meso-Mediterranean (Portugal) an Mediterranean (Spain) and the sampling points considered in the study.

**METHODS:**  
For each site 20 plots were considered (Fig. 1). In each plot a maximum of 4 species were sample (3 individuals per specie) from different functional groups in two different seasons. Total of c. 3 Sites X 20 plots X 4 FG X 3 ind X 2 seasons = 1440 samples. For each individual leaf  $\delta^{13}\text{C}$ , leaf  $\delta^{15}\text{N}$  and xylem water  $\delta^{18}\text{O}$  were analyzed (with a Isotope Ratio Mass Spectrometer (dual inlet, ISOPrime, GV, Micromass, UK). Water sources  $\delta^{18}\text{O}$  were also considered: soil water in 3 depths (10, 30 and 50 cm) in each plot (with 3 replicates), precipitation and groundwater.