

## the Long Term Socio-Ecological Research Montado:

a dryland, savannah-like ecosystem, dominated by cork and holm oak (*Quercus suber* and *Quercus ilex*)

## used by humans for centuries:

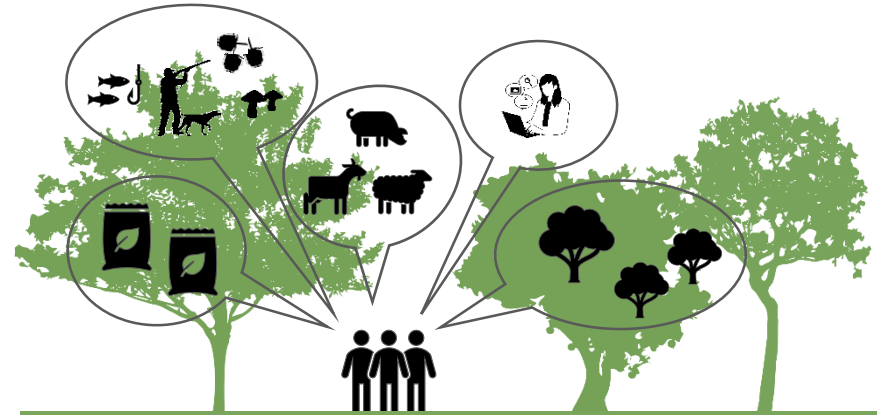
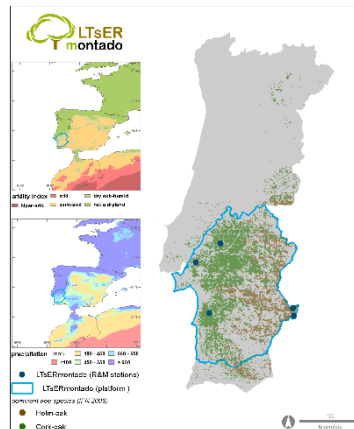
traditional agro-silvo-pastoral use, shaped by grazing, agriculture, hunting, fire, which build a profitable multiuse system, with high ecological value

## the LTsERmontado platform

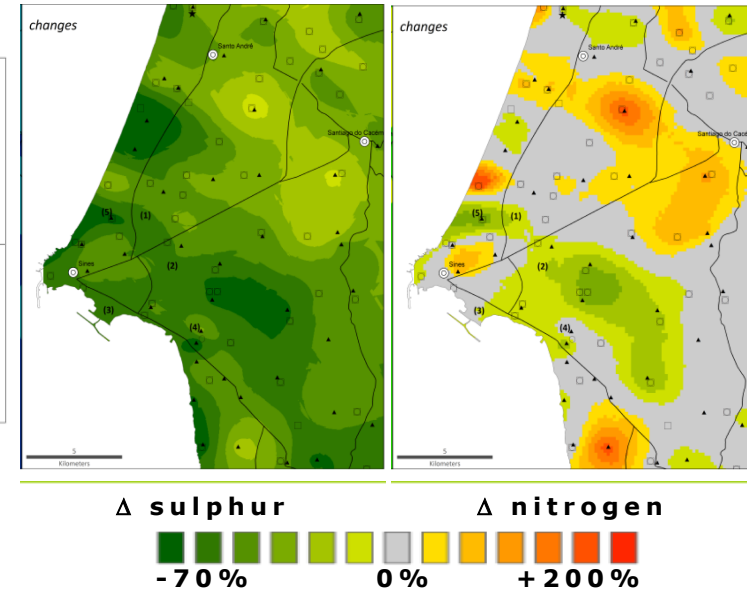
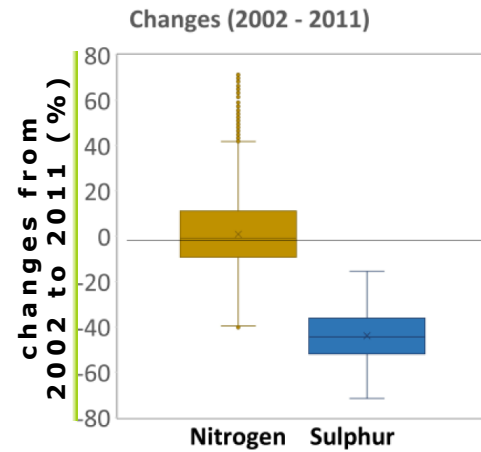
is used to exchange experiences and knowledge and to interact, in order to find shared nature-based solutions to maintain its long-term sustainability

## the LTsERmontado sites

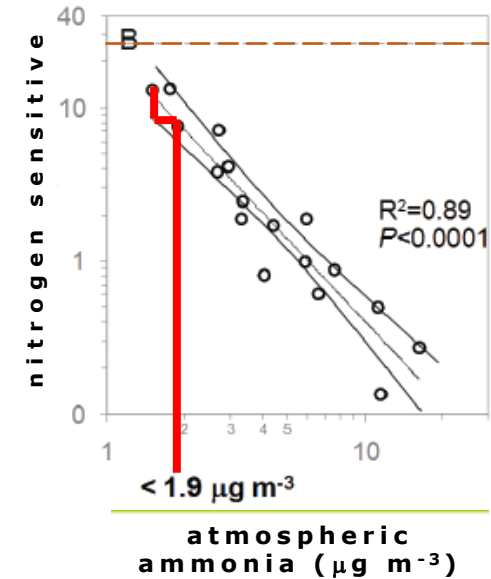
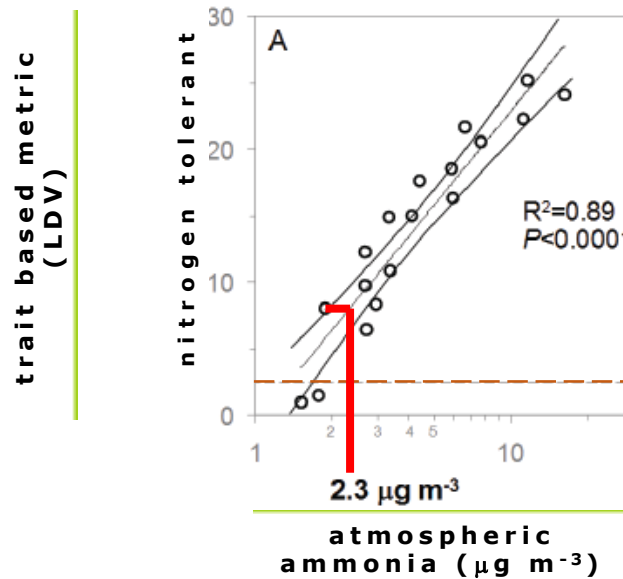
are used to develop research and to apply and test the solutions found, and to develop new science-based knowledge to address the identified problems



from atmospheric concentrations to effects in ecosystems: tools to measure the success of air quality directives over time and space: large reductions in Sulphur deposition to ecosystems but no change in nitrogen deposition, from 2002 to 2011

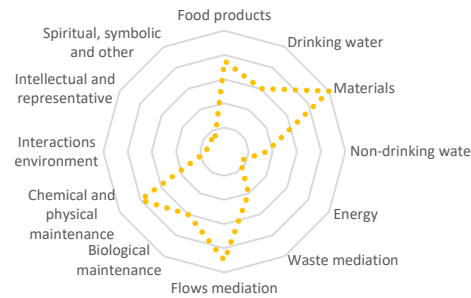


protect European ecosystems from air pollution: tools to establish critical levels and loads for N pollution: using trait-based metrics based on sensitive and tolerant species to set the critical levels of atmospheric nitrogen and critical loads for nitrogen deposition on montado ecosystem

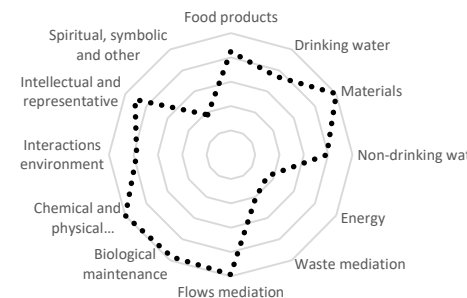


**assessing montado's key ecosystem services:** through socio-cultural valuation, "materials" were highly valued, revealing the importance of cork. Regulation services valuation showed the high knowledge of stakeholders about the montado. Cultural services were more valued at local level, unveiling a higher attachment of stakeholders to their farms.

**REGIONAL**



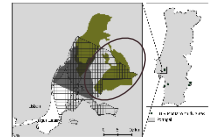
**LOCAL**



**visions for a sustainable future:** starting from the present-day scenario, in a real-life example of a LTER site, several plausible future scenarios were evaluated. Nature-based recreation was the only activity with a negative economical balance. This helped understanding the consequences of todays planning to the future of montado's ecosystem services, while including a long-term economic perspective.

**LTER site nowadays and 3 plausible management scenarios**

**A. Companhia das Lezírias**



Main production: cork  
other: organic beef (0.32 heads/ha); hunting (1200 participations/year) and nature based recreation (5800 part/year).

**D. Forest improvement**



0.1 heads/ha  
Hunting decrease  
Increase of nature-based recreation  
Increase of tree density

**C. Cattle intensification**



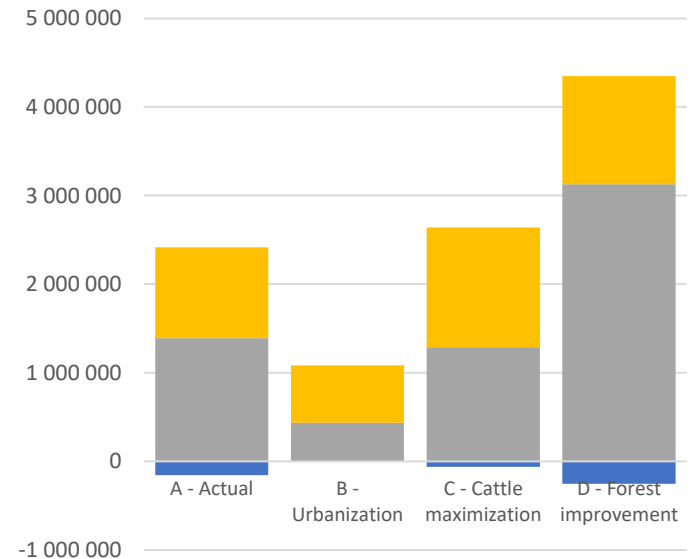
1.4 heads/ha  
Hunting decrease  
Decrease of nature-based recreation  
Reduction of trees density

**B. Urbanization**

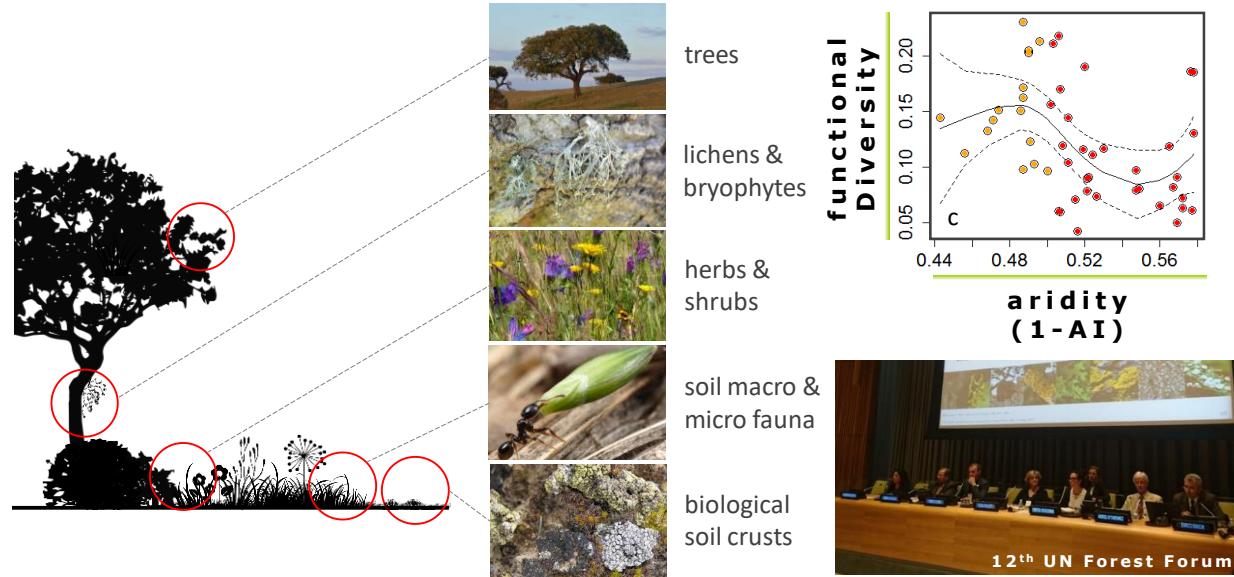


No livestock  
No hunting  
No nature recreation  
Density of trees reduced

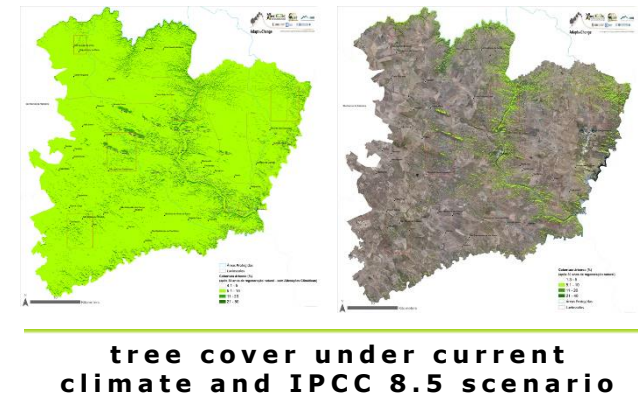
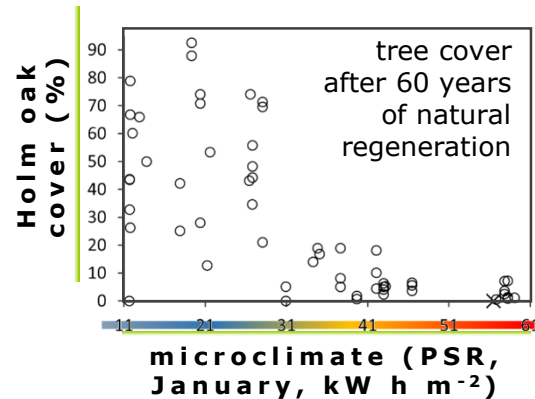
■ Nature-based recreation (€) ■ Game (€)  
■ Cultivated goods (€) ■ Overall C flux (€)



**developing indicators for the effects of climate change:** based in functional traits, functional groups of plants, lichens, bryophytes and soil fauna have been used as indicators of the effects of climate change in montado. Plant functional diversity showed a non-linear relationship with climate, suggesting the existence of response thresholds. Lichen functional groups were proposed as long-term ecological indicators at the 12th United Nations Forum on Forests



**ensuring the future of montado:** to guide the options between tree natural regeneration or assisted reforestation we lack knowledge on the roles of micro and macroclimate. High resolution models of reforestation success, taking into account the macro and the microclimate were built, under scenarios of climate change. These were web disseminated with a GIS interface



Nunes A, et al. 2017. Which plant traits respond to aridity? A critical step to assess functional diversity in Mediterranean drylands. *Agricultural and Forest Meteorology*. Matos P, et al. 2017. Tracking global change using lichen diversity: towards a global scale ecological indicator. *Methods in Ecology and Evolution*. Principe A. 2012. Microclimate matters for the natural regeneration of abandoned agriculture areas and ecophysiological performance of *Quercus ilex* in drylands