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Masters of survival: Why are climate relict plants so important?



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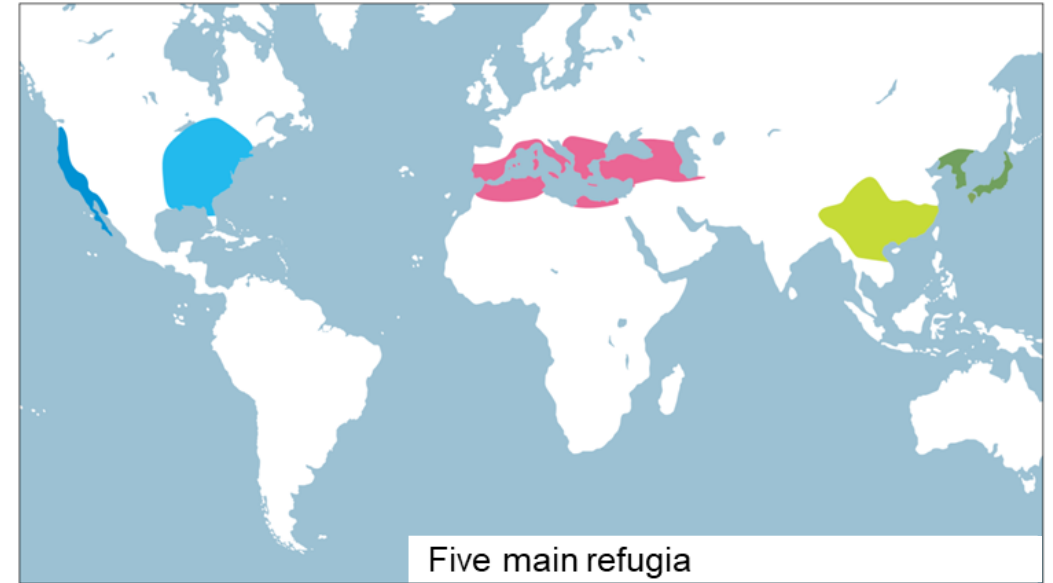
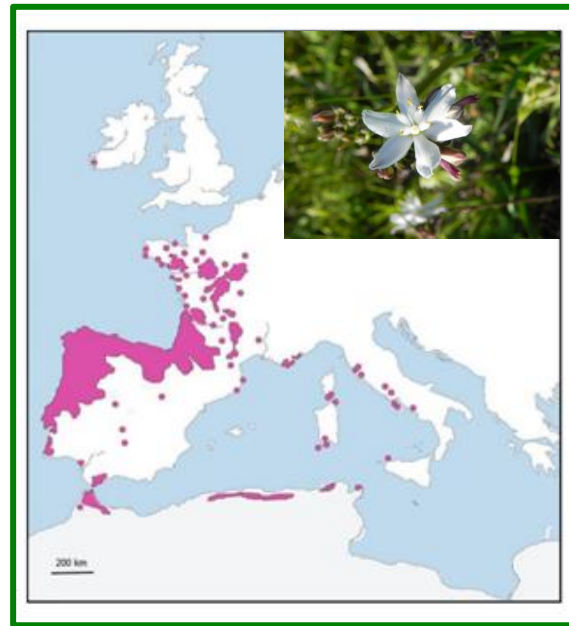
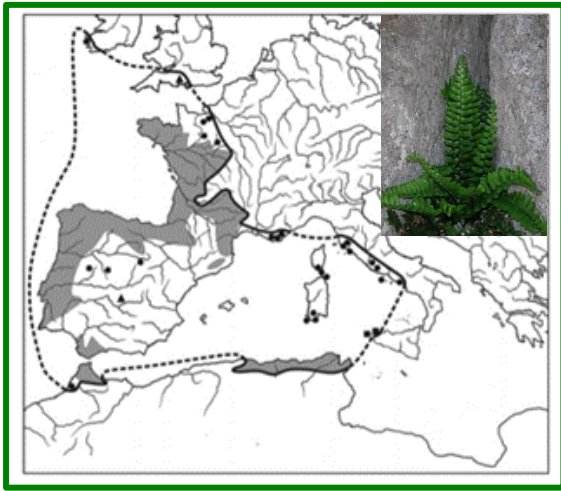
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INTRODUCTION

The Mediterranean Basin hosts several plant species defined as **climate relicts**.

“Populations of a species that persist in isolated enclaves of suitable climate space, surrounded by areas with climatic conditions that do not permit the existence of the species” (Hampe & Jump, 2011)

Cool-humid temperate (“Atlantic”) (*Asplenium marinum* and *Simethis mattiazzii*)

Warm-humid temperate (“Balkan-Pontian-Anatolian”, even herbaceous taxa) (*Allium siculum*, *Paeonia mascula* s.l.)

Warm-humid tropical?

N.B.: their current fragmented distribution pattern may mirror recent shrinkage due to climate change!



'OUT OF TIME' AND 'OUT OF SPACE'

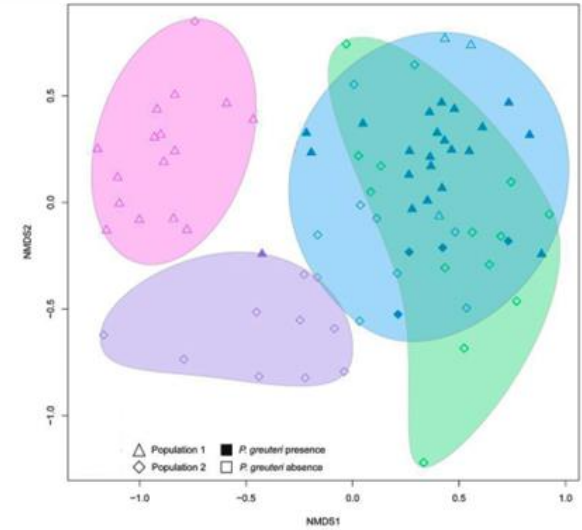
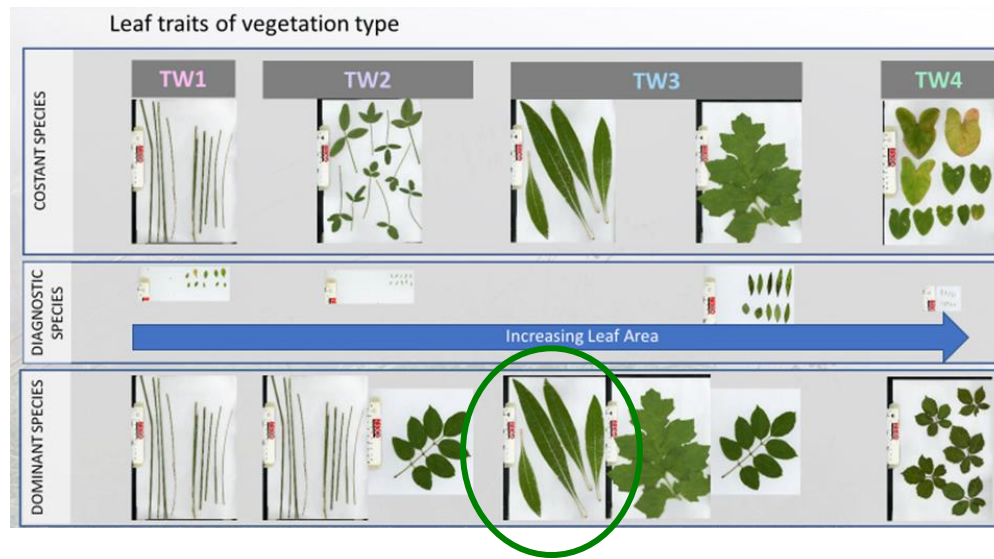
Taxa with **very narrow niche and/or distribution range** may provide **high quality information**

Their survival is often related to particularly stable and long-lasting favourable (micro)climatic conditions (e.g., no or slight seasonal water stress, no frost damage) (e.g., *Zelkova sicula*).

Many of these relict plants represent the **last remnants of ecosystems** once widespread across the entire Palearctic. They gradually faded during the Pleistocene, mostly due to repeated glacial events and to last millennia of man-induced forest disruption.



after Magri et al. (2017)



‘OUT OF TIME’ AND ‘OUT OF SPACE’

Not surprisingly, many of these relict species show numerous **traits** which **do not fit** with those of the plants living in the communities where they grow (e.g., *Ptilostemon greuteri*).

Past global changes may have affected not only the assemblage of co-occurring vascular plants, but also other key components of the ecosystems where they belong, like pollinators, **seed dispersers** (**macaques**), **predators** (e.g., *Contarinia ampelitsiae*), symbiotic and/or pathogenic soil microorganisms and fungi.





'SPECIAL' TARGET SPECIES

It looks very promising to compare the distribution pattern of relict plants with that of other co-occurring taxa of high biogeographic interest with **very narrow** and/or **highly fragmented distribution ranges**, like:

Evolutionary odd/isolated (e.g., taxa belonging to monotypic genera/subgenera) (e.g., *Cytisus aeolicus*)

Mesothermic ferns of both temperate and tropical origin (e.g., *Woodwardia radicans*)

Mesothermic deciduous woody plants (e.g., *Zelkova abelicea*)

Evergreen/Lauriphyllid woody plants (e.g., *Cneorum tricoccon*)



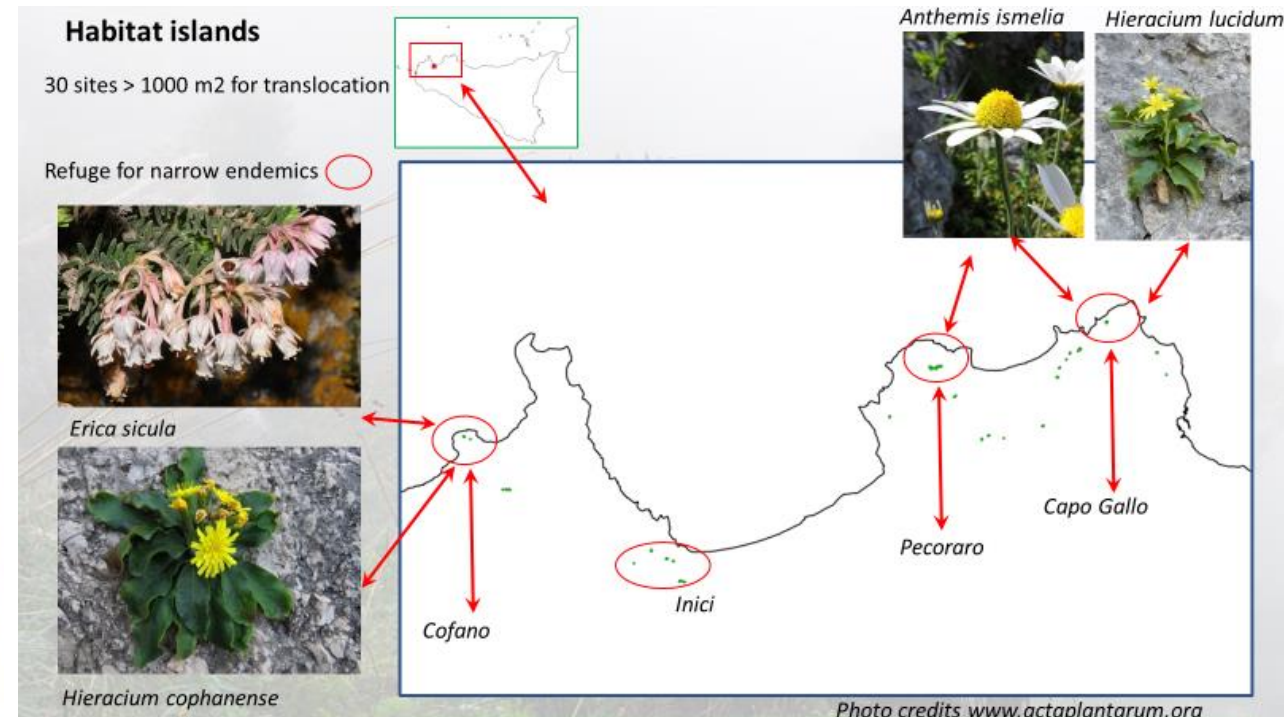
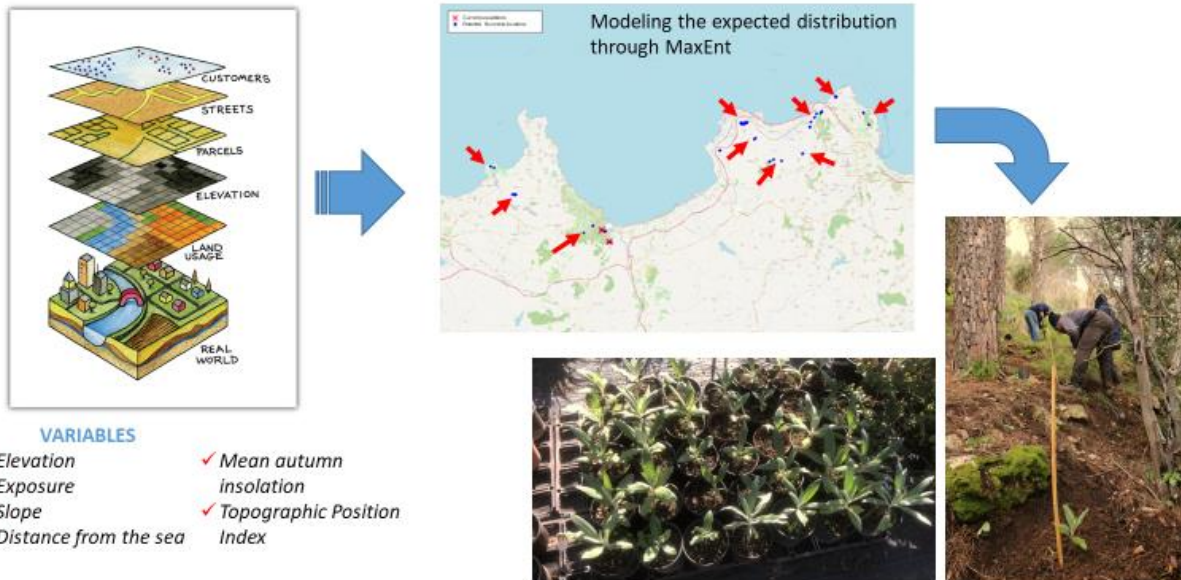
TAKE HOME MESSAGES

Understanding the mechanisms and processes allowing the persistence of climate relicts may help at identifying important and still overlooked refugial areas.

Climate relicts have adopted several strategies to face global changes. To survive in the long-term, some of them underwent important niche shifts, which in turn required deep changes in their traits.

Niche modelling, phylogenetics and population genetics prove to be an effective tool to trace and interpret the evolutionary history of climate relicts.

Modeling potential distribution for plant translocation



THANK YOU FOR YOUR ATTENTION!
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**Ptilostemon
greuteri**



some plant images were taken from the site of [Acta Plantarum](https://www.actaplantarum.org/galleria_flora/) https://www.actaplantarum.org/galleria_flora/