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Tree form (large and fruit-bearing trees ~ 5%)

## Zelkova abelicea

*Zelkova abelicea* (Lam.) Boiss. (Ulmaceae) is a **relict** tree species **endemic** to the island of Crete (Greece). Its distribution is extremely fragmented and is confined to six spatially and genetically distinct populations. It is found in open, mountain forest communities, usually mixed with maple (*Acer sempervirens*), oak (*Quercus coccifera*) and occasionally cypress (*Cupressus sempervirens*) trees. It grows between 800 and 1800 m a.s.l. in all mountain massifs of Crete; in the Lefka Ori, Kedros, Psiloritis, Dikti and Thripti. All populations are significantly **threatened by intensive pastoralism**. The most important pressure is **overgrazing** and **browsing** through livestock mainly by goats and sheep with a major impact on tree habit, vigor and sexual regeneration. Over 95% of saplings across the island exhibit stunted, dwarfed, shrub-like form, while few individuals develop into fully shaped, regularly fruiting trees. Soil erosion is the second most important disturbance - clearly correlated with intensive trampling and grazing. Water stress, fire as well as climate change represent additional threat factors. *Z. abelicea* propagates vegetatively by producing new shoots (suckers) from the roots of old plants. Sound seeds are produced every three years (**masting behavior**). Seed germination is slow at low temperatures (5 - 10°C) and is inhibited at higher temperatures. The species holds a very **strong patrimonial value**, as traditional shepherd walking sticks (**katsounes**) are preferentially made with its hard, light and durable wood. Pruning of plants and illegal collection of wood hinders the growth and development of fruiting trees. Given the level of threat, *Z. abelicea* has been included as Endangered (EN) in the IUCN Red List of Threatened Species and is protected by the Greek legislation (Presidential Decree 67/1981), the Bern Convention (Appendix I) and is also included in Appendices II and IV of the European Habitats Directive (92/43).



Dwarfed form (non-flowering individuals ~ 95%)

## The project

Within the framework of the International ZELKOVA project ([www.zelkova.ch](http://www.zelkova.ch)), the CIHEAM-MAICh in collaboration with the four Forest Directorates of Crete and the University of Fribourg initiated in 2014 a project entitled: 'Conservation of *Z. abelicea* in Crete' ([www.abelitsia.gr](http://www.abelitsia.gr)). The overall objective of this project is to promote and enable the long term conservation of *Z. abelicea* in Crete by coupling *in situ* and *ex situ* conservation actions such as i) fencing small natural stands to examine the effect of excluding grazing and browsing on the growth of the species and on local vegetation dynamics and ii) collecting seeds and vegetative material for *ex situ* conservation in seed banks or transplantation in *ex situ* plantations. Additionally, communication and outreach activities such as information and environmental education events are being implemented to promote and advertise the values of *Z. abelicea* to the general public and influence decisions-makers.

## In situ conservation actions

- ✓ Protect *Zelkova* individuals' from grazing and browsing,
- ✓ Examine the effect of excluding grazing and browsing on the growth of the species and on local vegetation dynamics.

In total, 31 small plots have been fenced  
14 in Lefka Ori, 4 in Mt. Kedros, 10 in Mt. Dikti and 3 Mt. Thripti

As soon as fences were installed, dwarfed *Z. abelicea* individuals and local vegetation reacted positively to the removal of browsing pressure confirming the strong impact of grazing as a major driving force in shaping the form and size of the species. The annual average height of *Z. abelicea* individuals is increasing from year to year in all fenced plots. Vegetation cover and species richness showed to be higher within the fenced plots. In some areas, the effects of excluding browsing on *Z. abelicea* seem to be less significant. This suggest that site-specific **biotic** and/or **abiotic** factors, such as **precipitation**, **temperature** and/or **soil properties** could be additionally associated with these variations. The relationship between abiotic factors and the Growth Rate of *Zelkova* individuals on different Mt. massifs is being investigated.

## Entomological investigation

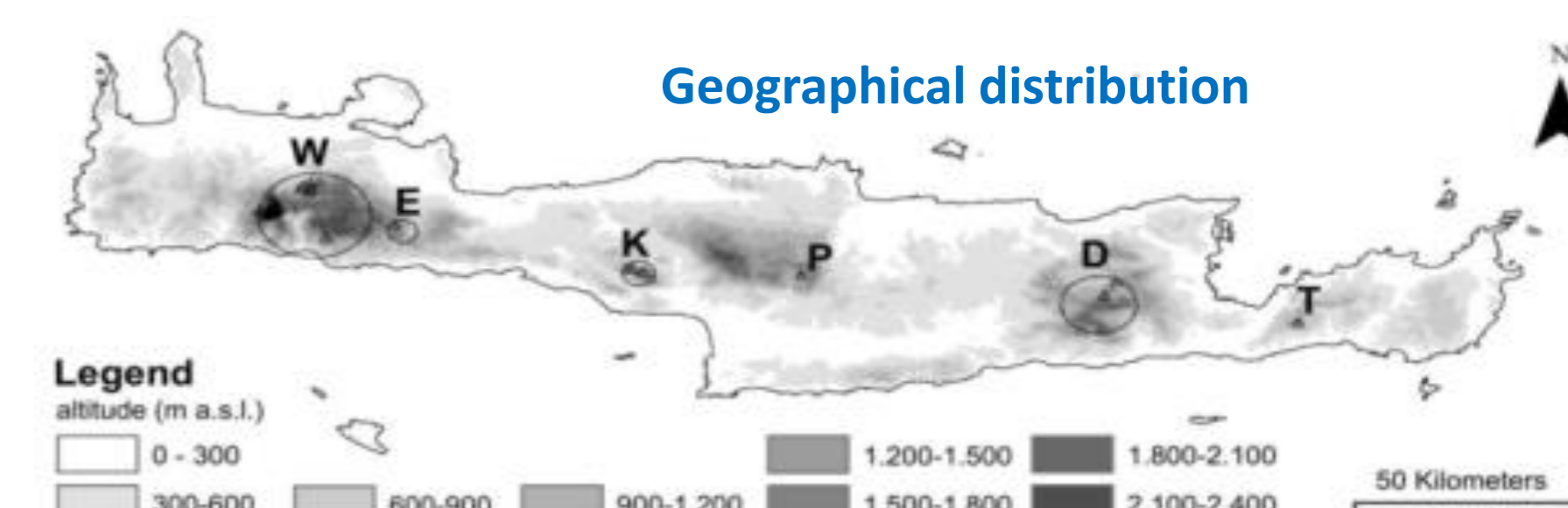
A unidentified Dipteran insect was recently observed to lay eggs on and affect the flowers' morphology of *Z. abelicea* by inducing gall formation. Flowers, fruits and insect fauna are being sampled to identify the unknown insect species and to investigate **if** and **how** this insect influence embryo development and fruit soundness.

## Ex situ conservation actions

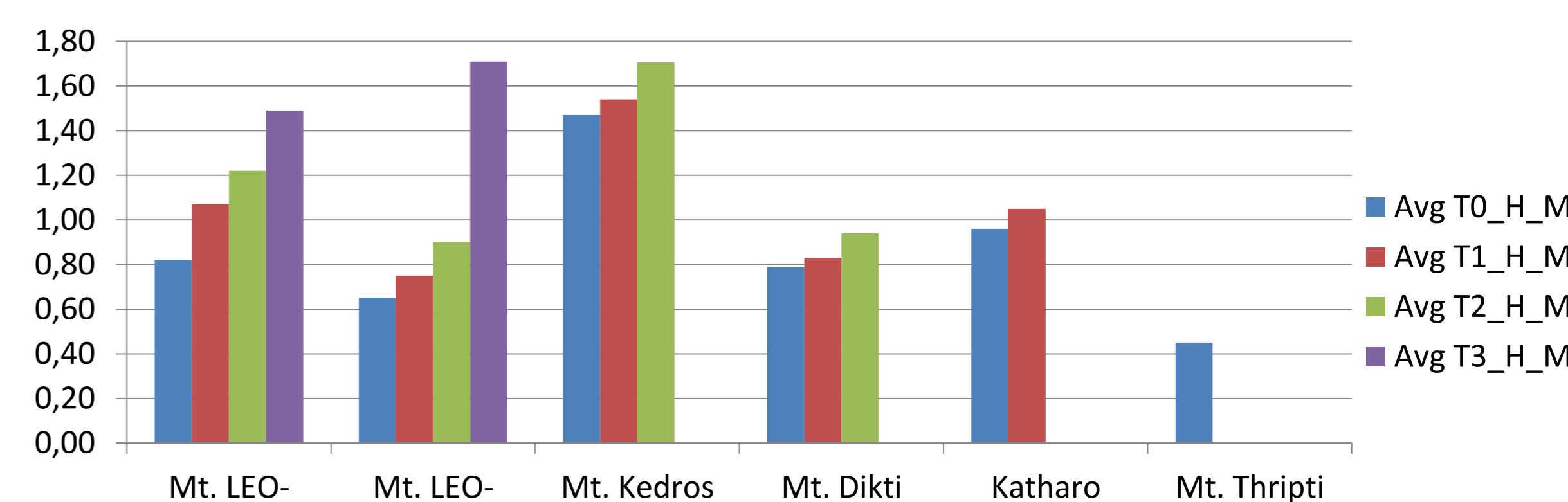
- ✓ Collection of seed and vegetative material from different subpopulations
- Sound seed proportions are found to be very low and fluctuates strongly between populations (50-100% of seeds are empty). Parts of sound seeds are being stored in the seed bank of CIHEAM-MAICh, others are planted in nurseries for seedlings production. Vegetative propagation shows low success and further investigations are needed to develop a more effective vegetative propagation protocol. Propagated seedlings and plantlets are used in habitats restoration and/or *ex situ* plantations for public green spaces. In 2016, an *ex situ* plantation was established in the Lefka Ori on a public land offered by the Municipality of Platania. The establishment of this plantation endorsed and improved the cooperation between local institutions, local authorities and local inhabitants engaging them in the process of conserving/protecting the species.

## Communication and outreach activities

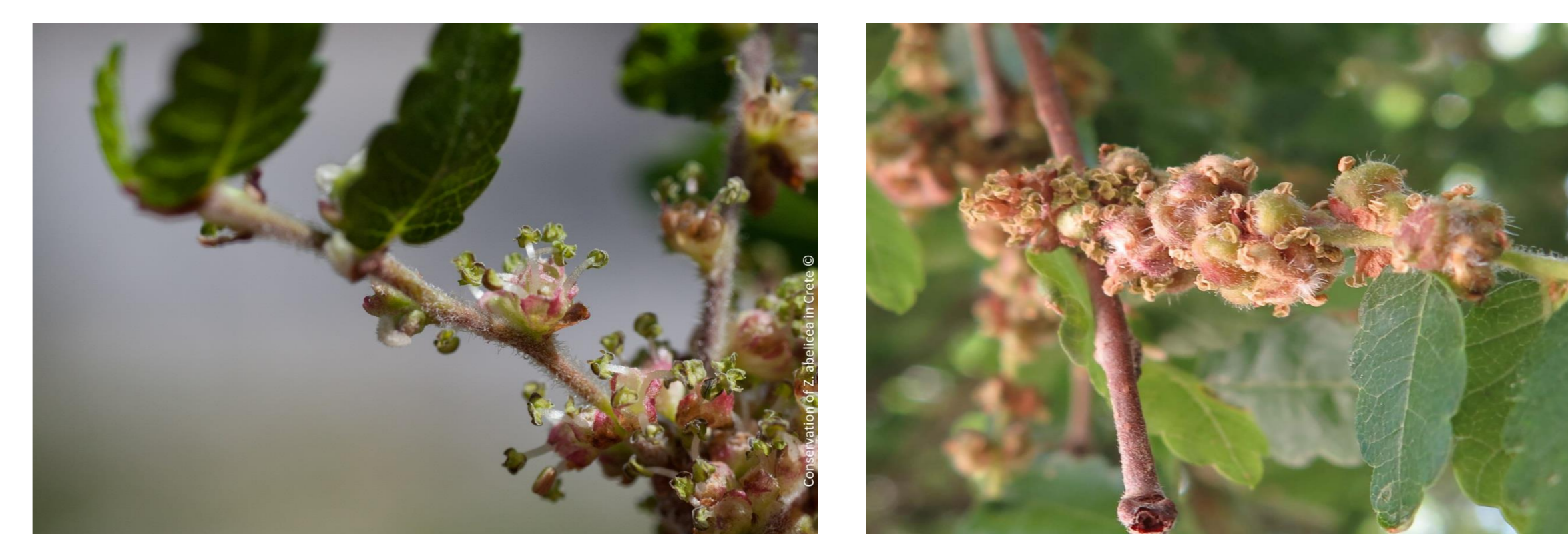
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Lefka Ori (West and East), Kedros, Psiloritis, Dikti (South and Katharo plateau), Thripti



Annual average height (m) of *Zelkova* individuals per Mt. massif



Normal flowers and flowering shoot of *Z. abelicea*

Deformed flowers and induced gall formation



Seed collection and vegetative propagation

