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[Regional assessment]

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Taxonomy [\[top\]](#)

Kingdom	Phylum	Class	Order	Family
PLANTAE	TRACHEOPHYTA	MAGNOLIOPSIDA	URTICALES	ULMACEAE

Scientific Name:	<i>Zelkova abelicea</i>
Species Authority:	(Lam.) Boiss.

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Assessment Information [\[top\]](#)

Red List Category & Criteria:	Endangered B1ab(iii)+2ab(iii) (Regional assessment) ver 3.1
Year Published:	2012
Assessor/s:	Kozłowski, G., Frey, D., Fazan, L., Egli, B. & Pirentos, S.
Reviewer/s:	de Montmollin, B. & Bilz, M.
Contributor/s:	Bazos, I. & Delipetrou, P.
Justification:	<i>Zelkova abelicea</i> is endemic to Crete where it has an extent of occurrence (EOO) of 2,094 km ² and an area of occupancy (AOO) of 64 km ² . The population is regarded as severely fragmented as even within the biggest distribution area, the Levka Ori mountains, several subpopulations are highly isolated. There is a continuing decline in its habitat due to soil erosion caused by trampling livestock. Overgrazing by goats and sheep furthermore hinders the species' development to fruiting and mature trees and therefore a decline in mature individuals can be assumed. Hence, this species is considered as Endangered.
History:	2011 – Endangered 1998 – Vulnerable (Oldfield <i>et al.</i> 1998) 1998 – Vulnerable 1997 – Vulnerable (Walter and Gillett 1998)

Geographic Range [\[top\]](#)

Range Description:	This species is endemic to the island of Crete. There are over 40 stands/populations of <i>Z. abelicea</i> , occurring in all four main mountain ranges of Crete: Levka Ori, Psiloritis (Ida Mountains), Dhikti and Thripiti. The majority of them are growing in the Levka Ori, with more than 30 stands. The second most important area is the Dhikti range with nine known populations. In the Psiloritis range there are nowadays only two known populations: one on the northern slopes of Mt. Kedros and the second in the Rouvas Forest. In the fourth mountain chain, Thripiti, there is only one small population. The occurrence of <i>Z. abelicea</i> in all four main Cretan mountains was already known to the scientific community in the past: in the Levka Ori probably already in the 18th century; in the Dhikti Mountains in the second half of the 19th century; on the Kedros Mountain and in the Rouvas Forest in the first half of the 20th century. The highly isolated and small population in the Thripiti Mountains was discovered later, probably in the second half of the 20th century.
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	<p>(Kozłowski <i>et al.</i> 2012b). The present distribution of <i>Z. abelicea</i> (1993-2010) covers almost exactly the historical occurrences. Thus, no dramatic shifts in distribution during the past 300 years could be demonstrated. However, several isolated populations, at Letka Ori and Kissamos, where the species was known to exist before 1930, could not be confirmed (Rechinger 1943).</p> <p>The global EOO of the species is 2,094 km² and the AOO covers 64 km². The biggest part of the AOO is located in the Levka Ori with 81.2%, followed by 18.5% in the Dhikti range, and 0.3% in the remaining three regions.</p>
Countries:	Native: Greece (Kriti)
Range Map:	Click here to open the map viewer and explore range.

Population [top]

Population:	<p><i>Zelkova abelicea</i> can be found as normally growing individuals with a crown, flowering, producing fruit and with leaves 1.5-6 cm long. Shrubby dwarfed individuals are very common, often with multiple stems, dense growth and leaves <2 cm, mainly due to grazing and probably water stress in some areas. Dwarfed shrubby individuals are in fact much more frequent than normal growing individuals and can form dense thickets in some areas. With a few exceptions in Levka Ori Mountains, the populations of <i>Z. abelicea</i> are actually totally dominated by dwarfed individuals. This is especially pronounced in relatively small and isolated populations (e.g. Thripiti with no normally developed trees at all). In the Psiloritis, Dhikti and Thripiti Mountains, the proportion of dwarfed trees is between 90 and 100%. Normally developed trees, thus, are in a majority of populations very rare. According to recent field observation only fully developed trees can produce fruits (Fazan <i>et al.</i> 2012, Kozłowski <i>et al.</i> 2012b). The density of <i>Z. abelicea</i> per hectare is relatively high (1,327.5 individuals/ha). However, since the majority of trees are severely browsed and dwarfed, the average number of large trees per hectare is very low (27.5 individuals/ha). According to estimations of Kozłowski <i>et al.</i> (2012b), there might be more than 1,000,000 severely browsed and dwarfed <i>Z. abelicea</i> individuals in all four mountain ranges across Crete, the majority in the Levka Ori. Although only a small proportion of <i>Z. abelicea</i> stands is formed by large trees, there still might be as much as 20,000 normally developed and fruiting individuals. Here again, the majority of normally developed trees probably exist in the Levka Ori.</p> <p>Recent study of Fazan <i>et al.</i> (2012) demonstrated that dwarfed and severely grazed trees of <i>Z. abelicea</i> can attain high ages (>500 yr.) and that dwarfed individuals often surpass in number and age their normally growing counterparts of the same population. These findings change significantly our perception of population age structure in human influenced forest remnants in Mediterranean landscapes. Furthermore, the sexual reproduction (flowering and fruiting) of <i>Z. abelicea</i> is not a problem of age, apart for very young immature trees, but is mainly influenced by the level of grazing and/or other disturbances. Only normally growing non-grazed trees are reproducing sexually. Thus, some dwarfed, severely grazed and very old individuals reproducing only vegetatively may not have the same genotype as large fruiting trees of the same population. Future conservation efforts and management strategies will need to include both forest remnants with normally growing trees and populations composed of dwarfed grazed individuals.</p>
Population Trend:	↓ Decreasing

Habitat and Ecology [top]

Habitat and Ecology:	<p><i>Zelkova abelicea</i> often grows in mixed stands with <i>Acer sempervirens</i>, <i>Quercus coccifera</i> and occasionally <i>Cupressus sempervirens</i>, on north-facing slopes, as well as in or around sinkholes where soil moisture is most abundant, soil conditions are most favourable and water supply most adequate and relatively constant (Egli 1997, Søndergaard and Egli 2006). <i>Z. abelicea</i> also grows in or around rocky river beds or gullies which are dry during summer but where humidity tends to remain in the subsurface and at high elevations (>1,500 m asl) on south-facing slopes. <i>Z. abelicea</i> propagates vegetatively by producing new shoots (suckers) from the roots of old plants. Seed production exhibits mast seeding behaviour (large production of sound seeds every three years). Seed germination is slow at low temperatures (5 - 10°C) and is inhibited at higher temperatures (Fournaraki 2010). The dispersal units of <i>Z. abelicea</i> are short annual shoots with dry leaves still attached, which fall off together with a few fruits, usually in autumn. It is concluded that the shoots act to assist wind dispersal of the fruits.</p> <p><i>Z. abelicea</i> grows between 900 and 1,800 m a.s.l., which corresponds to the upper timberline in the Cretan mountains (Egli 1997). The species reaches its highest elevation (c. 1,800 m asl) in the Levka Ori, where it was observed at 1,760 m asl (close to Eligas Gorge) by Rackham and Moody (1996) and 1,780 m asl at Pachnes by Egli (1997). In the Dhikti Mountains it also reaches the timberline (c. 1,600 m asl) whereas in smaller and lower mountain chains (e.g. Kedros, Thripiti) it grows at 1,350 m asl at the maximum. Thus, the species is one of the highest elevation trees on the island, lying in supra- and</p>
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	oro-Mediterranean mixed discontinuous woody stands dominated by evergreen and deciduous broadleaved trees (Søndergaard and Egli 2006). As a rule, the highest and at the same time strongly isolated stands, as those close to the Eligas Gorge, should merit special conservation efforts.
Systems:	Terrestrial

Threats [top]

Major Threat(s):	The most important pressure in all investigated populations is the overgrazing and browsing through livestock. Soil erosion is the second most important disturbance - clearly correlated with intensive trampling and grazing. Sheep and goats destroy seedlings and saplings thus diminishing sexual regeneration. Although the plant regenerates well by suckering, these clonal populations may never produce mature trees or seeds. The last decades a flourishing trade of walking sticks made from <i>Zelkova</i> wood has developed and this has led to increased pruning of trees (Fouraraki and Thanos 2006). The negative influence of drought during the summer months is difficult to detect during field inspection. Nevertheless, visible symptoms of water stress (e.g. dead branches without browsing, dry and brownish leaves during vegetation period, etc.) were observed. Pollarding and other forms of wood utilization seem to be marginal today, and they were only observed in plots with a relatively large number of normally developed trees (e.g. in the Levka Ori). Fires are very important disturbance to the vegetation of Crete and signs of recent burning were observed in more than 40% of the study plots. Finally, the geographical isolation is very accentuated for the single population in the Thripiti Mountains and the only two distant populations in the Psiloritis Mountains. However, several populations in the Dhikti and Levka Ori are very remote as well (Kozłowski <i>et al.</i> 2012b). Lack of protection and of public education may also have adverse effects, for example cutting of trees for firewood by ignorant soldiers has occurred.
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Conservation Actions [top]

Conservation Actions:	<p><i>Zelkova abelicea</i> is listed on Annex II of the Habitats Directive and under Appendix 1 of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). It is protected in Greece by the Presidential Decree 67/81 and included in the Red Data Book (Phitos <i>et al.</i> 1995). Almost all of the population of the plant is included in the Natura 2000 sites GR4320002, GR4320005, GR4330002, GR4330005, GR4340008.</p> <p>The current <i>in situ</i> and <i>ex situ</i> protection measures are inadequate (Kozłowski <i>et al.</i> 2012a, b). <i>Ex situ</i> conservation of this species requires major planning and coordination efforts including the establishment of well-documented collections in botanic gardens in Greece and especially in Crete. Collections should be created using plant material collected from all the mountain regions where <i>Z. abelicea</i> still occurs. Presently, the majority of the gardens cultivate <i>Zelkova</i> plants almost exclusively from the Levka Ori region, which has the biggest, accessible and thus best known occurrence of <i>Z. abelicea</i>. The gene bank and cultivation at the Mediterranean Agronomic Institute of Chania, for example, was based exclusively on plant material collected in Levka Ori. In contrast, the populations from small, threatened and genetically highly isolated populations of the Cretan Mountains (Psiloritis, Dhikti and Thripiti) have rarely if ever been used in <i>ex situ</i> culture (Kozłowski <i>et al.</i> 2012a, Christie <i>et al.</i> 2012). The practical conservation and propagation efforts carried out by Egli (1997) and Søndergaard and Egli (2006) provide relevant guidance. Further surveys of these collections may yield valuable findings for future <i>Z. abelicea</i> conservation approaches. Conservation efforts and field studies conducted by the authors could be reactivated and included in local conservation action plans, ideally in collaboration with botanic gardens and/or other relevant scientific institutions in Crete (Kozłowski <i>et al.</i> 2012a).</p> <p>The Forest Directorate of Chania, which is responsible for the largest part of the population, has attempted to fence some areas unsuccessfully due to conflicts between landowners and shepherds but has had one successful operation against illegal trading (Fournaraki and Thanos 2006).</p> <p>Much more attention should be given to the following disjunct populations: (1) Afendis Kavousi, the only populations in the Thripiti Mountains; and to both of the remaining populations of the Psiloritis Mountains: (2) Kedros, and (3) Rouvas Forest. Furthermore, a fourth population growing at the highest elevation on Crete in the vicinity of the Eligas Gorge (potentially well adapted to the extreme and changing environmental conditions), should also be considered as a conservation priority. Additional and very important reason to protect these isolated populations is the fact that <i>Z. abelicea</i> has an unexpected high variability that is additionally structured according to the four mountain ranges in the island (Christie <i>et al.</i> 2012). Thus, each mountain range possesses unique genetic compositions and should be treated as independent conservation unit.</p>
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