Zelkova sicula

Assessment by: Garfi, G., Pasta, S., Fazan, L. & Kozlowski, G.


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Taxonomy

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Phylum</th>
<th>Class</th>
<th>Order</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantae</td>
<td>Tracheophyta</td>
<td>Magnoliopsida</td>
<td>Urticales</td>
<td>Ulmaceae</td>
</tr>
</tbody>
</table>

Taxon Name: *Zelkova sicula* Di Pasq., Garfì & Quézel

Taxonomic Source(s):

Taxonomic Notes:
The genus *Zelkova* includes only six species, three of which grow in eastern Asia, one in Transcaucasia, and two in the Mediterranean basin (this species in Sicily and another, *Z. abelicea*, which is a threatened species endemic to the mountains of Crete (Greece) (Kozlowski and Gratzfeld 2013).

Assessment Information

Red List Category & Criteria: Critically Endangered B1ab(iii)+2ab(iii) ver 3.1

Year Published: 2017

Date Assessed: September 13, 2017

Justification:
The species is currently known from only two localized natural subpopulations, each occupying a very small area (about 0.18 and 0.50 hectares, respectively) (Garfì et al. 2011). Both the extent of occurrence (EOO) and the area of occupancy (AOO), estimated using a 2x2 km grid, are very much less than 8 km², and there is a continuing decline in the quality of habitat as a result of a range of threats, including grazing, fire, and climate change. No successful pollination has been observed so far in the few flowering plants (Garfì 1997, Garfì and Buord 2012), which fluctuate from year to year from about 20 to 70 in total for the two subpopulations. All the examined seeds proved to be sterile, and the species only reproduces through root suckers, whilst re-sprouting allows prompt recovery from damage caused by disturbance and drought stress (Garfì et al. 2002). Unable to perform sexual reproduction and due to its extreme genetic impoverishment, the number of individuals are potentially subject to decline owing to diseases and/or global warming (Gratzfeld et al. 2015), the latter also affecting the habitat. Though the recent finding (2009) of a second subpopulation (Garfì et al. 2011) increased the number of known plants, the probability of extinction remains very high. The species is assessed as Critically Endangered B1ab(iii)+2ab(iii).

A range of conservation actions are in place for this species, including the establishment in 2016 of additional sub-populations outside the natural range of the species, and the species should be reassessed in 2021.

Previously Published Red List Assessments

1998 – Endangered (E)
Geographic Range

Range Description:
The species is known from two localities some 17 km apart on the volcanic outcrops of the Iblei Mountains, Siracusa Province, in southeastern Sicily (Garfi et al. 2011). One subpopulation is located in Bosco Pisano (Municipality of Buccheri) and consists of scattered individuals covering a 130 m long strip along a slope, between 495 and 526 m asl; the second subpopulation is located in Contrada Ciranna (Municipality of Melilli), and is mostly concentrated within a 240 m long gully, between 318 and 357 m asl. Both the EOO and the AOO, estimated using a 2x2 km grid, are very much less than 8 km².

Four new subpopulations were created in 2016 comprising 25-26 plants at each locality (Garfi et al. 2016), within the activities of the LIFE Project Zelkova@zione (www.zelkovazione.eu). They are located respectively in the Regional Park of the Nebrodi Mts., the Regional Park of the Madonie Mts., the Regional Park of Sicani Mts. and in the SCI ITA090022 Bosco Pisano, the latter a few hundred meters from one of the existing subpopulations. These new subpopulations are not included in the assessment since fewer than five years have passed since they were established.

Country Occurrence:
Native: Italy (Sicilia)
Distribution Map

*Zelkova sicula*

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**Range**
- Extant (resident)

**Compiled by:**
- IUCN (International Union for Conservation of Nature)

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http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T61678A86134112.en
**Population**

The species is known from only two subpopulations, the first one consisting of about 260 individuals, the second of some 1,600 individuals. Recent genetic investigations revealed strong genetic differences between the two subpopulations but no differences at all within each of them (Christe et al. 2014). That means that each subpopulation is clonal, hence they should be both considered as issuing from probably centuries-long sprouting of two single surviving genetic individuals (Garfi and Buord 2012, Gratzfeld et al. 2015).

Number of mature individuals (=population size): since the population is clonal, the number of mature individuals has been estimated at about 1,860, corresponding to the number of reproducing units.

**Current Population Trend:** Stable

**Habitat and Ecology (see Appendix for additional information)**

The plants of the Bosco Pisano subpopulation and some of those of the Contrada Ciranna subpopulation grow within a mosaic-like open landscape dominated by thorny shrubland and open Quercus suber (cork oak) woodland. Most parts of the Contrada Ciranna subpopulation forms an almost pure stand. Both stands are located on bare soils with outcropping volcanic rocks; they are restricted to the bottom of gullies and along narrow streams, suggesting that this peculiar microtopographic position plays a key role in improving water supply, and helping the species withstand seasonal water stress.

The species grows as a shrub or small tree in its current habitat, but has the potential to grow into a larger tree in less constraining conditions.

**Systems:** Terrestrial

**Use and Trade**

No part (leaves, wood, etc.) of the species is known to have any direct local uses. However the species is probably one of the most palatable plants within local pastures, so presumably it could contribute value to local livestock grazing.

**Threats (see Appendix for additional information)**

Although a second subpopulation was found in 2009, both known subpopulations contain a very low number of individuals. Being unable to perform sexual reproduction and due to its extreme genetic impoverishment, the probability of extinction of this species is very high. At present its survival relies solely on vegetative propagation through root suckering mechanisms.

Moreover, the plant communities hosting this species are very degraded due to past land uses such as logging, in addition to current cork harvesting, wildfires and (over)grazing. Ongoing investigations into the water physiology of the species suggest that it requires moist conditions and highlight the negative effects of temperature extremes and droughts; such factors periodically cause severe damage to the plants, and have significantly increased in frequency and intensity in recent years presumably as a consequence of climate changes. Moreover, they may intensify the occurrence of wildfires and the impact of pests and diseases. Fires represent a very real threat to this species; whilst the long-term
impact in terms of mortality requires ongoing monitoring, a large wildfire in August 2017 over an area of more than 7 km² impacted the Contrada Ciranna subpopulation, causing more or less severe damage to 60% of plants there (G. Garfì pers. comm. 2017).

**Conservation Actions (see Appendix for additional information)**

The species was assessed as CR globally in 2006 (Garfì 2006, Montmollin and Strahm 2005) and in 1998 (Garfì, in Walter and Gillett 1998).

**Actions in Place**

Since 2013 the species has been officially protected by the Presidential Decree of the Sicilian Region 27/05/2013.

*In situ*: Both subpopulations are fenced to prevent grazing, and fall within two SCIs (Sites of Community Importance) of the European Natura 2000 Network. Several actions of an ongoing EU LIFE Project, e.g. the implementation of a grazing management plan and the afforestation activities to restore local habitat functions and speed up vegetation dynamics, aim at improving the conservation status of the species. In June and November 2016, 25-26 plantlets per site were introduced in small pilot areas at Bosco Tassita (Nature Regional Park of Nebrodi Mts.), Bosco Pomieri (Nature Regional Park of Madonie Mts.), Bosco Ficuzza (Nature Regional Park of Sicani Mts.) and in the SCI ITA09002 Bosco Pisano (Garfì et al. 2016) following the IUCN Re-introduction Guidelines.

*Ex situ*: Currently the species is cultivated at the Botanical Garden of the University of Catania, at the National Botanical Conservatory of Brest (France), at the Regional Forest Nursery of Spina gallo (Siracusa) of the Sicilian Forest Department, at the Parc Saint-Mitre of Aix-en-Provence (France), in a private garden in the town of Buccheri, and at a private estate at Fasano di Puglia. Moreover, in the framework of the above-mentioned LIFE project Zelkov@zione, new plants have been obtained through root cuttings (by the Conservatoire National Botanique de Brest) and through in vitro techniques (by the Institute of Biosciences and BioResources of Palermo with the support of the University of Fribourg, Switzerland). Some of this material is being used to create new subpopulations in other Sicilian sites, some of them selected outside its current range as they are suggested to be more suitable for the survival of the species in case of global warming. Four new subpopulations have been created in 2016, including 25-26 plants each, within the LIFE Project Zelkov@zione. They are located respectively in the Regional Park of the Nebrodi Mts., the Regional Park of the Madonie Mts., the Regional Park of Sicani Mts., and in the SCI Bosco Pisano, the latter a few hundred meters from one of the existing subpopulations.

**Actions Needed**

Field exploration throughout the Iblei Mountains and the Sicilian territory, supported by modern GIS and remote sensing tools, has been carried out in Autumn 2016 in order to find new subpopulations which may contain precious genetic heritage to be conserved. 99 potential locations classified by both automatic and manual procedures were selected and 72 sites explored. Though no new site was found yet, the model proved to work well, so new campaigns are planned in the near future with more refined methods.

Better information on the reproduction biology, ecological requirements (soil and water) and on ecosystem-level relationships (competition, facilitation, parasites and predators) should improve
conservation measures.

Credits

Assessor(s): Garfi, G., Pasta, S., Fazan, L. & Kozlowski, G.

Reviewer(s): Perez Graber, A. & Allen, D.J.
Bibliography


Citation


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External Resources
For Images and External Links to Additional Information, please see the Red List website.
Appendix

Habitats
(http://www.iucnredlist.org/technical-documents/classification-schemes)

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Season</th>
<th>Suitability</th>
<th>Major Importance?</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Wetlands (inland) -&gt; 5.2. Wetlands (inland) -</td>
<td>Resident</td>
<td>Suitable</td>
<td>Yes</td>
</tr>
<tr>
<td>Seasonal/Intermittent/Irregular Rivers/Streams/Creeks</td>
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<td></td>
<td></td>
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</table>

Threats
(http://www.iucnredlist.org/technical-documents/classification-schemes)

<table>
<thead>
<tr>
<th>Threat</th>
<th>Timing</th>
<th>Scope</th>
<th>Severity</th>
<th>Impact Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Climate change &amp; severe weather -&gt; 11.2. Droughts</td>
<td>Future</td>
<td>Whole (&gt;90%)</td>
<td>Very rapid declines</td>
<td>Medium</td>
</tr>
<tr>
<td>Stresses: 1. Ecosystem stresses -&gt; 1.2. Ecosystem degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Agriculture &amp; aquaculture -&gt; 2.3. Livestock farming &amp; ranching</td>
<td>Ongoing</td>
<td>Majority (50-90%)</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>&amp; ranching -&gt; 2.3.2. Small-holder grazing, ranching or farming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stresses: 1. Ecosystem stresses -&gt; 1.2. Ecosystem degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Biological resource use -&gt; 5.3. Logging &amp; wood harvesting</td>
<td>Ongoing</td>
<td>Whole (&gt;90%)</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Unknown/Unrecorded</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Stresses: 1. Ecosystem stresses -&gt; 1.2. Ecosystem degradation</td>
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<td></td>
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</tr>
<tr>
<td>7. Natural system modifications -&gt; 7.1. Fire &amp; fire</td>
<td>Ongoing</td>
<td>Majority (50-90%)</td>
<td>Unknown</td>
<td>Unknown</td>
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<tr>
<td>suppression -&gt; 7.1.1. Increase in fire frequency/intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stresses: 1. Ecosystem stresses -&gt; 1.2. Ecosystem degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Invasive and other problematic species, genes &amp; diseases</td>
<td>Ongoing</td>
<td>Whole (&gt;90%)</td>
<td>Slow, significant declines</td>
<td>Medium</td>
</tr>
<tr>
<td>-&gt; 8.2. Problematic native species/diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-&gt; 8.2.1. Unspecified species</td>
<td></td>
<td></td>
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<tr>
<td>Stresses: 2. Species Stresses -&gt; 2.1. Species mortality</td>
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</tbody>
</table>

Conservation Actions in Place
(http://www.iucnredlist.org/technical-documents/classification-schemes)

<table>
<thead>
<tr>
<th>Conservation Actions in Place</th>
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</thead>
<tbody>
<tr>
<td>In-Place Research, Monitoring and Planning</td>
</tr>
<tr>
<td>Action Recovery plan: Yes</td>
</tr>
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### Conservation Actions in Place

<table>
<thead>
<tr>
<th>Section</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic monitoring scheme</td>
<td>Yes</td>
</tr>
<tr>
<td>In-place land/water protection and management</td>
<td>Yes</td>
</tr>
<tr>
<td>Percentage of population protected by PAs (0-100)</td>
<td>100</td>
</tr>
<tr>
<td>Invasive species control or prevention</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Successfully reintroduced or introduced benignly</td>
<td>Yes</td>
</tr>
<tr>
<td>Subject to ex-situ conservation</td>
<td>Yes</td>
</tr>
<tr>
<td>In-place education</td>
<td>Yes</td>
</tr>
<tr>
<td>Subject to recent education and awareness programmes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Conservation Actions Needed

(https://www.iucnredlist.org/technical-documents/classification-schemes)

#### Conservation Actions Needed

1. Land/water protection -> 1.1. Site/area protection
2. Land/water protection -> 1.2. Resource & habitat protection
3. Species management -> 3.2. Species recovery

### Research Needed

(https://www.iucnredlist.org/technical-documents/classification-schemes)

#### Research Needed

1. Research -> 1.2. Population size, distribution & trends
2. Research -> 1.3. Life history & ecology
3. Research -> 1.5. Threats
6. Monitoring -> 3.4. Habitat trends

### Additional Data Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>Estimated area of occupancy (AOO) (km²): 8</td>
</tr>
</tbody>
</table>
### Distribution
- Continuing decline in area of occupancy (AOO): No
- Estimated extent of occurrence (EOO) (km²): 8
- Continuing decline in extent of occurrence (EOO): No
- Number of Locations: 2
- Lower elevation limit (m): 318
- Upper elevation limit (m): 526

### Population
- Continuing decline of mature individuals: No
- Extreme fluctuations: No
- Population severely fragmented: Yes
- Continuing decline in subpopulations: No
- Extreme fluctuations in subpopulations: No
- All individuals in one subpopulation: No

### Habitats and Ecology
- Continuing decline in area, extent and/or quality of habitat: Yes
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