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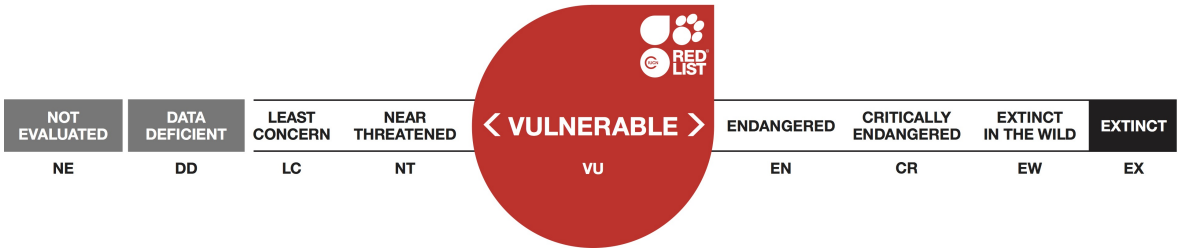
Language: English

Zelkova sinica, Chinese Zelkova

Assessment by: Bétrisey, S., Song, Y., Liu, Z. & Kozlowski, G.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Plantae	Tracheophyta	Magnoliopsida	Rosales	Ulmaceae

Taxon Name: *Zelkova sinica* C.K.Schneid.

Common Name(s):

- English: Chinese Zelkova

Taxonomic Source(s):

Board of Trustees, RBG Kew. 2018. Plants of the World Online Portal. Richmond, UK Available at: http://www.plantsoftheworldonline.org.

Assessment Information

Red List Category & Criteria: Vulnerable A2c; C1 ver 3.1

Year Published: 2018

Date Assessed: June 19, 2018

Justification:

Zelkova sinica is an endemic tree in the mountainous region of central China. Its subpopulations are scattered and restricted to a few riparian habitats. The area of occupancy (AOO) is low and estimated to be less than 300 km^2, but does not fit the supplementary conditions for the threatened category under criterion B. The total number of subpopulations is estimated to be between 70 and 100. This imprecision is due to flaws in field exploration and frequent errors in determining the species. Primary forests decline in China has been very important in the past due to conversion of forest to agricultural lands and overexploitation of forest resources. Moreover, old and large *Z. sinica* individuals have been systematically cut from the 1950s to the 1980s for their economic value. The population reduction is suspected to be at least 30% over the last 180 years (three generations) and large parts of the habitat of the species have been irreversibly destroyed or altered. Therefore, the species is assessed as Vulnerable A2c. The species is still declining and shows a low regeneration in the wild, with most of the subpopulations constituted of fewer than 30 individuals. The deterioration of its habitat associated with a low regeneration and low number of individuals represent important challenges for the survival of many subpopulations. Illegal logging and the impact of tourist infrastructures within protected areas are a serious threat to small subpopulations. The total number of mature individuals is estimated to be less than 10,000 and it is projected that more than 10% of the actual population will disappear within the next 100 years, which makes the species fall within the threshold for Vulnerable under criterion C1.

Geographic Range

Range Description:

Zelkova sinica is a tree endemic to China. It is mainly distributed in the mountainous region of central China along the Qin Mountains (Qinling), with a few isolated subpopulations in adjacent provinces. Wild

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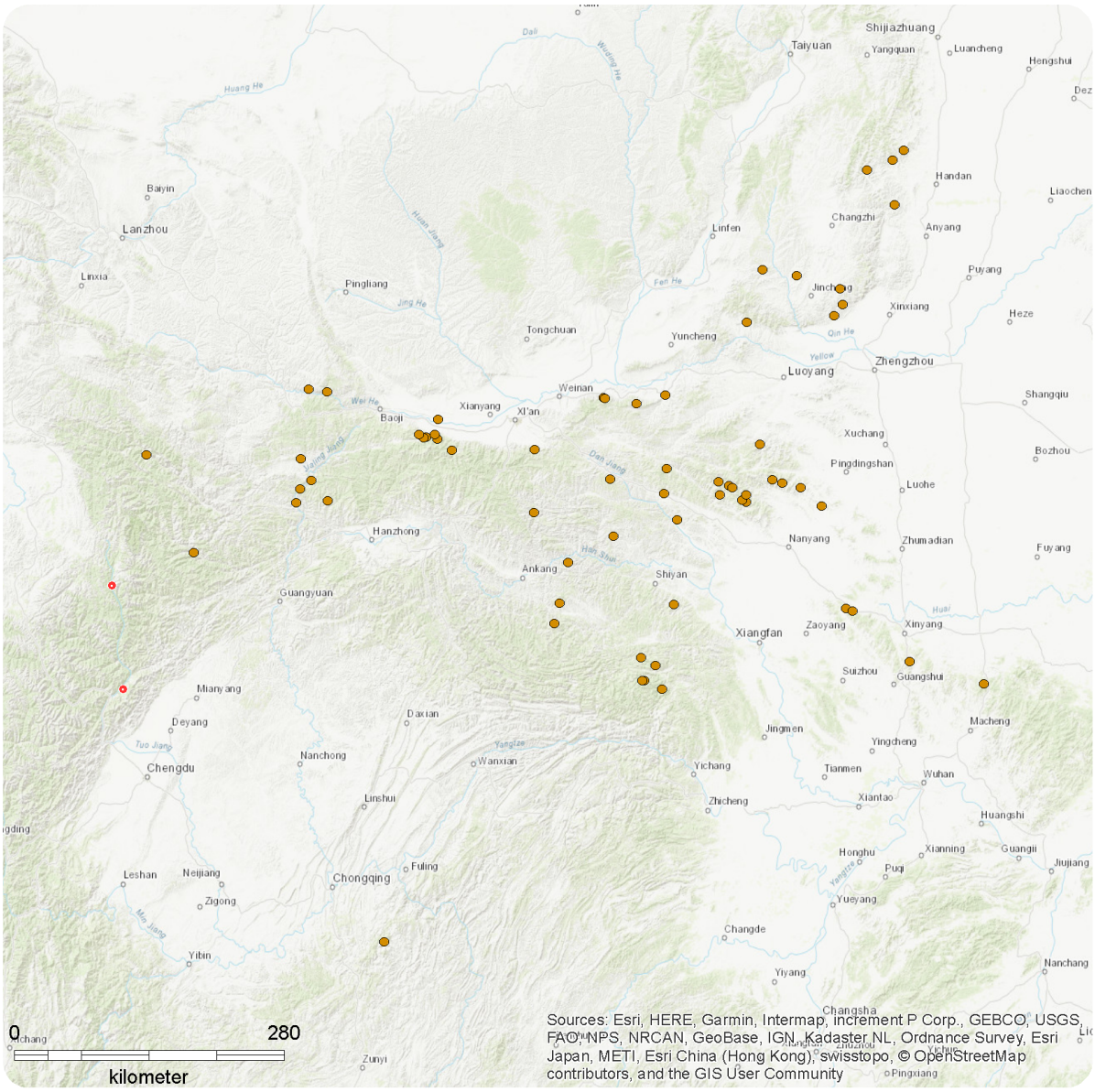
subpopulations are known from the Provinces of Gansu, Hebei, Henan, Hubei, Shaanxi, Shanxi and Sichuan, and also from Chongqing Municipality (Fang *et al.* 2011, Zheng and Raven 2003, CVH 2018). Isolated planted individuals sometimes can be found outside the native distribution area of the species. It has an estimated extent of occurrence (EOO) of 536,762 km^2 and the estimated area of occupancy (AOO) is 256 km^2.

Country Occurrence:

Native: China (Chongqing, Gansu, Hebei, Henan, Hubei, Shaanxi, Shanxi, Sichuan)

Distribution Map

Zelkova sinica



Range

- Extant (resident)
- Possibly Extinct

Compiled by:

BGCI

NE DD LC NT VU VULNERABLE EN CR EW EX

The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

The total population of *Z. sinica* is estimated to be composed of 3,000 to 5,000 mature individuals distributed in 64 to 80 localities. The exact number of subpopulations is difficult to estimate, because of frequent misidentifications of the species, lack in recent observations and a general lack of investigations of its distribution. The majority of subpopulations is restricted to the direct vicinity of small rivers and occurs as isolated groups separated by vast mountains and hills. Known subpopulations are often very small and do not exceed 30 individuals. Only one subpopulation in Zhen Whu Ding (Nanzhao County, Henan Province) is known to hold between 1,000 and 1,500 mature individuals, which count for at least 20% of the estimated total number of individuals of the species. With the exception of this large subpopulation, the regeneration rate of *Z. sinica* seems to be very low in its natural habitat, with few young trees and almost no seedlings encountered in the field. Remaining subpopulations have been preserved mainly due to their location in remote and inaccessible areas. Many subpopulations are found in different types of protected areas in the Qin Mountains and Dabie Mountains.

Based on the information affecting the extent of occurrence of the species, the population reduction of the species is suspected to be between 30 to 35% over the last 180 years (three generations).

Current Population Trend: Decreasing

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

Zelkova sinica grows mainly in valleys along rivers between 300 and 2,500 m asl in humid, subtropical deciduous forests of central China. The species is mostly restricted to the vicinity of rivers but can also grow in small patches in drier habitats. The trees can reach a height of 30 m and diameter of 100 cm, although it is often much smaller in its natural habitat. The species prefers a warm climate and deep soils with a slightly acidic to highly calcareous pH (Kozlowski and Gratzfeld 2013, Zheng and Raven 2003).

Systems: Terrestrial

Use and Trade

The wood of *Zelkova* spp. (*Z. serrata, Z. schneideriana* and *Z. sinica*) is heavy, hard and resistant to decay, and its reddish colour is very attractive and sought in Asian markets. The wood of *Z. sinica* has a high commercial importance value. It is very expensive and large trees have been cut systematically in most of its range since the 1950s, and used in construction and furniture industries (Cao *et al.* 2005, Kozlowski and Gratzfeld 2013). The tree also provided an appreciated wood for fire before most of their subpopulations were included in protected areas. Due to its large crown and beautiful leaf colours during autumn, the tree is valued as a landscape element in China (Jin *et al.* 2012, Cao *et al.* 2005), although *Z. sinica* is not planted as often as *Z. schneideriana* or *Z. serrata*.

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

Main threats to *Z. sinica* are agricultural expansion and the conversion of primary forest to plantation forests (e.g. bamboo, poplar, *Eucalyptus*) (Kozlowski and Gratzfeld 2013). In China, the loss of primary forest was very important from the 18th century to the 1980s and mostly due to an increase of the human population and demand for agriculture land (Houghton and Hackler 2003). While affecting the whole territory, the decline seemed to be more intense in the southern and central parts of the country

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(Houghton and Hackler 2003, Miao *et al*. 2013). Uncontrolled commercial logging was very important during the 1950s to the 1980s and the vast majority of centennial trees were cut for commercial trade during that period. Due to the very high price for large and old *Z. sinica* trees, such majestic individuals are nowadays extremely rare in the wild. Early unmanaged logging activities have also deteriorated the soil integrity, especially along rivers, which has altered the growing potential for this species in its primary habitat. The remaining subpopulations are currently mostly included in protected areas or are too remote to be exploited. Nevertheless, individuals and small patches of primary forest located in the direct vicinity of protected areas have been until very recently converted to plantations or transformed for agricultural purposes. Based on the information affecting the extent of occurrence (EOO) of the species, the population reduction of the species is suspected to be between 30 to 35% over the last 180 years (three generations). While illegal logging has considerably diminished (Fang 2007), but still occurs in protected areas and the wood of *Z. sinica* is particularly sought for its burning qualities and commercial value. Even in protected areas, some stands are sometimes cut when roads and paths are created, especially for the development of large infrastructures for tourism (e.g. hotels, recreational activities). The regeneration of the species seems to be very low in natural forests, partially due to a limited seed germination rate that does not exceed 20% (Jin *et al.* 2012). Young immature trees and seedlings are generally difficult to find in the wild, except in the large subpopulation of Zhen Wu Ding (Henan Province). It is unknown if natural succession within the forests will be favourable or not to this species in the future. The major fragmentation of the subpopulations of the species associated with a low regeneration and number of individuals per locality is problematic for the long-term survival of the majority of stands situated in the periphery of the main range of the species along the Qin Mountains.

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

Zelkova sinica has not been evaluated in the China Plant Red Data Book (Li-Kuo and Jian-Ming 1992) and is not included in the 1999 State Council of China List of National Key Protected Wild Plants.Due to its important economic value and rarity in the wild, there is an interest to start afforestation projects of this species in China (Zhang *et al.* 2010). Studies have investigated the global ecology and seed germination characteristics of the species (Chen *et al.* 2010, Jin and He 2005) and established a protocol for a massive production of plants via seeds and root suckers (Jin *et al.* 2012). An international research project at genus level has been led by the University of Fribourg (Project Zelkova, www.zelkova.ch); both genetic and environmental factors have been investigated to allow a better conservation of the genus at the global level (Kozlowski and Gratzfeld 2013). The species is still rarely cultivated in botanic gardens neither in China nor worldwide. An *ex situ* collection survey (Kozlowski *et al.* 2012), reported 33 *ex situ* collections of *Z. sinica*, with 27 collections of known wild origin and only three collections located in botanic gardens in China.

It is urgent to start monitoring the remaining stands of the species and to insure legal protection of the individuals in China. This is very important for the few stands located outside protected areas but also in their direct vicinity where forests are often replaced by plantations except for the stands included in the strict perimeter of the protected area. The protection of the species should also be strengthened inside protected areas where infrastructures for tourism can represent major threats. Afforestation projects using this species could be effective, but special attention should be paid to the use germplasm of of local provenance to conserve the genetic diversity of the species. The large subpopulation of Zhen Whu Ding (Nanzhao County, Henan Province) should benefit from a special conservation status to protect the most important occurrences of this species, especially for the ones situated in Chongqing Municipality and Sichuan Province. Urgent *in situ* conservation is necessary to protect the small subpopulations

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situated in Shaanxi, Hebei, and Shanxi Province. The habitat fragmentation and deterioration needs to be significantly reduced in order to stop the decline of the species. Supplementary investigations are still required to estimate more precisely the total number of subpopulations. *Ex situ* collections should be enhanced throughout the different regions of China where the species occurs. The selection of priority sites for *ex situ* conservation should be based on the low number of individuals and their genetic isolation.

Credits

Assessor(s): Bétrisey, S., Song, Y., Liu, Z. & Kozlowski, G.

Reviewer(s): Gratzfeld, J.

Facilitators(s) and Compiler(s): Rivers, M.C.

Bibliography

Cao, Y., Liu, Z., Zhao, H. 2005. Preliminary investigation on the suitability of some deciduous broad-leaved trees in Beijing. *Journal of Chinese Landscape Architecture* 21: 62-64.

Chen, L., Zhang, R., Wang, L. and Zhang, Y. 2010. Study on the characteristics of fruiting, seeds and seedlings for Zelkova sinica Schneid. *Journal of Shanxi Agricultural University* 30: 350-352.

CVH (Chinese Virtual Herbarium). 2018. Chinese Virtual Herbarium. Available at: http://www.cvh.org.cn/en. (Accessed: 2018).

Fang, J., Wang, Z. and Tang, Z. 2011. *Atlas of Woody Plants in China: Distribution and Climate, Volume 1.* Springer.

Houghton, R.A. and Hackler, J.L. 2003. Sources and sinks of carbon from land-use change in China. *Global Biogeochemical Cycles* 17: 1034.

IUCN. 2018. The IUCN Red List of Threatened Species. Version 2018-2. Available at: www.iucnredlist.org. (Accessed: 15 November 2018).

Jin, X. and He, P. 2005. Biological characteristics in Zelkova. *Nonwood Forest Research* 23: 45-47.

Jin, X., Hu, X., Sun, Y., Zhang, D. and He, P. 2012. Callus induction and plant regeneration from immature embryos of Zelkova sinica Schneid. *Horticultural Science* 47: 790-792.

Kozlowski, G. and Gratzfeld, J. 2013. *Zelkova* – an ancient tree. Global status and conservation action. Natural History Museum, Fribourg.

Kozlowski, G., Gibbs, D., Fun, H., Frey, D. and Gratzfeld, J. 2012a. Conservation of threatened relict trees through living *ex situ* collections: lessons from the global survey of the genus *Zelkova* (Ulmaceae). *Biodiversity and Conservation* 21: 671-685.

Liu, H.L., Zhang, R.Q. and Geng, M.L. 2016. Chloroplast analysis of Zelkova schneideriana (Ulmaceae): genetic diversity, population structure, and conservation implications. *Genetics and Molecular Research* 15(1).

Miao, L., Zhu, F., He, B., Ferrat, M., Liu, Q., Cao, X. and Cui, F. 2013. Synthesis of China's land use in the past 300 years. *Global and Planetary Change* 100(224-233).

Zhang, R., Chen, L., and Wang, L. 2010. Utilization of the rare native trees Zelkova sinica in Shanxi for greening. . *Shanxi Forestry Science and Technology* 39: 38-41.

Zheng, Y.W. and Raven, P.H. 2003. Zelkova. Flora of China. Vol. 5. Ulmaceae – Basellaceae. Missouri Botanical Garden Press, St. Louis.

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Disclaimer

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)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.4. Forest - Temperate	-	Suitable	-

Threats

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

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.1. Housing & urban areas	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
1. Residential & commercial development -> 1.3. Tourism & recreation areas	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.2. Small-holder farming	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.2. Agro-industry plantations	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
4. Transportation & service corridors -> 4.1. Roads & railroads	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.2. Intentional use: (large scale) [harvest]	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		

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6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

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

Conservation Actions in Place
In-Place Species Management
Subject to ex-situ conservation: Yes

Conservation Actions Needed

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

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
2. Land/water management -> 2.1. Site/area management
3. Species management -> 3.4. Ex-situ conservation -> 3.4.2. Genome resource bank
4. Education & awareness -> 4.2. Training
5. Law & policy -> 5.1. Legislation -> 5.1.2. National level

Research Needed

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

Research Needed
1. Research -> 1.2. Population size, distribution & trends
3. Monitoring -> 3.1. Population trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km²): 256
Estimated extent of occurrence (EOO) (km²): 536762
Lower elevation limit (m): 300
Upper elevation limit (m): 2500

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Population
Number of mature individuals: 3000-5000
Continuing decline of mature individuals: Yes
All individuals in one subpopulation: No
Habitats and Ecology
Generation Length (years): 60

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The IUCN Red List Partnership

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The IUCN Red List Partners are: Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.