

Conservation of Magnoliaceae in China: five flagship species in Yunnan, SW China

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According to Professor Liu Yuhu's classification of Magnoliaceae, the family has 16 genera and over 300 species in the world, and 160 species in 11 genera are found in China. Yunnan Province in south-west China hosts more than half China's Magnoliaceae, with south-east Yunnan and the border area with Vietnam boasting a particularly diverse array of the species. Among the 160 Chinese species, 25 species were described in the *China Plant Red Data Book* and 23 species were included on the list of the national key protection plants of China in 1999. *Manglietia grandis*, *Manglietia sinica*, *Magnolia phanerophlebia*, *Magnolia sargentiana* and *Michelia coriacea* in Yunnan were flagged as requiring urgent conservation actions. As part of the Global Trees Campaign Programme, the detailed comprehensive field investigations of the five species have been carried out since December 2005. Based on the data analysed from the investigations, the current distribution, population size, habitat and regeneration, human uses and threatening factors of the 5 species have been firstly reported in this paper, and the global threatening Categories have also been evaluated by using the IUCN Red List Categories and Criteria (Version 3.1). Meanwhile, conservation considerations for each of the species have also been proposed.

Introduction

The Magnoliaceae family comprises 16 genera and over 300 species, and China hosts 69% and 53% of the world's genera and species respectively. Most of the species in the family have high ornamental value, with elegant tree-shape, fragrant and colourful flowers. In addition, most of the species in the family have high quality wood and they are greatly in demand timber trees. Therefore Magnoliaceae plants have long been exploited for landscaping, gardening, building construction and furniture making.

Due to overexploitation, habitat degradation caused by agriculture land expansion, many Chinese Magnoliaceae plants have been threatened and they are now facing a high risk of endangerment and even extinction in the wild. Among the 160 Chinese species, 25 species were described in the *China Plant Red Data Book* and 23 species were included on the list of the national key protection plants of China in 1999. Magnoliaceae has become one of the families that contain most of the rare and endangered angiosperm species. Undoubtedly, conservation of the Chinese Magnoliaceae plants is the urgent issue for international concern. As supported by Fauna & Flora International (FFI), the current distribution, regeneration, population ecology and threatening factors of the five Chinese priority species, *Magnolia phanerophlebia*, *Magnolia sargentiana*, *Manglietia grandis*, *Manglietia sinica* and *Michelia coriacea*, have been investigated in detail. The objective is to provide comprehensive information relevant to their conservation and restoration. In this paper we discuss the five Chinese Magnoliaceae species in detail.

Magnolia sargentiana

Magnolia sargentiana is a deciduous tree up to 25 metres tall, and it is distributed in the broad-leaved forest at 1,400-3,000 m in central and south Sichuan and north-east and east Yunnan. The field investigations revealed that it still exists in most of its recorded distribution regions. However no single integral population exists; most trees are individuals scattered in agricultural fields or broad-leaved forest. Currently *M. Sargentiana* in China numbers some 36,930 individuals in total, with a total area of occupancy of 125,933 hectares. The average density is some 29 individuals in every 100 hectares.

Field observations showed that the tallest *M. sargentiana* in Sanjiangkou Provincial Nature Reserve in Yunnan was around 22 m and the shortest individual was 3 m tall. Most of the individuals (70% of the total) had flowered. The lower percentage of young trees shows the poor rate of regeneration, which may be due to the habitat degradation caused by human disturbance. The main accompanied woody plants are *Actinidia* spp., *Alstonia scholaris*, *Aralia chinensis*, *Camellia* spp., *Castanopsis platyacantha*, *Cerasus conradina*, *Cercidiphyllum japonicum*, *Davidia involucrata*, *Decaisnea fargesii*, *Ficus heteromorpha*, *Lithocarpus* spp., *Machilus* spp., *Munronia* spp., *Schima* spp., *Qiongzhusia tumidissinoda*, *Rehderodendron macrocarpum*, *Rubus corchorifolius*, *Spiraea* spp., *Symplocos* spp., *Taxus chinensis*, *Tetracentron sinense*, *Toona* spp., *Lonicera* spp.

The species habitats are clearly degraded. The areas of protected vegetation where the species occurs are isolated from each other because of farmland exploitation. At present, vegetation destruction is still ongoing in some regions and habitat fragmentation is worse than ever within the protected vegetation. Within the protected vegetation areas, the habitat quality for *M. sargentiana* is comparatively high.

M. sargentiana has long been used by indigenous peoples. The most directly destructive use in north-east Yunnan is wood chopping for coal-mine timber, fuel-wood, medicinal use and agricultural field expansion. Shoot production from the bamboo *Qiongzhusia tumidissinoda* suppresses its regeneration and threatens its development. The right habitat is facing a risk of disappearance.

Current populations are rather fragile, and it is certain that they will be continuously declining. With considerations of this field work we may propose conservation considerations as follows:

- Enforcing the acting of the both national and provincial laws or regulations and to prohibit any further wood-chopping and its medicinal bark-collecting;
- Prohibiting further actions to improve the bamboo growth inside the forest and to force the natural regeneration of the species;
- Propagating the species from seed or other vegetative materials for *ex-situ* conservation and utilization.

Manglietia grandis

Manglietia grandis is an evergreen tree distributed in mountain evergreen broad-leaved forest at 800-1500m in the Malipo and Xichou areas of south-east Yunnan, and the Jingxi and Napo areas in the south-west of Guangxi Province. However, field investigations did not find any specimens of this species that are recorded the Napo and Jingxi areas. Currently, occupancy area of the species is only around 20 hectares in south-east

Yunnan, with about 1200-1500 individuals in total. As the species is found on the border of south-east Yunnan and Vietnam, it may also be distributed in Vietnam.

Most *M. grandis* in south-east Yunnan are isolated individuals or as occur as small patches scattered in the forests, which have been heavily logged. Field observations at Malipo and Maguan in Yunnan indicated that the species has strong sprouting ability and normally 3-4 sub-branches could sprout from the tree base after logging. Meanwhile, as the habitat in the Jinchang area of Malipo has been badly affected by human activities, seedlings or saplings (height ≤ 1.0 m) were rarely found.

Manglietia grandis is mostly found on sunny slopes. Surveys in the well protected forest revealed that it has a relatively stable population structure. Among all the counted individuals, heights from 0.5 cm to some 25 m were observed. 40% of specimens were seedlings of less than 1.0 m in height; 30% were over 10 m tall. Surveys in the well protected vegetation also showed that the species could easily clone to be a multiple trunks or branches. It could be concluded that *M. grandis* can easily regenerate through seeds and vegetative cloning.

Manglietia grandis is one of the top-quality timber trees for house building and furniture making. And it is also a potentially useful landscape or gardening plant ornamental horticulture. Tree logging or chopping for house building has affected the species' prospect of survival and its population development in south-east Yunnan, and this is particularly true for the populations or individuals outside the core region of the nature reserve. As well as the encouragement of using indigenous plants for landscaping, the recent over-collection of fruits is also affecting its regeneration. Field work has also indicated that *M. grandis* growing in deep soil or thick humus could regenerate well. However, most of the distributed area for *M. grandis* in south-east Yunnan, is in limestone mountains, unsuitable for its development.

In conclusion, excessive tree logging and fruit collecting of *M. grandis*, habitat degradation caused by the local featured crop development, and the limitations of limestone habitats are factors that threaten the species. Conservation actions should include both *in-situ* and *ex-situ* measures. As tree logging and chopping is still continuing, practical management in the nature reserves should be strengthened. For these individuals or populations outside the nature reserves, it might be necessary to consider the legal protection of individual locations. Meanwhile, propagation from seeds and vegetative materials should be studied, for both *ex-situ* conservation and the sustainable use of the species. Programmes of habitat restoration and population re-enforcement, based on the mass propagation of the species, should be launched in the future.

***Manglietia sinica* (CR: D)**

Manglietia sinica was taxonomically separated from *Manglietiastrum sinicum* by Dr. Chen and Dr. Nooteboom in *Notes on Magnoliaceae III: The Magnoliaceae of China*. However, most of the Chinese botanists prefer its status as *Manglietiastrum sinicum* proposed by Prof. Liu Yu-Hu, as an endemic monotypic genus distributed in south-east Yunnan. For years, *Manglietia sinica* has been recognized only around 10 individuals in the wild and it was listed for the category I for national protection in China. Current field investigations have confirmed that the individuals and the recorded distribution, which is scattered in the broadleaved forest in the Xichou and Maguan areas of south-east Yunnan. All the individuals are big trees with average height of 31 m, base diameter of 61 cm. The average crown-size of the well developed one in Xichou is 173. The main associated species are *Manglietia megaphylla*, *Parakmeria yunnanensis*, *Cornus controversa*, *Bretschneidera sinensis*, *Exbucklandia populnea*, *Sassafras tzumu*, *Choerospondias axillaris*, *Acanthopanax evodiaefolius*, and several bamboos.

No seedlings or saplings surrounding the investigated trees or in their natural habitat were found, and it seems that the species might be very difficult to regenerate naturally. However, some 6,000 seedlings and saplings have been raised from seeds collected from the extant individuals. Thus, we can infer that the poor nature regeneration may be due to habitat degradation before nature reserve was established, and also recently because of seed collection for cultivation or *ex-situ* conservation purposes.

Manglietia sinica has scented flower accompanied with deep green shiny leaves, and also it has attractive bark and a straight trunk. Its wood has fine and shiny structure, high tolerability for rotting and strong insecticidal properties. It was said that the trees had been heavily logged for building or furniture before 1980.

Based on the current status of *M. sinica*, conservation actions should be considered as follows:

- Forbidding any further human disturbance (agriculture cropping) surrounding the extant individuals
- Prohibiting seed or fruit collecting
- Launching a conservation programme of reinforcement and translocation, and to conduct a vegetative propagation project.

***Michelia coriacea* [CR: B2a+b(i,ii,iii,v)]**

Michelia coriacea was proposed as a new species by Prof. H.D. Zhang & Dr B.L.Chen in 1988. As Mr. Figlar and Dr.Nooteboom separated the family Magnoliaceae into two genera, *Magnolia* and *Liriodendron*, the name *Magnolia coriacea* has been forced to be used in some publications. However, the Chinese botanists are still consider that *Michelia* should be a distinctive genus and hence name of *Michelia coriacea* is commonly used nowadays in China. Therefore, *M. coriacea* is used as the scientific name in this report.

M. coriacea was described as a small evergreen tree up to 10-18m distributed in the Guangnan, Xichou and Malipo districts of south-east Yunnan. The current field work has indicated that the species is a big tree up to 30m high in the primitive patched forest in Malipo. *M. coriacea* is generally as a scattered companion in the evergreen broadleaved forest in Xichou and Tiechang districts of Malipo, and the Jinchang, Daping, Shipeng and Mada districts of Malipo. It can be confirmed that some 200 individuals occur in Xichou County and around 300 in Malipo, and the total number of specimens of *M. coriacea* in China is only around 500.

Michelia coriacea specimens in Xichou occur in the secondary shrubby woods or by the roadside and most of them in the secondary woods were top-cut ones and the multiple-stems (mostly 3-5 each plant) sprouted from the trunk base. The top-cut individuals were 6 m high, with the average height of 4.3m. Occasionally, young plants or seedlings were found in the shady moist microhabitat. It is clear that *M. coriacea* in the secondary woods of the limestone mountain is difficult to regenerate.

Michelia coriacea individuals at two protected sites of Malipo have height of over 15 m and an average crown-size of close to 300 m². The trees were had abundant flowers, but no young trees or seedlings were found in the communities. 'Poor fruiting but well blooming' infers that more a detailed study on reproductive biology of the species is certainly needed.

The numbers of *M. coriacea* have greatly declined during the past decades. Logging and chopping for timber and firewood may be the main threat to the species. Destruction of the native vegetation along with the development of *Cunninghamia lanceolata* and other crops is also affecting the species survival. The *ex-situ*

conserved plants in Wenshan Forestry Station of Seedlings have already flowered, but they are fruiting as poorly as the wild ones. The conservation of *Michelia coriacea* should include:

- Forbidding any further vegetation destruction where the species is located and chopping of the species;
- Studying the reproductive biology of *M. coriacea* to for understand why it fruits poorly, and thus improve fruiting by artificial means;
- Carrying out a vegetative propagation study.

***Magnolia phanerophlebia* [B2a+b(i,ii,iii,v),D]**

Magnolia phanerophlebia was proposed as a new species by Dr.B.L.Chen in 1988, based on the specimen 87T001 collected in the Maguan district of south-east Yunnan. Dr. Chen and Dr. Nooteboom noted that it is quite similar to *M. candollii* var. *obvovata*, from which it differs by its shorter peduncles and fewer carpels. Dr. J Li merged the species into *M. talaumoides* as the same species proposed by Dandy in 1930, and *Flora Yunnanica* adopted Dr. J.Li's taxonomic treatment. Certainly, the taxonomy of the species still need to be studied, particularly to view the real specimen and living plants of *M. talaumoides* typed in Vietnam. However, it may be worth to note that *M. phanerophlebia* is morphologically different from *M. candollii* var. *obvovata* or *M. condollii*, according to the field observations. In this report is treated as *M. phanerophlebia*.

According to field investigations and personal interviews with local forest workers, *M. phanerophlebia* is mainly distributed in Bojiyakou and Jiziyuan in Gulinqing of south-east Yunnan. The total number of specimens should be less than 200. Judged by the limited distribution near the two locations and the postulated occurrence in other places of south-east Yunnan, the total individuals could not more than 500.

Magnolia phanerophlebia is an evergreen shrub or a small tree 3-4 m high and 6cm in diameter, distributed in the evergreen broadleaved forests at 500-800 m in Maguan of Yunnan, China. Field investigation found that it can be over 5 m or even up to 10 m tall if no human disturbance occurs, such as vegetation destruction for banana cropping and tree-chopping.

At present, the habitats of *M. phanerophlebia* have been badly damaged and the remaining individuals are once to be chopped or damaged. The remaining *M. phanerophlebia* plants are facing a great danger of disappearance. It may be fortunate that the species has strong survival capability, demonstrated by the cloned (sprouted) multiple branches or stems. It also can regenerate via sexual reproduction (one seedling was found) under the suitable ecotope.

Magnolia phanerophlebia is a potentially valuable shrub or small tree for gardens or landscaping. The main threats to the species and its habitats are the human activities of deforestation, farming and firewood chopping. Based on the current status of only two locations, the following conservation actions should be taken as soon as possible:

- Forbidding any further deforestation or vegetation destruction of the remaining patched habitats;
- Strengthening the public awareness of the importance of *M. phanerophlebia*;
- Carrying out vegetative propagation for *ex-situ* conservation, population reinforcement, and a habitat recovery programme in the near future.