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First international training course on conservation of Plant Species with Extremely Small Populations

Plant Species with Extremely Small Populations (PSESP) is a conservation concept that emerged in China in 2005. Species qualify if there are < 5,000 mature individuals in the wild and < 500 individuals in each population. To date, c. 100 such species have been effectively conserved and their habitats incorporated in China's Ecological Conservation Red Lines scheme, which prohibits or limits human impact in areas of ecological importance such as nature reserves, wetlands and public forests. After nearly 2 decades, the implementation and achievements of both regional and national PSESP conservation programmes has led to a broader recognition of this concept.

During 15–29 July 2023, supported by the Key Research and Development Programme of Yunnan Province (202103AL140002), the first International Training Course on Conservation and Utilization Techniques of PSESP was offered at Kunming Institute of Botany, Chinese Academy of Sciences, Kunming. The 20 participants came from Azerbaijan, Bangladesh, Brunei, India, Indonesia, Laos, Myanmar, Nepal, Pakistan, the Philippines, Uzbekistan and Viet Nam. During the 5-day indoor session, techniques, case analysis and theory of the PSESP conservation system were introduced. In the subsequent field session, the participants visited the Western Yunnan Provincial PSESP ex situ and



Transplanting *Firmiana major* at its reintroduction site, Fuming County, Yunnan Province, China, in July 2023. Photo: the authors.

near situ conservation garden, in situ conservation sites, and reinforced and reintroduced populations of *Acer yangbiense*, *Firmiana major* and *Poncirus polyandra* in Yunlong, Yuanmou and Fuming counties, respectively, in Yunnan. The implementation and challenges of these conservation programmes were discussed with the participants.

The training course achieved its aims to introduce and share knowledge and information about the PSESP programme and to demonstrate how its innovative approaches and strategies could be tailored and adopted to local conservation efforts across Asia.

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The slipper orchid *Paphiopedilum gratrixianum* requires priority conservation in Yunnan, China

With unique and beautiful flowers, the slipper orchids *Paphiopedilum* spp. have always been popular in horticulture. Conservation of the genus faces serious challenges, however, as they may be collected by orchid enthusiasts and the species are rare in the wild. *Paphiopedilum gratrixianum* Rolfe has a disjunct distribution in southern China, Laos, Thailand and Viet Nam. It is categorized as Endangered on the Red List of Biodiversity–Higher Plants of China, as Critically Endangered on the IUCN Red List of Threatened Species, as a first-rank plant for national key protection in China, and as a Plant Species with Extremely Small Populations by the Yunnan provincial government in 2021.

In 2021 a population of c. 150 mature individuals of *P. gratrixianum* was discovered in Zhenyuan County, Yunnan Province. With the support of the Yunnan Plant Species with Extremely Small Populations conservation programme (2021S14X-09), we carried out further surveys for the species in April 2022 and October 2023. We discovered the species in two additional localities: c. 200 individuals in Shiping County, Honghe Autonomous Prefecture (> 150 km from Zhenyuan) and c. 150 individuals in Mojiang County, Pu'er City (> 80 km from Zhenyuan). All of the c. 500 individuals now known in China occur outside protected areas. With a narrow distribution range and low numbers,



Paphiopedilum gratrixianum blooming in the wild.

P. gratrixianum requires urgent priority conservation. During our surveys we collected some seeds and we are now attempting to cultivate seedlings for ex situ conservation and scientific research, at Kunming Botanical Garden.

An additional, previously known population of *P. gratrixianum* in Xiping County, Yunnan, became extinct in 2019 as a result of overcollection. Priority conservation actions are required to prevent the similar extinction of the three known extant populations, including establishment of in situ conservation sites, increasing publicity and law enforcement efforts, and development of artificial propagation and in vitro preservation technologies. Further surveys are also required in southern Yunnan and adjacent areas, along with research on the genetic diversity, pollination ecology and seed germination of the species.

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Finding *Pedicularis fastigiata*, a long-lost Critically Endangered plant species of China

Pedicularis fastigiata Franchet, a perennial herb species of the family Orobanchaceae, is endemic to the southern Hengduan Mountains in western Yunnan, south-west China. It was categorized as Critically Endangered on the Red List of China's Higher Plants in 2020. This species had only been collected once, in 1896, by Prince Henri d'Orléans and was described by Adrien René Franchet in 1900. According to the single type collection stored at the herbarium of the Muséum national d'Histoire naturelle, Paris

(isotype, barcode 00520823), this species is only known from the Mékong valley, in the southern Hengduan Mountains, an area of c. 400,000 ha in western Yunnan. Surveys (the Qinghai–Tibet Plateau Expedition in 1982 and Biluoxueshan Biodiversity Survey in 2003–2013) close to the type location and adjacent areas were unable to relocate the species.

With the joint support of the Key and Major Programme for Basic Research Project of Yunnan Province (grant no. 202201AS070045, 202101BC070002), the National Key Research and Development Programme of China (grant no. 2022YFF1302401), the Strategic Priority Research Programme of the Chinese Academy of Sciences (grant no. XDA26020203) and the Platform Programme for Basic Research Project of Yunnan Province (grant no. 202205AM070008), we surveyed for *P. fastigiata* in the southern Hengduan Mountain range during May–August 2023. We discovered c. 800 individuals in flower in three areas of coniferous/broad-leaved mixed forests at an altitude of 2,900 m. The total area of occupancy of the species is c. 500 m². This suggests that it should be categorized as Critically Endangered on the IUCN Red List on the basis of criterion B2ab(i,ii,iii,v). Also, because of its restricted distribution, small population size and habitat degradation, it should be included in the list of Plant Species with Extremely Small Populations in China. Our survey and information obtained from interviews with people local to the area indicated that the main threats to this species are its small population size, the high frequency of destruction by people, grazing and habitat loss. Urgent and effective measures need to be taken to protect this species.

The Kunming Institute of Botany is now carrying out studies on the population genetics of *P. fastigiata* and its genetic relationships to other *Pedicularis* species of the southern Hengduan Mountains, to obtain a better understanding of the microevolution of this species. In collaboration with staff of nature reserves, we are also planning to collect seeds of *P. fastigiata* for propagation and future restoration of the species in the wild. Using species distribution models, we plan to identify and explore other sites in China where the species could potentially grow.

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