

Specialist Groups to researchers in fields such as taxonomy, systematics and biogeography.

The Small Mammal Specialist Group is exploring a re-organization of its structure, to be more efficient and comprehensive in future reassessments, and we spoke to mammalogists at the Congress who can assist in improving our goals. We view participation of Specialist Groups at international conferences as critical and it is important to present our mission and activities to the researchers who work closely with small mammals. It is through them that we will gather the necessary data to enhance the quality of Red List assessments, develop plans and implement viable conservation actions, addressing the Assess–Plan–Action priorities of the Species Survival Commission.

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## Revolutionizing tropical peatland restoration in Indonesia: the 4N approach

The Center for Standardization of Disaster Resilience and Climate Change Instruments, Indonesia Ministry of Environment and Forestry, and the Mushroom Initiative collaborated from early 2020 to September 2023 to reforest degraded Indonesian peatlands using the 4N rehabilitation concept. The 4N approach stands for: No plastic (replacing plastic polythene bags with biodegradable pots made from *purun* grass and bamboo during planting), No burning (employing local community land preparation instead of burning), No chemical fertilizer (using mycorrhizal fungi instead of chemical fertilizers), and promoting Native peatland tree species over non-peatland trees. Through the 4N concept we can simultaneously restore peatland ecosystems and reduce and avoid greenhouse gas emissions to help mitigate climate change. Fire is a major threat to peatlands, and intensive maintenance is one of the main components of successful peatland reforestation.

The project involved eight researchers with expertise in microbiology, silviculture, genetics, carbon valuation, forest community empowerment and policy, and more than 10 stakeholders. We collaborated to rehabilitate c. 116 ha of tropical peatlands in Pdamaran, South Sumatra (51 ha) and Tumbang Nusa, Central Kalimantan (65 ha). More than 190,000 seedlings of 50 native peatland species were



The making of *purun* pots for raising seedlings as an alternative to polythene bags, and 3-year old planting of the native peatland species *Shorea balangeran*. Photos: Wahyu Catur Adinugroho.

planted and inoculated with 15 mycorrhiza species. Planting took place each year, starting in 2020 and concluding in March 2023. A final evaluation in early September 2023 showed that seedling survival exceeded 70%.

The 4N approach has several benefits. Replacing plastic polythene bags, which have a carbon footprint of 6 kg CO<sub>2</sub> per 1 kg of plastics ([timeforchange.org/plastic-bags-and-plastic-bottles-co2-emissions-during-their-lifetime](https://timeforchange.org/plastic-bags-and-plastic-bottles-co2-emissions-during-their-lifetime)), eliminates 54 kg CO<sub>2</sub>/ha of emissions. Avoiding fire use through manual land preparation can potentially prevent a total of 290 t CO<sub>2</sub>/ha of emissions from burned peat soils (Agus, 2008, *International Symposium on Land Use after the Tsunami*, 5, 103–109) and shrubs (Volkova et al., 2021, *Fire*, 4, 64). The use of mycorrhizal fungi is estimated to avoid the use of up to 187 kg/ha of fertilizer, thereby reducing emissions from chemical fertilizers by 82 kg CO<sub>2</sub>/ha (2006 IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Institute for Global Environmental Strategies, Japan). In addition to their adaptability to local sites, selecting native tree species also reduces the carbon footprint associated with transporting seedlings. Planting native species in waterlogged tropical peatlands reduces carbon emissions from peat oxidation but can necessitate up to three plantings because of the challenging conditions. The 4N approach is a departure from outdated revegetation practices, offering sustainability, community involvement, and a reduced carbon footprint, thus contributing to a sustainable future.

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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,