

Enhancing science-based conservation of the threatened flora of Sardinia

The project Collection of Seeds of Native Plant Species from Sardinian Flora for Ex situ Conservation at the Millennium Seed Bank was successfully concluded in 2015. This collaborative project started in 2006 following the signing of a Memorandum of Collaboration between the Royal Botanic Gardens, Kew (RBG Kew) and the Centre for Conservation of Biodiversity (CCB) at the University of Cagliari, Italy. The aim of the project was to study and conserve native species of Sardinia within the framework of the Millennium Seed Bank Partnership led by RBG Kew. Sardinia is the second largest island in the Mediterranean Sea, with a vascular flora of c. 2,500 native species and a high level of endemism (c. 370 taxa). Since 1997 CCB has been playing an active role in conserving the island's plant diversity through its Sardinian Germplasm Bank. This role has been strengthened through this project by enhancing seed conservation, training and research activities on Sardinian and Mediterranean plant species.

As part of the conservation activities, seed lots of 218 native species were collected and stored at the Sardinian Germplasm Bank and duplicates sent to the Millennium Seed Bank at RBG Kew for back-up storage. About 40% of these species are endemic to the West Mediterranean region, with about half of these being exclusive to the island. About 15% of the stored species are included in The European Threatened Plant List (Sharrock & Jones, 2009, *Conserving Europe's Threatened Plants: Progress towards Target 8 of the Global Strategy for Plant Conservation*, Botanic Gardens Conservation International). Seeds of eight of the top 10 most threatened Sardinian endemics (Bacchetta et al., 2012, *Anales Jardin Botanico Madrid*, 69, 81–89) have been conserved, including Critically Endangered species such as *Lamyropsis microcephala* and *Polygala sinisica* for which ex situ conservation measures had not been previously implemented.

Scientific and technical training on seed conservation has been delivered through annual exchange visits, four co-supervised PhD students (two with scholarships funded by Cagliari University and the EU), and a Kew Visiting Honorary Research Associate position. The research objectives were to (1) investigate seed biology and germination ecophysiology of threatened Sardinian species, (2) understand future challenges for plant survival, and (3) study plant demography and assess the impact of actual and potential threats on populations. The biological and environmental control of seed dormancy and germination were investigated through joint research on 11 species (*Aquilegia barbaricina*, *A. cremonophila*, *A. nugorensis*, *Centranthus amazonum*, *C. ruber*, *Lamyropsis microcephala*, *Polygala sardoa*, *P. sinisica*, *Paeonia corsica*, *Rhamnus persicifolia* and *Ribes multiflorum* subsp. *sandalioticum*). The impact of climate

change on the seed dormancy loss and germination kinetics was modelled for *A. barbaricina*, *P. corsica*, *R. multiflorum* subsp. *sandalioticum*, *R. persicifolia* and *Taxus baccata* through seed germination experiments both in the laboratory and the field, and how thermal thresholds for dormancy loss and germination may vary along an altitudinal gradient has been investigated. In parallel, several plant population studies began for *L. microcephala* and *Anchusa littorea*, to facilitate a better understanding of plant conservation and management in situ.

This successful collaboration has contributed significantly towards Global Strategy for Plant Conservation Target 8 (<http://www.cbd.int/gspc>) and Aichi Biodiversity Target 12 (<http://www.cbd.int/sp/targets>) in Sardinia, and has also built a long-term scientific programme leading to a greater understanding of the autecology and natural regeneration of threatened Sardinian species. This integrated science-based conservation approach is a model that could be applied to other threatened plants to ensure their long-term conservation both in situ and ex situ.

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Residents of Mudumalai Tiger Reserve secure funds for resettlement after a 25-year struggle

It is estimated that nearly 100 million people live within India's forests. Some of these people, living in forest interiors, subsist with minimal access to electricity, education, medical facilities or markets. These forests are the last refuges for many threatened species, including the charismatic tiger and Asian elephant. Voluntary resettlement of families from protected areas can be advantageous for both people and wildlife when conducted in a fair and transparent manner.

The Wildlife Conservation Society India Program (WCS India) supports families who want to resettle from forest interiors, helping resettling or resettled families secure adequate compensation from the government, identifying alternative land, acquiring official identity cards that allow them to apply for various government-sponsored subsidies, obtaining education and medical attention, and integrating them into mainstream economies through livelihood support. WCS India has supported over 1,300 families who have expressed willingness to resettle from within various protected areas in the Malenad conservation landscape of south-west India.

A number of obstacles, in particular the slow sanctioning of funds from the government, hinder voluntary resettlement. September 2015 saw a long-awaited victory for residents of Mudumalai Tiger Reserve, Tamil Nadu, when the National Tiger Conservation Authority sanctioned funds for resettlement of 88 families from two villages within the Reserve. This came after 25 years of appeals to elected representatives, legal petitioning and protest marches.

In 1990 the Chetti community, resident in Mudumalai Tiger Reserve, collectively decided to move out of the Reserve after years of crop losses from wild animals. To spur government action, residents of the Reserve filed two legal petitions, in 1990 and 1998, seeking an official court directive to the Tamil Nadu State Government that would provide guidelines for their resettlement. In 2007 the legal action taken by the Chettis was successful and the courts directed the government to resettle families from the Reserve within 1 year. Although the government constituted a District-level Implementation Committee and identified a suitable site for resettlement within 1 year, it took them much longer to start resettling the families.

The delays in government action did not discourage the Chettis. They formed a Village Relocation Committee on their own initiative, a responsibility that otherwise rests with the government. Additionally, representatives of these families held protest marches, and submitted written communications to several ministers, to bring their plight to the attention of officials and the general public. In 2010 WCS India began supporting the Chettis in their struggle.

A WCS India conservationist, P.M. Muthanna, with experience of resettlement programmes, provided advice and guidance for catalysing government action. At the national level, Ullas Karanth, of WCS New York, raised the issue during multiple official meetings of the National Tiger Conservation Authority.

In July 2015 the Chettis successfully requested a Parliamentary Committee on Technology, Science, Forest and Environment to direct immediate government action to solve their problem. In September 2015 the National Tiger Conservation Authority finally removed what was the single largest obstacle to the resettlement of the Chettis, sanctioning funds for their resettlement. With this financial support, alternative lands already identified, and a village committee constituted, we hope that the resettlement will now progress smoothly.

Villagers from a nearby forest have also recently expressed their willingness to resettle but are apprehensive as a result of the long struggle faced by the Chettis. This demonstrates the importance of prompt government action for successful voluntary resettlement from forest interiors. If conducted in a fair and timely manner, the resettlement of villagers from within protected areas can serve both livelihood improvement and wildlife conservation goals.

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