

# Plants in European mountains threatened by climate change

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*Papaver alpinum* L. subsp. *rhaeticum* (Leresche) Markgr. (Papaveraceae) is an Alpine species that grows on limestone debris. PHOTO A. MONDONI

In the last decades, many studies have focused their attention on global warming, observing on-going changes in mountain areas and trying to predict future scenarios. Temperatures in the European Alps have risen by up to 2 °C in the last century and are predicted to increase further by up to 5 °C by 2085 (Nogués-Bravo et al. 2007). Plant species in mountains are adapted to live in cold climates, and it is very uncertain whether all of them will be able to cope with global warming. Biodiversity scenarios for the 21st century predict a significant reduction of Alpine habitats and the loss of many high mountain plants (Thuiller et al., 2005; Engler et al., 2011). Indeed, global warming drives a general upward shift of plants, increasing the competition between species and causing extinction of those plants which already live at the top of the mountains (Theurillat & Guisan, 2001; Parolo & Rossi, 2008). The University of Pavia is involved in the long-term research project GLORIA (Global Observation Research Initiative in Alpine Environment) studying 60 summit sites in all major European mountains. Recent results of this study provide evidence that the most cold-adapted species are declining and the most warm-adapted species are increasing. This process is described as 'thermophilization of the mountain floras' (Gottfried et al., 2012). Unfortunately, mountains host a large number of endemic plant species, which might be lost in the coming decades. It is estimated that up to 60% of species growing in the mountains around the Mediterranean Basin are threatened by extinction (Thuiller et al., 2005).

Given these circumstances, collecting and banking seeds of Alpine plant species is an effective tool to fight this potential loss of biodiversity and to provide propagation material to re-establish wild plant populations. Short timescale seed regeneration or re-collection from wild populations of Alpine species will be important to maintain high quality collections, but also to ensure conservation of large genetic diversity and novelty for replanting in future habitats (Mondoni et al. 2011).

In partnership with the MSBP, the Lombardy Seed Bank (LSB-CFA), hosted at the University of Pavia, started a new initiative, with the aim of saving threatened Alpine species growing in the southern Italian Alps and in the northern Apennines from extinction. The new initiative will undertake joint

expeditions of both British and Italian researchers, to collect seeds of the most threatened species, such as endemic species, rare species and those at the boundaries of their areas of distribution. The seed collecting will take place in close cooperation with managers of protected areas, and local and national nature protection authorities. The seed collections will be stored for long term conservation in Pavia and at the MSB, and their viability will be monitored over time. The seed material can be used in future actions of assisted migration and to re-establish natural populations damaged by climate change.



*Silene elisabethae* Jan (Caryophyllaceae) is a narrow endemic species growing on calcareous meadows in the southern Alps. PHOTO A. MONDONI



*Linaria tonzigii* Lona (Plantaginaceae) is an endemic species restricted to the Orbie mountains (Bergamo province), growing on calcareous scree. PHOTO S. ORSENIGO

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# Understanding climate change impacts in the sub-Antarctic

by Stuart Cable, MSBP Herbarium Team Manager

On Christmas Day in 2008, a team of four botanists from Kew (Renata Borosova, Marie Briggs, Stuart Cable, and Jo Osborne) and two entomologists from BugLife (Roger and Rosie Key) flew to the Falklands to begin a 42 day expedition to South Georgia to survey invasive plants and insects. The work was undertaken as part of the RSPB's South Atlantic Invasive Species Project, aimed at reducing the impact of invasive species in the South Atlantic UK Overseas Territories, and was funded by the European Commission through the European Development Fund EDF-9 .

The government of South Georgia and South Sandwich Islands is concerned that climate change will favour introduced species to the detriment of the native flora. The longer and warmer summers could enable introduced plant species to produce viable seeds and spread invasively, facilitated by the arrival of insect pollinators and the melting of the glaciers that restrict the movement of insects as well as reindeer and other introduced animals that act as seed dispersers. Reindeer were introduced to feed the workers of the vast industrial-scale whaling stations that operated on South Georgia until the 1960s. The whalers also introduced sheep and cattle and imported fodder from the northern hemisphere that probably contained the seeds of the invasive species that persist on the island today.

One of the most remote of the UK Overseas Territories, South Georgia lies 1600 km north of the Antarctic in the South Atlantic Ocean. With mountain ranges reaching 3000 m, most of its 3755 km<sup>2</sup> are covered in permanent snow and glaciers, but at low altitude, within the shelter of its numerous bays, there is a sparse covering of herbaceous vegetation. South Georgia is home to over 50 million seabirds, including globally important populations of wandering albatross and macaroni penguins. During the summer months, the beaches are overrun by 4.5 million fur seals and 0.5 million elephant seals.



The team spent 42 days on *Seal*, a yacht specially designed for high-latitude sailing in poorly charted waters. PHOTO S. CABLE