



# Mountain Biodiversity and global change



# Impressum

Published by the Global Mountain Biodiversity Assessment (GMBA) of DIVERSITAS, Institute of Botany, University of Basel with the support of the Swiss Agency for Development and Cooperation (SDC)

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## **Design and Layout**

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## **Editing and Proofreading**

Beverly Peterson Stearns, Hamden CT, USA

Printed by Print Media Works, Schopfheim, 79650 Germany

On paper "Allegro" woodfree, half-matt coated, 250g/m<sup>2</sup> (cover), 150g/m<sup>2</sup> (content)

Binding Walter Industriebuchbinderei, 79420 Heitersheim, Germany

## **Citation**

Spehn EM, Rudmann-Maurer K, Körner C, Maselli D (eds.) 2010  
Mountain Biodiversity and Global Change. GMBA-DIVERSITAS, Basel

This publication is available from:

Global Mountain Biodiversity Assessment (GMBA)  
Institute of Botany, University of Basel,  
Schönbeinstr. 6, CH-4056 Basel, Switzerland  
[www.gmba.unibas.ch](http://www.gmba.unibas.ch)

Swiss Agency for Development and Cooperation (SDC)  
CH-3003 Bern, Switzerland  
[www.deza.admin.ch](http://www.deza.admin.ch)

ISBN 978 3 605835 23 6

Cover photo: Matterhorn, Switzerland, Photo: Christian Körner

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# Assessment and prevention of non-native plant invasions in mountains

Mountains may increasingly become threatened by invasive non-native plants due to climate change, increased anthropogenic disturbances, and the deliberate introduction of non-native species that are pre-adapted to a cold climate. The Mountain Invasion Research Network evaluates the threat of plant invasions to mountains globally.



*Lupinus polyphyllus* in the abandoned gold mining village of Kiandra in the Australian Alps | Photo: Keith McDougall

A harsh climate, isolation and limited human activities have made mountain ecosystems relatively resistant to plant invasions. However, in the future, climate change and increasing human pressures may make mountains as susceptible to invasions as other areas. The Mountain Invasion Research Network (MIREN, [www.miren.ethz.ch](http://www.miren.ethz.ch)) integrates on a global scale monitoring, experimental research, and management of plant invasions on mountains. The MIREN core program includes 10 mountain regions covering the major climatic zones and including continents and islands.

MIREN has identified almost 1500 plant taxa worldwide that are naturalized or invasive on mountains. The most widespread species are typical of European pastures and were introduced during the past few hundred years, many in association with livestock grazing. Most of these species appear to have had relatively little impact on biodiversity. However, some problematic invaders (e.g. *Hieracium* spp., *Cytisus* spp., *Salix* spp.) have appeared recently, as mountain land use has shifted in many regions from agriculture to tourism and recreation. These species have often been selected for cold adaptation and now pose an important threat to biodiversity. This threat is likely to grow, as deliberate introductions of non-native species expand and global warming allows invaders to reach higher altitudes.

Mountains are among the very few eco-regions not yet strongly altered by invasions; managers thus have the unique opportunity to respond in time to prevent invasions. Proactive measures, such as restricting the transport of likely invasive species and early detection surveys, may help to prevent invasions before they have major impacts.

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# Management of an invasive plant species in the Australian Alps

MIREN documents case studies of plant invasion management in mountains worldwide to foster learning. The example of hawkweed management in the Australian Alps illustrates that eradication is very challenging once a non-native species spreads into a topographically complex mountain landscape.



A dense colony of Orange Hawkweed (*Hieracium aurantiacum*) in undisturbed snow gum woodland, Kosciuszko National Park, Australia | Photo: Keith McDougall

In the early 1990s, the Australian Alps were regarded as being at low risk of invasion by non-native plants because of their harsh climate. In 1999, the European orange hawkweed (*Hieracium aurantiacum*) was found to have naturalized from a ski resort garden. Its known invasive behavior and threat to biodiversity in mountain areas in New Zealand and North America alerted national park managers, leading to broader survey and the discovery of further populations and another hawkweed (*H. praealtum*). Despite immediate removal of hawkweed plants using herbicides, both species spread rapidly, invading both disturbed and undisturbed environments and forming extensive colonies.

There is now a concerted and costly effort to eradicate hawkweeds in the Australian Alps involving state and federal governments and ski resort companies. The program comprises surveys utilizing volunteer labor, GIS mapping and modeling of spread, outreach, research into the reproductive biology of hawkweeds, and advice from researchers in New Zealand, where several hawkweeds are now intractable in montane grasslands. The Australian hawkweed program has demonstrated the new and potentially high impact of plant invasions on mountains. It is representative of an increasing focus on prediction and prevention (e.g. modeling species movements under climate change, assessing potential invaders from lowlands, and removal of horticultural species from ski resorts) and learning from experiences in mountains elsewhere. If effective, these management approaches will be far more cost-effective than reactionary management.

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