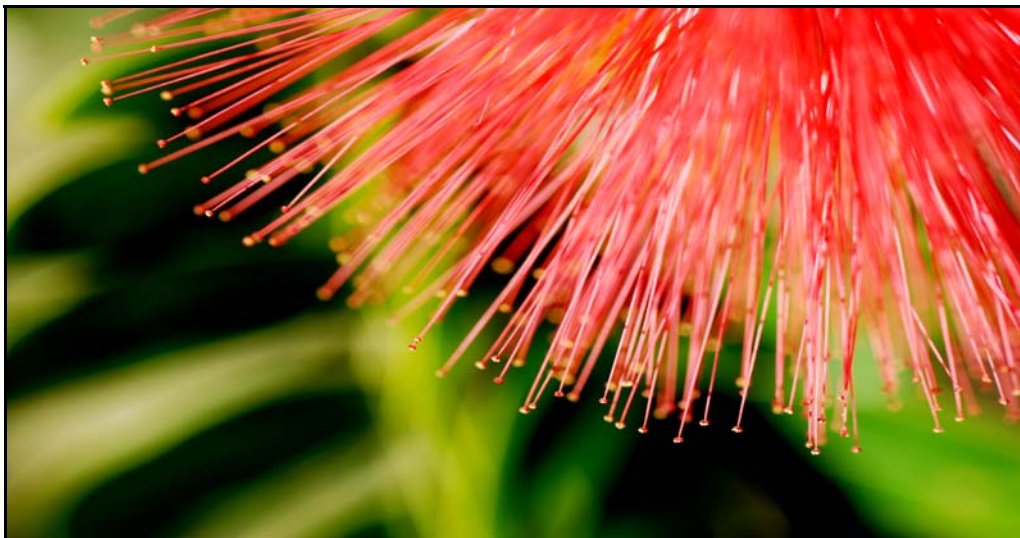


## Plants and climate change: which future?

### Chapter 5: Plant species at risk

#### Chapter summary

*In an era of rapid climate change, species have three basic alternatives, they can: 1) migrate to appropriate environmental conditions; 2) adapt to the new environmental conditions; or 3) become extinct. In a changing environment, 'weedy' species with fast generation times and wide ecological tolerances are more likely to adapt or migrate quickly and are more likely to flourish. Conservative species with specific habitat requirements or long generation times are more prone to the threat of extinction. At present an estimated one-quarter of vascular plant species are under threat in the wild. With predicted temperature increases, changing hydrological cycles and other factors of climate change, as many as half of all plant species may be lost over the next century. This is a catastrophic scenario given the fundamental importance of plants to life on earth. As yet there is a lack of published information in plant extinctions directly due to climate change but with baseline information now being collected on the distribution, threat status and ecology of various plant groups, monitoring schemes can be established. Plant species restricted to high-risk habitats, including montane, island or coastal habitats are likely to be the first casualties of climate change. Plant conservation action needs to be increased now to ensure that options are available for the future.*



#### Key points from this chapter:

- Recent models, based on a temperature rise of 2 to 3°C over the next 100 years, suggest that up to half of the world's plant species will be threatened with extinction. Levels of extinction will be directly related to the extent to which we limit global warming.
- Species that are already under threat will become rarer and more likely to become extinct.
- Alpine plants are one group particularly at risk. Such species tend to have a narrow habitat tolerance and grow in marginal habitats. Many alpiners exhibit relict distributions and have migrated to highlands since the last Ice Age.
- Other species with 'nowhere to go' and which are already of grave conservation concern, include island species such as the 300 endemic tree species from Jamaica as well as 70 threatened plant species that are confined to the cloud forests of Cuba.
- 10% of the world's tree species are threatened with extinction. This is of particular relevance as trees facilitate significant carbon storage and play a crucial role in the carbon cycle.

#### Case studies from this chapter:

##### **Case study 5.1 – Plant Red Listing in Cuba**

Island floras are rich in endemic species which generally have restricted distributions and are under a high degree of threat. Cuba for example has a very rich flora with 7,020 vascular plant species of which 50% are endemic to the island. The main threats to the flora are habitat loss, fires, agricultural and

forestry development and mining. Recently 1,414 taxa have been evaluated using the IUCN Red List Categories and Criteria including 1,089 plant species that grow only on the island. Of the recorded endemic species; 21 are extinct and 1,006 are threatened with extinction. 191 of the threatened endemic plants are tree species. With changing climatic conditions the wild populations of these globally threatened species are likely to be placed under more severe stress. The 70 threatened species that are confined to high altitude cloud forest are potentially most at risk as temperatures increase (Iturralde *et al.*, 2005).

### Case study 5.2 – Alpine species

The world's alpine plants are amongst those most threatened by climate change, since it is most likely that the area with suitable conditions available for them to inhabit can only get less. On Greece's Mount Olympus and Spain's Sierra Nevada range for example, only 200-400m separate timberlines from summits. This is the true alpine zone.

Many of the world's countries have very limited areas of alpine environment. For example, of the 11,500sq km of mountain terrain in Australia, only a very small percentage is true treeless alpine, all of which is at a relatively low altitudes. In such areas there is only a very limited opportunity for altitudinal shift, since species are already at the limit. With a small change in the global average temperature, the alpine environment of Mount Bogong in Victoria, will move up the mountain from 1,750-1,900m. But this mountain is only 1,940m high (Busby, 1988). The snowbeds of Australia comprise a number of endemic plants already at risk of extinction. *Caltha introloba* and *Celmisia sericophylla* for example have total world populations of a few thousand individuals at maximum (Molau, 2007).



In addition to the adverse changes in climatic conditions, alpine plants already face strong competition from other plants. Research done in the Alps compared plant surveys done 80-100 years ago and showed that on more than two thirds of the sites resurveyed, grassland species from lower slopes had crept up as much as 4 metres per decade (Pauli *et al.*, 2003). The risks of this climate-induced upward migration include;

*“Drastic area losses or even the extinction of cryophilous plants, a disintegration of current vegetation patterns and impacts on the stability of high mountain ecosystems.”*

Such research is suggesting a very grim future for both alpine plants and associated ecosystems. As warming encourages species from the lower slopes to invade, they out compete the plants at the top. In the Italian Alps for example, trees are advancing into alpine meadows (Natura, 2007).

A more subtle effect on alpine plant communities will be the creation of changes within the communities themselves. Experiments conducted with plant species from the southern alpine region of Norway show that the effects of climate change (including more extreme conditions due to less protective snow cover) may start to significantly modify the interaction and competition between individual plant species (Klanderud, 2005).

### Case study 5.3 – Tree species with nowhere to go

Because trees contain more carbon, live longer and decompose more slowly than smaller herbaceous plants (MA, 2005) they play a crucial role in the carbon cycle, and thus in climate change mitigation and adaptation.

Ten years ago a global evaluation of tree species indicated that around 10% of all tree species are threatened with extinction. At the time, 976 tree species were considered Critically Endangered according the IUCN Red List Categories and Criteria (Oldfield *et al.*, 1998). This figure has now risen to 1,002 species. Some of these species are already reduced to less than 50 individuals in the wild. In

the absence of immediate conservation action these are likely to go extinct regardless of the changing climate. In the longer term, there is more hope of saving Endangered and Vulnerable tree species if action is planned now that takes into account the impacts of climate change.

According to the 1998 global evaluation of tree species, 56% of globally threatened trees were considered to be threatened because of a limited geographical range and declining habitat. These species with restricted range may be particularly vulnerable to changing climate.

Island endemic trees accounted for approximately one third of globally threatened trees. Jamaica alone has over 300 endemic trees that are of global conservation concern. High rates of forest destruction and degradation through soil erosion and the rampant spread of invasive species have been the main threats to the flora of Jamaica. The trees that occur only in Jamaica provide one example of plant species that have nowhere to go in response to climate change. There are very many other examples.

Globally threatened tree species associated with montane habitats for example also fall into the nowhere to go category. The 1998 global tree evaluation recorded 73 Critically Endangered tree species as being confined to montane habitats. The number of Endangered and Vulnerable montane tree species amounts to over 700. Recently a list of 502 cloud forest trees for the State of Chiapas was compiled as part of Red Listing exercise for trees of Mexican cloud forests. IUCN Red List Categories and Criteria were applied to over 100 of these species (Newton, 2007). In a parallel exercise, defining and mapping groups of tree species associated with climatic variables in the Chiapas cloud forests has been undertaken, to investigate potential changes in the distribution of tree species resulting from forest disturbance and climate change. Results of the study show that a change in climate consistent with low-emission scenarios would be sufficient to cause major changes in forest composition within 50 years. Disturbance and deforestation, combined with climate change threaten the regional distribution of five Endangered tree species, including the endemics *Magnolia sharpii* and *Wimmeria montana*. 11 Vulnerable species and 34 species requiring late successional conditions for their regeneration could also be threatened (Golicher *et al.*, 2008).



The trees and shrubs of the Caucasus region have recently been assessed using the IUCN Red List Categories and Criteria (Eastwood, 2005). 150 taxa were evaluated; seven are Critically Endangered, 10 Endangered and 15 Vulnerable. The main threats to these globally threatened species are exploitation and habitat degradation through logging and to some extent over-grazing. In addition, some of the species are narrow endemics whose distributions are restricted to specific forest habitats such as the Colchic or Hyrcanian forests. With climate change, the threat of extinction will undoubtedly increase for these trees with nowhere to go.