

Ex situ conservation of bryophytes at Kew

Bryophytes are non-vascular, non-flowering plants, closely related to the very first plants to grow on land. The term ‘bryophyte’ is used to describe three different types of plant: mosses, liverworts and hornworts. These are generally grouped together and perceived as being small, hard to identify and as ‘those weedy plants that grow in lawns and greenhouses’, but this is not the full story!

Bryophytes can be found in almost all terrestrial habitats (including rainforests, arctic ecosystems and deserts) and actually dominate in a few (for example sphagnum bogs). Although diminutive, they play very important roles in the regulation of some large-scale ecosystem processes such as nutrient, water and carbon cycling. Although the UK and Northern Ireland are relatively low in flowering plant diversity, they have a surprisingly high number of bryophyte species. Unfortunately, a number of these are threatened with decline or extinction and are in need of active conservation.

Conservation

Conservation can be divided into *in situ* and *ex situ* activities. Put simply, *in situ* conservation is the preservation of species within their natural habitats and *ex situ* conservation the preservation of species outside of that habitat.

Botanic gardens are very often involved in *ex situ* conservation: growing threatened plants within their living collections, or collecting and storing seeds such as in the Millennium Seed Bank at the Wakehurst Place site of the Royal

Botanic Gardens, Kew. Sometimes plants grown in botanic gardens can be returned to their natural habitats in reintroduction programmes.

Ex situ conservation of bryophytes

In August 2000 we started a project for the *ex situ* conservation of threatened UK bryophytes in the Micropropagation Unit at Kew. We wanted to develop standard methods for the collection, tissue culture and cryopreservation of threatened bryophytes – and investigate the possibility of growing plants for reintroduction to their natural habitats.

The project is a collaboration between Kew and three of the UK statutory conservation agencies (English Nature, Scottish Natural Heritage and the Countryside Council for Wales), with an emphasis on developing *ex situ* techniques as a complement to *in situ* conservation efforts.

Collection of material

Material for the project is only collected by authorised individuals and after consultation with the appropriate conservation agencies. Collection protocols have been produced and circulated for different types of bryophytes. The protocols emphasise the importance of limiting damage to the natural populations and of collecting representative genetic samples. Where possible fruiting bodies (sporophytes) are collected, but leafy shoots (gametophores) can also be used.

Tissue culture

Bryophytes are grown in axenic (free from contaminating fungi, algae or bacteria) tissue culture in the *ex situ* collection. This is very different from the natural environment but provides a secure and uniform method of maintaining the plants. In order to obtain axenic cultures, plant material



Round-leaved Feather-moss



Rock cultures transplanted to the natural environment

must first be cleaned and surface-sterilised with diluted bleach. Here in the Micropropagation Unit we have specifically developed methods for growing bryophytes in tissue culture using both the fruiting bodies and leafy shoots.

Cryopreservation

Plant material that is continually sub-cultured (as is necessary to maintain a tissue culture collection) may become adapted to growing in culture conditions over time. But one aim of the *ex situ* collection is to provide a repository of material that can be used in future reintroduction programmes. Adaptation to culture conditions is therefore undesirable. Such problems can be avoided if the plants are kept alive, but in a state of suspended animation where growth and development are halted.

Cryopreservation is the storage of material at very low temperatures (-196°C) in liquid nitrogen (see Plant cryopreservation information sheet K31). If prepared correctly, various types of plant material can be frozen and maintained indefinitely until required. Here in the Micropropagation Unit we have also developed methods for the cryopreservation of bryophyte material. Increasing numbers of threatened species are being stored in a liquid nitrogen bank safely and cheaply.

Reintroductions

The Slender Thread-moss (*Orthodontium gracile*), one of the threatened moss species held within the *ex situ* collection at Kew, is now being reintroduced to its natural environment.

Material removed from storage in liquid nitrogen was thawed and re-grown in axenic tissue culture. Small pieces were transferred onto fragments of sandstone (on which it naturally grows), fed with weak nutrient solution (slightly richer than rainwater) and carefully nurtured. These 'rock cultures' were slowly hardened off outside and then 'planted' at Kew's Wakehurst Place site. The survival and growth of the plants has been monitored and several have managed to successfully adapt to life outdoors. Larger scale trials are ongoing.

Further information

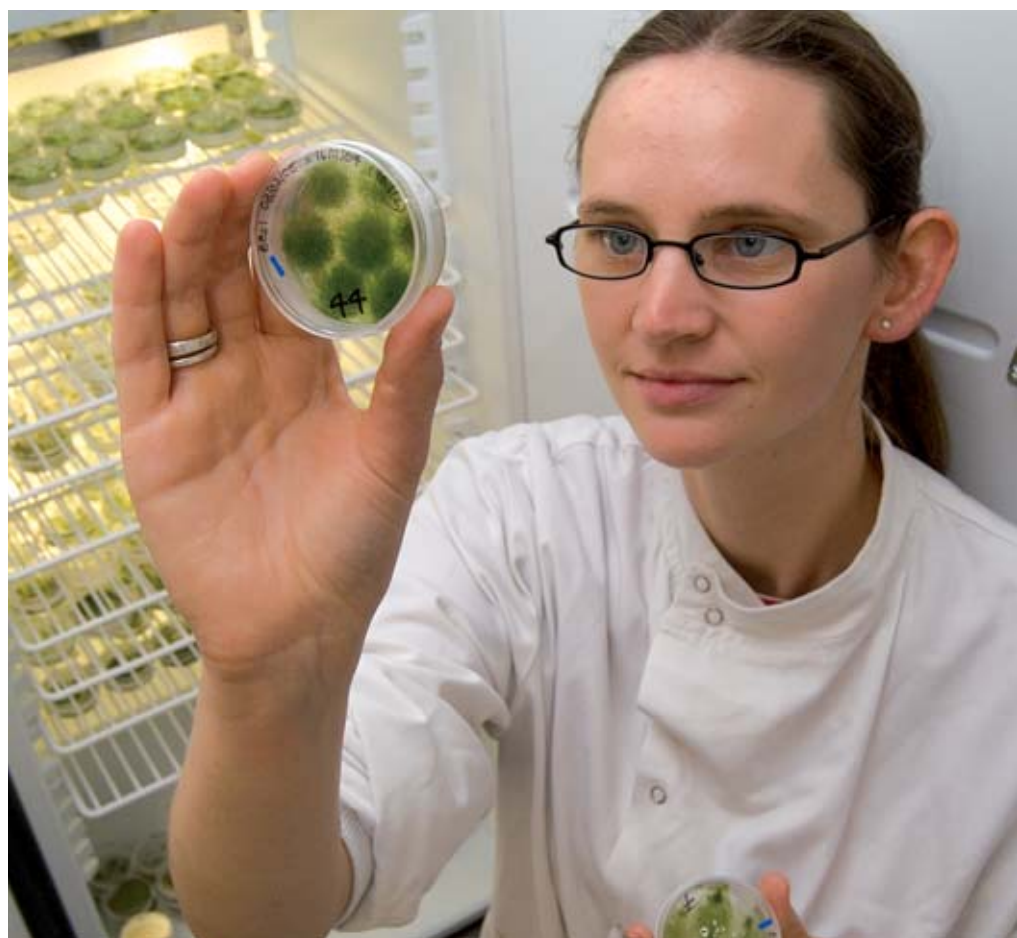
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Moss weaned onto sandstone rock



Bryophytes from the *ex situ* collection