

Are botanic gardens doing enough for conservation in Europe?

Jan Rammeloo and David Aplin

National Botanic Garden of Belgium, Meise, Belgium

Europe is home to more botanical institutes than any other continent, yet one quarter of its native species are under threat, with 800 facing global extinction. In late 2006, an *ad hoc* meeting drawn from European institutes and organisations involved in plant conservation met at Meise to discuss ‘*Are botanic gardens doing enough for conservation in Europe?*’ The aim of this paper is to report on its findings and subsequent progress to better support the sustainability of wild plant populations.

Evidently, most botanic gardens could be more committed to conservation. This obligation is not necessarily money dependant. At minimal expense, advocacy, the promotion of pertinent research projects to universities, education and the preparation of guidelines and standards can be achieved. Additional funding could facilitate a shifting of emphasis in traditional practices (ill-defined plant collections and garden-gathered seeds in Index Semina) and the publication of protocols. Greater financing would enable a ‘flagship project’ learning to grow threatened species beyond the seed bank. In all these aspects, it is vital that ex-situ and in-situ communities co-operate if the targets in the Global Strategy for Plant Conservation are to be reached. Despite the focus on European conservation here, it is evident that this paper has application beyond this continent

Diverse and threatened flora needs help

Europe is home to an estimated 12,500 vascular plants (Akeroyd, 1992). They inhabit a diverse range of conditions, from arctic tundra in the north to semi-arid desert in the south, and from high alpine peaks to Mediterranean coastlines. The flora represents one of the best known and most studied in the world. Over thousands of years, Europe’s landscape has undergone dramatic, human-led changes. Despite this, important areas of natural and semi-natural vegetation remain. As on other continents, Europe’s flora faces unprecedented threats through climate change (BGCI & Cabildo de Gran Canaria, 2006, Intergovernmental Panel on Climate Change, 2007) and other human-related activities. According to extensively documented predictions, these threats could occur quickly and result in significant habitat and species loss. Current estimates, depending on the criteria adopted, suggest 2,000–3,000 species are under threat (Council of Europe, 1977; European Commission, 2005) while c.800 face global extinction (European Commission 2006). In order to safeguard our natural heritage for future generations, urgent action is required from all sectors of the botanical community.

The European region as defined by the United Nations comprises 53 countries. It has the greatest concentration of botanic gardens in the world (Guerrant *et al.*, 2004), with 1001 gardens, arboreta and institutes registered with Botanic Gardens Conservation International. Included in this number are 728 located in 27 European Union (EU) Member States (*pers. comm.* Diane Wyse Jackson). The continent potentially offers an enormous and influential community to aid the conservation of native plants, and yet botanic gardens are the most under-used plant conservation resources in the world (Maunder *et al.* 2004). This is compounded by institutes’ preferentially growing and conserving exotic flora. The selection pressures on these taxa will be markedly different to those they would face in nature. While exotics will always attract the public’s gaze there should also concerted efforts to cultivate and conserve flora of local provenance.

In recent years, however, a number of botanic garden-led initiatives have resulted in significant advances supporting the continent’s commitment towards the Convention of Biological Diversity (CBD) and the Global Strategy for Plant Conservation (GSPC). These include the establishment of Botanic Gardens

Conservation International (BGCI), a charitable advisory network linking institutes around the globe to aid effective plant conservation, and a number of European-specific initiatives at national and regional scales. These predominantly focus on seed banking wild native taxa, e.g. REDBAG the Spanish network (see Hernández Bermejo & Molina, 2005); RIBES an Italian network (see Rossi *et al.*, 2006); GENMEDOC the inter-regional Mediterranean network and the EU-wide ENSCONET (see Müller & Linington *in press*). Networks incorporating the cultivation of threatened plants are comparatively scarce, the 'PlantNetwork Target 8 Project' and the Conservatoire Botanique National (CBN) in France (see Frachon *et al.*, 2005 and Lesouëf, 2004, respectively) are notable exceptions. The CBN is a model network at national level that finds synergy between *in situ* and *ex situ* conservation. It deals with a range of tasks from monitoring populations, seed collection and gene banking, genetics, *in vitro* and reinforcing local populations.

Are botanic gardens doing enough for conservation in Europe?

Despite these initiatives it is increasingly recognised that the botanical community could and should be doing more to aid plant conservation. This topic had recently been discussed in a number of national institutes which then took on an international dimension at the European Botanic Gardens' Congress (EuroGard IV) in the Czech Republic. A number of debates concluded that reviews and re-evaluations of current practices within botanic gardens were necessary and that this subject needed to be discussed more rigorously.

In December 2006, a meeting was convened at the National Botanic Garden of Belgium (Meise) comprised of an *ad hoc* group drawn from major European institutes and organisations involved in plant conservation (Figure 1). The aims were to: 1) discuss whether botanic gardens could be doing more to aid European plant conservation; 2) highlight current practices could be utilised more effectively for conservation; 3) develop a strategy for addressing these needs.



Figure 1 Delegates at the 'Are botanic gardens doing enough for conservation in Europe' meeting at Meise, December 1st 2006.

Prior to the meeting, a concept document was written with the intention to provoke comment and debate. It questioned whether traditional practices (such as the maintenance of publicly hidden plant collections, that did not aid research or conservation, and the dispersal of garden-gathered seed material through *index semina*) are relevant in meeting the unprecedented challenges to our native flora. It also highlighted areas where a possible 'European-wide conservation network' could aid co-operation and consultation to help prevent habitat and species loss.

It was apparent from the meeting that all European botanic gardens have the potential to further embrace conservation effort. This need not be dependent on funding. Throughout the meeting delegates outlined a number of initiatives that could be achieved. It became clear that they could be divided into funding categories that include initiatives that require: no additional funding; extra financing; and successful grant applications.

Conservation on a shoestring

Few, if any, botanic gardens can boast adequate funding. The lack of money however need not excuse inaction. In fact the initiatives outlined in this section are probably some of the most important, since they do not rely on repeat funding to sustain their continuation, just willingness and motivation from staff.

Establishing the conservation message into the hearts and minds of staff, at all levels of an institute, can still present challenges, yet if taken seriously provides a large benefit to any organisation. Communication beyond the confines of the garden is just as vital. Advocacy is perhaps one of our communities' weakest areas. It is therefore important to establish strong, core messages that highlight conservation needs to politicians and fund-raisers who influence policy and funding opportunities. Suitable platforms for doing just this exist on 'International Day for Biological Diversity' (22nd May) and World Environment Day (5th June). The agenda should highlight the threats to our flora and how by working together the *in situ* and *ex situ* communities can make a difference.

Dialogue should also reach out to the wider research community and get them involved in conservation. In universities, under- and postgraduate research can be directed to aid our knowledge of threatened plants and their interactions in their environment. Increased communication has to be encouraged between researchers to avoid duplication and share results. Research should not just be confined to scientists. Horticulturalists have superb knowledge on cultivating and propagating a large number of diverse species.

This expertise needs to be recorded and made accessible to all. One initiative for doing just this is to develop an online 'one stop knowledge base'. This would enable the altruistic sharing of cultural and ecological information on threatened and near-threatened taxa. It could be facilitated by using a wiki-type website that allows the user to easily add, remove, edit or change content without registration. The site 'Wikispecies' (<http://species.wikimedia.org>) has been designed for exactly this purpose. The advantage of using such a website is that information is immediately available throughout the world providing an excellent mechanism to aid capacity building. It is also free, simply found by search engines and allows all computer literate people the possibility to add information.

Conservation on a budget

Despite the possibility of significant contributions to plant conservation without additional funding, some form of financing soon becomes necessary. This section highlights a range of practical initiatives, discussed during the meeting that could be deployed by relatively small amounts of money or by re-allocating internal funding. It requires directors and curators to critically examine current practices. The re-allocation of money has obvious advantages, as it does not depend on successful grant applications.

It is increasingly recognised that climate change and habitat loss is not only likely to affect threatened taxa but also the distribution limits of more common species. It is therefore important to monitor more common taxa with declining ranges because these may become tomorrow's threatened taxa. Conservationists need to act now to save the genetic variation of these plants. For those already threatened, Red Lists provide vital information about a species vulnerability and are a vital starting point for conservation action. However, despite Europe having the most studied flora in the world a European Red List does not exist, although it is an achievable goal for an estimated €30,000 (*pers. comm.* Suzanne Sharrock, BGCI). The natural progression from the Red List would be more detailed work detailing information about a taxa's ecology, past distribution, conservation needs and any other data that may contribute to its successful conservation. There is already such a document for 50 Mediterranean island species on the brink of extinction (Montmollin & Strahm, 2005), but it is ideally required for all threatened taxa.

A comprehensive Red List would enable the evaluation of threatened taxa in *ex situ* collections to be prioritised. This would be done initially on a quantitative basis highlighting institutes with particular taxa and then progressing to qualitative analysis. One such survey was previously conducted by Maunder *et al.* (2001). This study looked at threatened plants defined by the Bern Convention. Results concluded that the

majority of the selected taxa were held in a small number of collections and dominated by garden-origin accessions with poor documentation. The results demonstrate that there is a lot more to legitimate conservation than simply growing threatened taxa in a garden.

Even when well documented wild accessions are cultivated a mechanism is ideally required to trace genotype(s) between gardens. This would clearly highlight the extent of duplicate material in different gardens and avoid taxa being regarded as 'safe' in *ex situ* cultivation when they may well be represented by a single genotype or collection. A mechanism that could facilitate the traceability of accessions is the International Plant Exchange Network (IPEN). IPEN has been developed specifically for botanic gardens as a tool to respect the access and benefit-sharing requirements of the CBD (Von den Driesch *et al.*, 2005). It uses unique numbers to enable the origin of the material (and its legal documentation) to be traced. However, in its current form there is no distinction between the different generations of a particular accession. This means that a plant would have the same code as its garden-gathered seeds despite the potential for great disparity in genotype. This is not surprising, since IPEN was never conceived for discriminating between this type of information, yet with simple modification (an extra code noting generation) it could be an extremely valuable tool aiding *ex situ* conservation.

Reviewing the relevance of traditional practices should be considered in some botanic gardens. Many institutes maintain large, publicly hidden plant collections that do not facilitate research, conservation or education. These collections often represent decades of plant acquisitions corresponding to past research and personal interests. However, many may now be redundant. In space- and financially-limited areas, such as glasshouses, these living holdings could be evaluated to determine whether they represent the best use of space to meet the challenges of today. Similarly, the limitations in the use of garden-gathered seed in *index semina* are critiqued frequently. Recent research has highlighted a steady decline in the percentage of wild-collected seed in European seed lists over the last decade. The majority of seeds represented in European *index semina* (c.80-85%) are from garden-gathered seeds that have limited use (see Aplin & Rammeloo, *in press*). This suggests that this practice is time consuming and inefficient, although, some curators have devised systems to reduce the collection of unwanted or inappropriate seed material (Vanderborgh, 1997).

Conservation with sufficient funding

With such a threatened flora, the scope for well-funded conservation projects is large. However, it seems sensible to focus resources on a flagship project, gaining knowledge and experience while developing co-operation between *in situ* and *ex situ* plant communities. It would also enable protocols to be developed and tested for future projects. It might concentrate on a plant group, perhaps a family or genus that grows in a range of different habitats, has seeds that are easily stored yet with plants that are difficult to cultivate. Alternatively, it might concentrate on areas where Europe's species are in greatest peril. Whichever is selected we should not ignore those often neglected "Cinderella species" such as ferns, mosses and liverworts that have important roles in the functioning of ecosystems and may be especially susceptible to climate change.

Concluding remarks

With over a thousand botanic gardens, institutes and arboreta in Europe, no species should be threatened with extinction. Yet today many species are faced with this threat. The December 1st meeting at Meise was hoped to spark motivation and actions that tackle the challenges that face the world's most studied flora. It clearly outlined that our institutes could all be doing more to halt species loss and that it is imperative to work alongside the *in situ* community. The conclusions were not entirely new; Bramwell *et al.* (1987); IUCN-BGCS & WWF (1989); Wyse Jackson & Sutherland (2000), Waldren & Wyse Jackson (2000), Guerrant *et al.* (2004) and Rae (2004), to name a few, have all highlighted many of the issues covered in this manuscript. However, this paper focuses on financial constraints and suggests these need not burden the progress of legitimate conservation. As botanical institutes we have an obligation to help save our

continent's flora and ensure that our gardens do not become a 'Noah's Ark' for the sake of collecting, because one day the rains may never end.

Acknowledgements

The authors wish to thank the following people for their contributions to the meeting at Meise: Gert Ausloos, Gianni Bedini, Costantino Bonomi, Michael Burkart, Maïte Delmas, Christina Fournaraki, Martin Gardener, Quentin Groom, Michael Kiehn, Simon Linington, Wolfram Lobin, Erzsébet Mihalik, Jerzy Puchalski, David Rae, Geert Raeymaekers, Jonathan Rudge, Leif Schulman, Suzanne Sharrock, Irini Vallianatou, Thierry Vanderborght, Leo Vanhecke, Fabienne Vanrossum, Steve Waldren, Bert van den Wollenberg & Peter Wyse Jackson.

References

- Akeroyd, J.R., 1992. *Global Biodiversity: Status of the Earth's living resources*. Chapman & Hall, London.
- Aplin, D.M., Linington, S., Vanderborght, T. & Rammeloo, J., 2007. *Indices Seminum*: are they really worth the effort? *Sibbaldia* 5: 93-107. (presented at the Third Global Botanic Gardens Congress, Wuhan, China).
- BGCI & Cabildo de Gran Canaria, 2006. *The Gran Canary Declaration II on Climate Change and Plant Conservation*. BGCI, London, UK & Cabildo de Gran Canaria, Las Palmas de Gran Canaria, Spain.
- Bramwell, D., Hamann, O., Heywood, V. & Synge, H., 1987. *Botanic Gardens and the World Conservation Strategy*. Proceedings of an International Conference, Las Palmas de Gran Canaria. Academic Press, London.
- Council of Europe, 1977. *List of rare, threatened and endemic plants in Europe*. Council of Europe.
- European Commission, 2005. *European Community Third National Report*. CBD Secretariat p. 51.
<http://www.cbd.int/doc/world/eur/eur-nr-03-en.pdf>
- European Commission, 2006. *Halting the loss of biodiversity by 2010 - and beyond: Sustaining ecosystem services for human well-being*. Communication from the European Commission, Brussels, 22.5.2006.
http://ec.europa.eu/environment/nature/biodiversity/current_biodiversity_policy/biodiversity_com_2006/index_en.htm
- Frachon, N. Jebb, M. & Rae, D., 2005. PlantNetwork's Target 8 Project – the survey stages. *Sibbaldia* 3: 67-82.
- Guerrant, E.O., Havens, K. & Maunder, M., 2004. *Ex Situ Plant Conservation: Supporting species survival in the Wild*. Island Press, Washington, D.C, USA.
- Hernández Bermejo J.E. & Molina F. H., 2005. REDBAG: The Spanish Network of Genebanks for Wild Plants *BGjournal* 2(2): 18-19.
- IUCN-BGCS & WWF, 1989. *The Botanic Gardens Conservation Strategy*. IUCN Botanic Gardens Conservation Secretariat, Kew, UK and WWF and IUCN, Gland, Switzerland.
- Intergovernmental Panel on Climate Change (IPCC), 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the*

Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_SPM-v2.pdf

Lesouëf J.Y., 2004. A plant recovery programme in the Conservatoire Botanique National de Brest (France). *Scripta Botanica Belgica* **29**: 115-118.

Maunder, M., Havens, K., Guerrant, E.O. & Falk, D.A., 2004. Ex Situ methods: a vital but underused set of conservation resources. **In:** *Ex Situ Plant Conservation: Supporting species survival in the Wild*. Guerrant, E.O., Havens, K. & Maunder, M. (Eds.) Island Press, Washington, D.C, USA.

Maunder, M., Higgens, S. & Culham, A., 2001. The effectiveness of botanic garden collections in supporting plant conservation: a European case study. *Biodiversity and Conservation* **10**: 383-401.

Montmollin, B., de and Strahn, W. (eds), 2005. *The Top 50 Mediterranean Island Plants: wild plants at the brink of extinction, and what is needed to save them*. IUCN/SSC Mediterranean Island Plants Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Müller, J. & Linington, S. In press, The European Native Seed Conservation Network – progress towards target 8 of the Global Strategy for Plant Conservation. Proceedings of the Third Global Botanic Gardens Congress, Wuhan, China.

Rae, D., 2004. Is there a role for horticultural research in botanic gardens? *In:* E. Robbrecht & A. Bogaerts (eds). EuroGard III. *Papers from the Third European Botanic Gardens Congress and the Second European Botanic Gardens Education Congress Scripta Bot. Belg.* **29**: 33-38.

Rossi G., Bonomi C., Bedini G., 2006. Conservazione ex situ della flora spontanea italiana: RIBES, una nuova iniziativa nazionale. *Informatore Botanico Italiano* **38(1)**: 236-247.

Vanderborcht, T. 1997, Seed Conservation at the National Botanic Garden of Belgium. *BGCNews* **2(9)**: 43-44.

Von den Driesch, M., Lobin, W., Helminger, T., Gröger, A. & Van den Wollenburg, B., 2000. The International Plant Exchange Network (IPEN): An instrument of botanic gardens to fulfil the ABS provisions. **In:** *Access and Benefit-sharing of genetic resources*. Federal Agency for Nature Conservation, Bonn, Germany.

Waldren, S. & Wyse Jackson, P., 2000. Conservation of Biodiversity. **In:** *Action Plan for Botanic Gardens in the European Union* Cheney, J. Navarrete Navarro, J. & Wyse Jackson, P. (comp & eds, 2000).

Wyse Jackson, P.S. & Sutherland, L.A., 2000. *International Agenda for Botanic Gardens in Conservation*. Botanic Gardens Conservation International, UK.