

Journal of Botanic Gardens Conservation International

BGjournal

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**The International Agenda –
five years on**



BGCI

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Working together for Plants*

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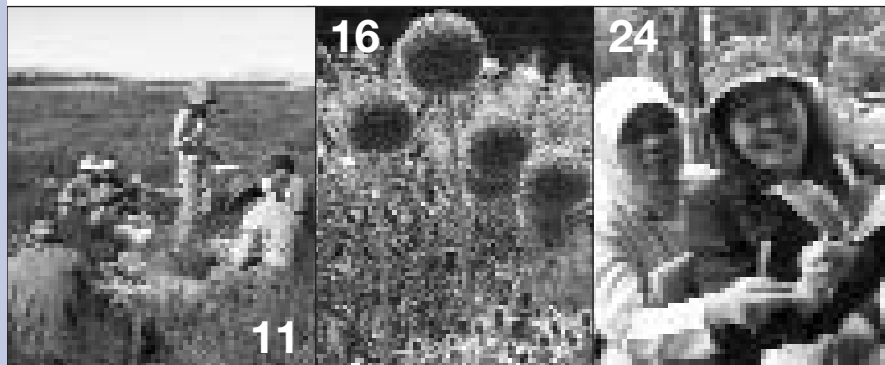
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Editorial

Botanic gardens are a powerful force for biodiversity conservation. Individually and collectively gardens are addressing the range of activities needed to help ensure the survival of threatened plant species around the world. *The International Agenda for Botanic Gardens in Conservation* published in 2000 remains the framework document summarising the issues that botanic gardens are well-placed to tackle and highlighting actions that can be taken. This issue of *BGjournal* looks at the impact, successes and relevance of the *International Agenda* five years on.

A very encouraging aspect of the *International Agenda* is its global acceptance by the botanic garden community. By the end of 2005, five years since its development, 443 organisations had registered their commitment to use the *International Agenda* as a framework for developing institutional policies and programmes for plant conservation. The range of countries in which the *International Agenda* is being implemented by at least one organisation continues to increase and now stands at 82 countries. In some of these countries, in Europe, North America, Australia and South Africa there is already a strong plant conservation movement to which the work of botanic gardens can contribute. In other parts of the world, one organisation signing the *International Agenda* may be a significant forward step in the development of plant conservation awareness and action.

At a political level, the value of the *International Agenda* is recognised. The Convention on Biological Diversity (CBD) acknowledges the *International Agenda* as the botanic garden community's contribution to the *Global Strategy for Plant Conservation* (GSPC). The *2010 Targets for botanic gardens* (see page 4) provide an explicit link between the two. Papers in this issue demonstrate how the *International Agenda* and GSPC are mutually reinforcing. Responsibility for the implementation of the GSPC is primarily governmental as a commitment to the CBD.

Implementation of the *International Agenda* is of course voluntary but can demonstrate to politicians the considered response of a botanic garden to global concerns and policies whether or not the country has signed up to the CBD.

At a practical level, analysis of the extent to which and ways in which the *International Agenda* is being implemented can help to determine where more support, resources or new partnerships might be needed either by an individual garden or botanic garden network. Clearly some of the recommendations of the *International Agenda* are being widely implemented and the targets that have subsequently been developed should be relatively easy to reach. The article on the South African National Botanic Gardens response to implementing the *International Agenda* highlights that aspects such as ex situ conservation,

identification and monitoring, training and capacity building and public education and awareness are being adequately addressed. Others are not currently being addressed to the same extent either because they have not been considered priorities to the same degree or they are being addressed by partner organizations. Similar broad areas of focus in implementation are likely to be highlighted internationally as BGCI makes available its online monitoring tool for the *International Agenda* currently being developed by the BGCI (US) office.

Ultimately the impact of the *International Agenda* will be what counts. As the 2010 date for the GSPC targets and the related *2010 Targets for botanic gardens* draws closer we need to demonstrate and highlight our successes in plant conservation and sustainable development. The forthcoming CBD COP in Brazil in April 2006 will be one opportunity to do this and BGCI will be using the opportunity to highlight the work of Latin American botanic gardens as an example of what can be achieved. The 3rd Global Botanic Gardens Congress in Wuhan, China, which will be held from 16-20 April 2007 will provide an excellent opportunity for all botanic gardens to review their progress with the *International Agenda* and conservation impact. Congress news will be posted on the website – please take a look and join us there!

Sara Oldfield

The *International Agenda for Botanic Gardens in Conservation* and the 2010 Targets for botanic gardens

The *International Agenda for Botanic Gardens in Conservation* provides a framework for the development of botanic garden policies and programmes for conservation (Wyse Jackson and Sutherland, 2000*). The *International Agenda* was drawn up with input from the botanic garden community worldwide and has proved to be a major influence in shaping the direction of botanic gardens.

Although each botanic garden is very different and it would be impossible for every garden to achieve all the tasks and recommendations outlined in the *International Agenda*, it gives guidance on how each botanic garden can develop its own role in conservation that is appropriate to its resources and relevant to local, regional and international environmental issues. The activities (211) have been compiled into a spreadsheet which helps individual institutions judge whether they are engaged in a particular recommendation, might do so in the future or are not doing it now nor contemplating such action in the future (Galbraith, 2003). This is shown in SANBI's institutional response to the *International Agenda* (see page 11). This spreadsheet has been developed into an interactive tool by BGCI (U.S.) and will be posted on the website shortly.

The *Global Strategy for Plant Conservation* (GSPC) sets out a challenge for governments and the wider biodiversity community to

achieve 16 outcome-orientated targets by 2010 based on five sub-objectives (CBD, 2003*). The *International Agenda* was published before the *Global Strategy for Plant Conservation* (GSPC) and the structure is different. However, the activities of the *International Agenda* contribute to all GSPC five sub-objectives and 16 targets. Botanic gardens can thus play an important role in supporting the GSPC when they sign up to the *International Agenda*.

Within the framework of the *International Agenda* a series of 20 targets for botanic gardens worldwide have been developed and agreed as a contribution to meeting the GSPC targets by 2010 (see Box over: *2010 Targets for botanic gardens* and posted on the BGCI website). These *2010 Targets for botanic gardens* were developed at the 2nd World Botanic Gardens Congress in 2004. These targets also provide guidance for developing national and regional targets for botanic garden networks – as for example in the U.K. (Jebb, 2005) and in the North American region (see page 8) and Europe (see page 5).

This issue of *BGjournal* shows how botanic gardens are working according to the framework provide by the *International Agenda* and at the same time implementing the targets of the GSPC through the botanic garden targets.

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2010 Targets for botanic gardens**

(a) Understanding and documenting plant diversity:

(i) A widely accessible working list of known plant species, as a step towards a complete world flora;

- 1) The herbaria of botanic gardens and their living collections contribute to and support the development of a working list of known plant species, by developing local, national and regional checklists, floras and monographs as appropriate;

(ii) A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels;

- 2) Botanic gardens contribute to, support, undertake and review national, regional and international threatened plant assessments to ensure that a preliminary evaluation is available in every country;

(iii) Development of models with protocols for plant conservation and sustainable use, based on research and practical experience;

- 3) Botanic gardens develop and disseminate models, protocols and case studies for priority plants, their ecosystems and cultural landscapes, within their area of expertise and interest, as relevant to achieve the targets of the *International Agenda for Botanic Gardens in Conservation*;

Sub-target: Botanic gardens develop, adopt and implement best practice in the implementation of the policies and guidelines of the Convention on Biological Diversity and relevant national laws and regulations in relation to access and benefit sharing;

(b) Conserving plant diversity:

(iv) At least 10 per cent of each of the world's ecological regions effectively conserved;

- 4) Botanic gardens support and contribute to national, regional and international conservation policies, planning and management of ecological regions, through documentation, research and advocacy;

(v) Protection of 50 per cent of the most important areas for plant diversity assured;

- 5) Botanic gardens support and contribute to the identification and conservation of the most important areas for plant diversity and the development of policies, planning and management through documentation, research and advocacy;

(vi) At least 30 per cent of production lands managed consistent with the conservation of plant diversity;

- 6) Botanic gardens contribute to the development and application of protocols and practices that support and promote the sustainable management and conservation of plant diversity in production lands;

(vii) 60 per cent of the world's threatened species conserved in situ;

- 7) Botanic gardens in every country support, promote and contribute to the integrated conservation and management of threatened species and populations in situ, working with protected area managers and communities at local, regional and national levels;

(viii) 60 per cent of threatened plant species in accessible ex situ collections, preferably in the country of origin, and 10 per cent of them included in recovery and restoration programmes;

- 8) 50 per cent of threatened plants included in accessible botanic garden ex situ conservation collections, including cultivated and genebank material, preferably in the country of origin;

Sub-target: 75 per cent of critically endangered species (CR) included in ex situ conservation collections by 2010, preferably in the country of origin;

- 9) Botanic gardens support and participate in recovery and restoration programmes for 5 per cent of the world's threatened plant species;

(ix) 70 per cent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained;

- 10) Botanic gardens in every country support, promote and contribute to the integrated conservation and management of medicinal plants, wild relatives of crops and other major socio-economically valuable plants, and maintenance of associated indigenous and local knowledge;

(x) Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems;

- 11) All botanic gardens carry out invasive species risk assessments of their collections and management practices;
- 12) Botanic gardens contribute to best practice for control programmes for at least 100 major invasive species that threaten plants, plant communities and associated habitats and ecosystems;

(c) Using plant diversity sustainably:

(xi) No species of wild flora endangered by international trade;

- 13) Botanic gardens in each country participate in the national and international implementation of CITES, through research, education and awareness, development of good practices, training and plant rescue;

- 14) Botanic gardens promote sustainable practices in international trade of wild flora through research, training, education and awareness;

(xii) 30 per cent of plant-based products derived from sources that are sustainably managed;

- 15) All botanic gardens develop and implement a policy to use plant-based products derived only from sustainable sources and promote awareness of the need for sustainable use of plant resources;

(xiii) The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted;

- 16) Botanic gardens contribute to local, national, regional and international programmes that seek to reverse the decline of plant resources and associated indigenous and local knowledge, innovations and practices, through their research, education and conservation activities;

(d) Promoting education and awareness about plant diversity:

(xiv) The importance of plant diversity and the need for its conservation incorporated into communication, educational and public awareness programmes;

- 17) Every botanic garden to have a communication, education and public awareness programme that 1) communicates the importance of plant diversity and ecosystem services in sustainable livelihoods and 2) promotes the need for action.

- 18) Botanic gardens to develop their capacity for communication, education and public awareness through training or employing appropriately qualified education staff and/or collaboration with others that can provide this expertise.

(e) Building capacity for the conservation of plant diversity:

(xv) The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy;

- 19) Appropriate resources and facilities developed to enable botanic gardens in every country of the world to achieve the targets of the *International Agenda* and the GSPC;

Sub-target: Double the number of trained botanic garden staff working in conservation, research and education;

Sub-target: Botanic gardens develop programmes to deliver training and capacity building in plant conservation;

(xvi) Networks for plant conservation activities established or strengthened at national, regional and international levels;

- 20) Botanic gardens and their networks strengthened to achieve the targets of the *International Agenda for Botanic Gardens in Conservation* and the *Global Strategy for Plant Conservation*;

Sub-target: At least 750 botanic gardens participate in the implementation of the International Agenda for Botanic Gardens in Conservation;

Sub-target: All botanic garden networks participate in the Global Partnership for Plant Conservation;

Sub-target: All botanic gardens participate in relevant national, regional and international conservation and education networks and partnerships.

** The GSPC target to which each 2010 target most closely relates is provided below (in italics) for easy reference and see text for further details. Approved by the 2nd meeting of the International Advisory Council (IAC) of BGCI held at the Institute of Botany, Vienna, Austria on 17th July, 2005.

European botanic gardens and the *International Agenda for Botanic Gardens in Conservation*



Left: Members of the BGCI/IABG European Botanic Gardens Consortium at meeting in Luxembourg, December, 2005 (Photo: BGCI)

Introduction

A large number of biodiversity-related strategies and agendas operate at international, regional and national level within the European Union. European botanic gardens therefore have to define their role and relevance in relation to plant conservation in the context of a complicated policy framework. In response to international biodiversity strategies and action plans, botanic garden networks in some regions are in the process of developing region-specific botanic garden targets – as for example the North American strategy reported in this issue. European botanic gardens however, in the face of a plethora of regional and international strategies, have decided not to attempt to develop further EU-specific botanic garden targets, but instead are reviewing the actions that are already underway in botanic gardens which are outlined in the *International Agenda for Botanic*

Gardens in Conservation, and through this, contribute to the achievement of global, regional and national plant conservation targets. This paper provides some preliminary results of this review process, and demonstrates that European botanic gardens are contributing in many and varied ways to biodiversity conservation in Europe through the implementation of the *International Agenda*.

International targets

The *International Agenda* was published in 2000, providing a global framework for the actions of botanic gardens in relation to the conservation and sustainable use of plant resources. In 2002, the *Global Strategy for Plant Conservation* (GSPC) was adopted by the 187 Parties to the Convention on Biological Diversity (CBD), including a set of 16 outcome-oriented targets for plant conservation to be achieved by 2010. Following the adoption of the

GSPC, botanic gardens began to examine how actions already being carried out in the framework of the *International Agenda*, actually contributed to the achievement of the targets of the GSPC. At the World Botanic Gardens Congress in Barcelona in 2004, a set of targets for botanic gardens, to be achieved by 2010 were developed in order to explicitly link the actions recommended in the *International Agenda* with the targets of the GSPC (Wyse Jackson, 2004). Following a period of consultation, these targets were agreed by the world botanic garden community (*2010 Targets for botanic gardens* (see page 4)). The targets provide a mechanism to monitor the achievement of the policies and practices of the *International Agenda* and to quantify the contribution of botanic gardens to the targets of the GSPC. The international botanic garden targets also provide the basis



Left: *Aceras anthropophorum*, a German Red List plant, on display in Bonn Botanic Garden, Germany (Photo: BGCI)

Right: In situ conservation area of natural oak forest in the Balkan Botanic Garden, Greece showing a native orchid species in situ, *Serapias vomeracea* (Photo: BGCI)

for the development of regional and national botanic gardens targets – as for example in the North American region (see page 8) and the U.K. (Jebb, 2005).



Right: *Dianthus gratianopolitanus*, a German Red List plant, on display in Bonn Botanic Garden, Germany (Photo: BGCI)

European biodiversity targets

In 2000, botanic gardens in Europe adopted the *Action Plan for Botanic Gardens in the European Union* (Cheney *et al.*, 2000). This sets out more than 30 objectives on science and horticulture, conservation of biodiversity, education, training and awareness, networking, co-operation and capacity building. Similar to the *International Agenda*, the *Action Plan* does not include specific outcome-oriented targets, but rather provides a framework for action to achieve such targets.

With the development of the GSPC and a focus on plants across the conservation community, Planta Europa (a network of organisations working for plant conservation in Europe), together with the Council of Europe (an inter-governmental organisation) developed the *European Plant Conservation Strategy* (EPCS) (CBD, 2002). In 2002, the EPCS was recognised by the Convention on Biological Diversity as a contribution to the GSPC with the 42 targets of the EPCS being arranged under five objectives, corresponding to the five objectives of the GSPC.

Within Europe, the EPCS is also seen as contributing to the Pan European Biological and Landscape Diversity Strategy (PEBLS) (ECNC, 2001). Within the framework of this strategy, in 2001 the European Union set a target to “halt the decline of biodiversity by 2010”. Following the setting of this headline



target, the European Commission undertook a year-long consultation process on its biodiversity strategy and the identification of priorities towards meeting the 2010 commitments. This process was finalised at a conference in Malahide, Ireland in 2004 where a number of priority objectives were identified, with specific targets for each objective to ensure clarity of what has to be achieved by 2010. These targets are outlined in the *Message from Malahide*. The European research community was engaged in this process through the European Platform for Biodiversity Research Strategy (EPBRS) and in particular through a meeting held in Killarney in May 2004 (EU presidency 2004 Website, 2004). The Killarney meeting also adopted a declaration and recommendations on biodiversity research which were subsequently endorsed at Malahide.

Strategies and Action Plans relevant to the work of European Botanic Gardens*

- *International Agenda for Botanic Gardens in Conservation*
- *Global Strategy for Plant Conservation*
- *Action Plan for Botanic Gardens in the European Union*
- *European Plant Conservation Strategy*
- *Message from Malahide*
- *Killarney Declaration*

*See text for further information

European botanic gardens and plant conservation targets

In 2004-5, European botanic gardens, in the framework of the European Botanic Gardens Consortium, initiated a process of understanding and recording in a meaningful way, their contribution to the achievement of European, as well as global biodiversity targets. As a starting point, the wide range of biodiversity targets were analysed and those relevant to the work of botanic gardens identified. It became clear that all

relevant targets could be grouped under the targets of the GSPC and in this way a matrix was developed, including the GSPC, *International Agenda for botanic gardens*, EPCS, Malahide and Killarney Declaration targets. Within this matrix, European botanic gardens are now starting to identify specific actions, ongoing or planned, which will contribute to the achievement of European and international plant conservation targets.

Even at this early stage in the exercise, it is clear the European botanic gardens are contributing to all the GSPC targets. It is also clear that the *International Agenda* still provides a relevant framework for botanic gardens in conservation, helping to guide and define appropriate actions to help achieve the various plant conservation targets. Some examples of how European botanic gardens are contributing to GSPC targets are provided in Table 1.

A full report on the contribution of European Botanic Gardens to biodiversity conservation will be prepared and presented at the Fourth European Botanic Gardens Conference in the Czech Republic in September 2006.

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GSPC Target	Botanic garden activity	International Agenda activity
(A) Understanding and documenting plant diversity		Int. Agenda activity
(1) A widely accessible working list of known plant species, as a step towards a complete world flora.	The National Botanic Garden of Belgium publishes a regularly updated flora of Belgium. The garden is also databasing nomenclatural type specimens of central Africa and is a partner in Species 2000 project.	2.3 (vii)
(2) A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels.	The botanic garden of the University of Vienna has compiled a list of Austrian plant taxa deserving conservation action as basis for the development of seed collection priorities.	2.3 (v)
(3) Development of models with protocols for plant conservation and sustainable use, based on research and practical experience.	Models, protocols and case studies for priority plants, their ecosystems and cultural landscapes are developed by Portuguese botanic gardens. In vitro conservation protocols are being developed for endangered species in Latvia.	2.7 (v)
(B) Conserving plant diversity		
4) At least 10 per cent of each of the world's ecological regions effectively conserved	Portuguese botanic gardens are contributing to national and regional conservation, through the development of planning and management programmes for different ecological regions.	2.5 (i)
5) Protection of 50 per cent of the most important areas for plant diversity assured	The botanic garden of Siauliai University, Lithuania carried out field research to support the proposal of an Important Plant Area (IPA) for the protection of an alkaline fen habitat.	2.3 (viii)
6) At least 30 per cent of production lands managed consistent with the conservation of plant diversity.	Botanic gardens in Portugal participate in the development of manuals of good agricultural practices.	2.8.2 (i)
7) 60 per cent of the world's threatened species conserved in situ.	The Balkan Botanic Garden in Greece manages an in situ conservation area of natural oak forest. This includes restricted access and delimitation of microhabitats of different orchid species in the conservation area.	2.5 (5)
8) 60 per cent of threatened plant species in accessible ex situ collections, preferably in the country of origin, and 10 per cent of them included in recovery and restoration programmes.	Several botanical gardens in Austria have ex situ conservation programmes for rare and endangered Austrian plant species, mostly in an ecosystem context. In addition, there are important collections of non-Austrian plants of high conservation value. As protocols for the cultivation of most of these taxa exist, and these ex situ collections in most cases are well defined genetically, they are well suited for use in in situ restoration.	2.6 (ii) 2.6 (iv)
9) 70 per cent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained.	The National Botanic Garden of Belgium holds a seed bank of wild Phaseolineae recognised as base collection by IPGRI. NBG has extracted ethnobotanical knowledge from the herbarium specimens of Central Africa belonging to two families (Cucurbitaceae, Leguminosae) as a prototype.	2.8.1 (iii)
10) Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems.	A list of invasive plants species in the Czech Republic has been prepared by Botanic Gardens of the Czech Republic.	2.5 (v)
(C) Using plant diversity sustainably		
11) No species of wild flora endangered by international trade.	The botanic garden Warsaw, Poland organised a special International Conference on CITES use by botanical gardens and has edited 3 guide books about CITES.	2.8.4 (iii)
12) 30 per cent of plant-based products derived from sources that are sustainably managed.	Portuguese botanic gardens have developed best practices for the conservation and sustainable use of <i>Mentha cervina</i> , <i>Mentha pulegium</i> , <i>Thymbra capitata</i> .	2.8.1 (ii)
13) The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted	By its collaboration with the Kisantu garden (Congo) the National Botanic Garden of Belgium contributes to the production of indigenous plant resources as a basis of food and medicine.	2.8.1 (ii)
(D) Promoting education and awareness about plant diversity		
14) The importance of plant diversity and the need for its conservation incorporated into communication, educational and public -awareness programmes.	Botanic gardens in Slovenia organise lectures, workshops and numerous other activities for the general public. This also includes guided tours of the gardens in order to present conservation efforts for some of the endemic and threatened plants. Special work sheets on the latter have been prepared for school children.	2.10
(E) Building capacity for the conservation of plant diversity		
15) The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy	Slovenian biology students are trained in practical work and conservation activities in the botanic gardens.	2.9 (iv)
16) Networks for plant conservation activities established or strengthened at national, regional and international levels.	The Association of Baltic Botanic Gardens has prepared an overview of threatened and rare species of native vascular plants in ex situ collections of Botanic Gardens of the Association.	2.19.1 (i)

Table 1. Examples of botanic garden contributions to GSPC targets and relevant International Agenda activity

- ➔ ECNC (European Centre for Nature Conservation), 2001. *Pan European Biological and Landscape Diversity Strategy*. [http://www.strategyguide.org/index.html, accessed November, 2005].
- ➔ EU presidency 2004 Website, 2004. *Message from Malahide. Halting the decline of biodiversity - priority objectives and targets for 2010*.

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The development of a strategic plan for a regional network of botanic gardens for conservation: the North American experience

The launch of the *International Agenda for Botanic Gardens in Conservation* at the World Botanic Gardens Congress in Asheville, North Carolina, U.S.A. in 2000 presented botanic gardens worldwide with an important challenge. The numerous recommendations for individual gardens and for networks within the *International Agenda* presents a complex landscape for individuals and institutions that want to contribute, or are contributing to conservation. One approach to such a global challenge is for networks of botanic gardens to provide local context and synthesis that can support individual institutions in planning their own programmes (*International Agenda* Section 2.19). We are happy to note there are now many national and regional biodiversity action plans for botanic gardens, including the northern region of North America. A national

biodiversity action plan for botanical gardens and arboreta in Canada was published in 2001 (Galbraith, 2001), a follow-up to workshop proceedings published in 1997 following the first national network meeting of the Canadian Botanical Conservation Network (Galbraith, 1997). Shortly after, work began on producing the *North American Botanic Garden Strategy for Conservation*, which was endorsed by major cooperating botanic garden groups in June, 2004. The purpose of this article is to outline the development of the strategy for North American botanic gardens which harmonises with the *Global Strategy for Plant Conservation* (GSPC), the *International Agenda*, and the Plant Conservation Alliance's *National Framework for Progress* (PCA, 1995).

Although North America north of the Rio Grande is not known as one of the richest global hotspots of biodiversity, the natural plant diversity within Canada and the United States is significant none the less. When the great botanical richness of Mexico and the Caribbean are included, the conservation and sustainable use of plant diversity in North America are indeed important global objectives.

The process

In 2002, discussions began among the American Public Garden Association (APGA, formerly AABGA), the Center for Plant Conservation (CPC), Botanic Gardens Conservation International

(BGCI), and the Canadian Botanical Conservation Network (CBCN) into the idea of cooperating on an organised approach to plant conservation projects and on related initiatives such as education for conservation and biodiversity themes. The four organisations agreed to formal cooperation with the signing of a Memorandum of Understanding at Tower Hill Botanical Garden in Massachusetts in the summer of 2003 (Jasaitis and Line, 2003). This partnership consists of organisations of varying strengths and capacities. Each of the individual organisations is committed to conservation activities, and brings with it its own perspective and initiatives.

The APGA is a large continent-wide professional association with members in the U.S.A., Canada, Mexico and the Caribbean. With over 600 institutional and 2000 professional members, APGA seeks to strengthen the abilities of its members in all areas of their professional work, including conservation. The US programme for BGCI (BGCI - US) (75 US, 11 Canadian and 15 Mexican institutional members) focuses its efforts on public policy, education and public awareness of the importance of plants and their need for conservation. BGCI unites a global network of botanic gardens for conservation, education and development goals. The CPC is a not-for-profit organisation that includes 33 botanic gardens in the U.S.A. in support of both in situ and ex situ

Below:
Participants of
North American
Meeting at the
2nd World
Botanic Gardens
Congress,
Barcelona,
Spain in April,
2004



conservation. The network includes a national collection of endangered plants of the U.S.A. held ex situ by the participating gardens. The CBCN has 20 institutional members. It has supported national and local plant conservation and education programmes in cooperation with BGCI, Environment Canada and other partners since 1995.

The process of developing a formal *North American Strategy* for botanical gardens in conservation began with workshops held in Barcelona, Spain immediately prior to the 2nd World Botanic Gardens Congress in April, 2004. A one-day workshop was held to consider global targets for the botanic garden community that would harmonise with the 16 targets of the GSPC (to be achieved by the year 2010) (Wyse Jackson, 2004). The targets (*2010 Targets for botanic gardens*) have since been approved with amendments by the International Advisory Committee (IAC) to BGCI in Vienna in July, 2005. They are posted on the BGCI website and included in this issue (see page 4).

Follow-up workshops held the next day encouraged the development of regional targets. Most of the participants in the North American regional workshop were from American or Canadian botanical gardens. It was recognised that it was also desirable to have the participation of the botanical garden community of Mexico and of the Caribbean in this process, both of which have previously developed action plans.

The resulting draft set of targets for the North American botanical gardens community was then subjected to nearly a year of consultations with individual institutions and networks in North America. The four cooperating networks (APGA, CPC, BGCI and CBCN) each reviewed the draft document, and circulated it among their members for comments. The draft document was also reviewed by the Association of Mexican Botanic Gardens (Asociación Mexicana de Jardines Botánicos AMJB).

The process was clearly useful in helping gardens think about their current and potential roles in



Left: MOU signing ceremony between the American Public Garden Association (APGA), the Canadian Botanical Conservation Network (CBCN), the U.S. Center for Plant Conservation (CPC) and BGCI, June, 2003 (l-r: Peter Raven (Missouri Botanical Garden), David Galbraith (CBCN), Kathryn Kennedy (CPC), Eliot Payne (CPC), Mary Pat Matheson (APGA), Patricia Jasaitis (BGCI-US), Christopher Dunn (APGA))

conservation. The collaborative effort also helped North America partners identify where their work relative to the global strategy is well underway, where gaps may exist, and for which global targets North American botanical gardens have a primary role and where their role is secondary but still essential. The feed-back on the draft targets included energetic commentaries and scepticism from some quarters. Of particular importance was concern over the relevance of targets to individual institutions and the fact that the target-setting exercise was taking place without any explicit framework for resources to support implementation. Recognising that the spirit of the consultation exercise was always to promote collaboration and keep in mind the need for others to participate, by June 2005, a revised set of targets were agreed by all four organisations within the Canada-US MOU, under the title of the *North American Botanic Garden Strategy for Plant Conservation*.

The Strategy

The *North American Strategy* was publicly introduced at the 2005 annual conference of the APGA in Chicago, Illinois, U.S.A (Anonymous, 2005). The context and intended uses of the targets within the *North American Strategy* are introduced within the document itself:

“This document will help demonstrate the collective impact that botanic gardens in North America have on the protection and conservation of native plants and plant communities.

By setting these outcome-oriented and measurable targets, which range from local to international in scope, botanic gardens in Canada, the United States, and Mexico will significantly contribute to the ultimate goal of halting the current and continuing loss of plant diversity.”

The *North American Strategy* bears a structural resemblance to the GSPC and the *2010 Targets for botanic gardens*. It consists of broad objectives to which the work of many institutions contribute. No single institution should feel bound to contribute to every one of the targets. The targets of the *North American Strategy* are grouped into six broad categories or themes:

- A. Understanding and documenting plant diversity
- B. Conserving plant diversity
- C. Using plant diversity sustainably
- D. Promoting public education and awareness about plant diversity
- E. Building capacity for conservation of plant diversity
- F. Supporting the *North American Strategy*

The development of the strategy itself is important, but it is the responsibility of the individual gardens and partner associations to develop practical, hands-on implementation planning and actions. Each participating organisation is working toward its own implementation of the strategy. For example, the Association of Mexican Botanic Gardens are presently preparing a set of Mexican aims for the North American Strategy.

Right: Working session of the partnership organisations held at Montreal Botanical Garden in November, 2005. (l-r, Dan Stark (APGA), Christopher Dunn (APGA), Kathryn Kennedy (CPC), Michel Labrecque (CBCN) under a portrait of Fr. Marie-Victorin, founder of Montreal Botanical Garden, Laurel Mclvor (CBCN), Sean Graham (CBCN) and Dan Shepherd (BGCI-US) (Photo: David Galbraith)



The Canadian Botanical Conservation Network, with support from BGCI and the *Investing in Nature: A Partnership for Plants in Canada* project, is preparing an update to its 2001 *Biodiversity Action Plan for Botanical Gardens and Arboreta in Canada* (Galbraith, 2001) that will harmonise the planned actions in Canada with the *North American Strategy*, the GSPC, and the *International Agenda*.

In 2006, the Center for Plant Conservation is undertaking a strategic plan update as well, which will address the contributions of their U.S. botanic garden network to the targets of the *North American Strategy* as well as the organisation's role in international plant conservation work.

The process of implementing the *North American Strategy* is now underway. In mid-November 2005, the Montreal Botanical Garden hosted a two-day meeting held with support from BGCI under the *Investing in Nature* programme. On the first day the four partner organisations, APGA, BGCI, CBCN and CPC, discussed the operation of their partnership and next steps under the 2003 MOU. On the second day a broader range of participants (Association of Mexican Botanic Gardens, the Association of Zoological Horticulture, the Flora of North America Association, the Plant Conservation Alliance, NaturServe, the IUCN-SSC and the Wildlife Conservation Society) were invited to discuss the *North American Strategy*

and next steps in its realisation. The *North American Strategy* is an example of a voluntary regional approach to encouraging plant conservation programmes. Participation by a wide cross-section of the broader plant and biodiversity conservation community is critical to the success of this or any other strategy. As the goal for any such exercise is to promote and organise on-the-ground plant conservation efforts and generate success, the development of strategic targets is only the beginning of the process, and a means, not an end. Ultimately our success will be judged by the effectiveness with which strategic documents like the *International Agenda* and the *North American Strategy* can be used to stimulate the provision of new resources to support our mutual goals, and to help us as a community recognise and celebrate our many successes and challenges in conserving the diversity of plant life in our region and around the world.



Right: The second day of the North American Strategy meeting held at Montreal Botanical Garden in November, 2005 (l-r, Sigfredo Escalante Rebollo (AMJB), Maité Lascurain (AMJB), Brian Johnson (BGCI-US). (Photo: David Galbraith)

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SANBI: institutional response to implementing the *International Agenda*

South Africa's network of eight national botanical gardens, spread across five provinces of the country, are managed by the parastatal South African National Biodiversity Institute (SANBI) (Willis, 2005). Established through the National Environmental Management: Biodiversity Act of 2004, SANBI has a much broader biodiversity mandate compared with that of the previous organisation from which it evolved, the National Botanical Institute (NBI) whose sole focus was on plants. The NBI itself was formed in 1989 through the amalgamation of the Botanical Research Institute (established 1903) and the National Botanic Gardens (established 1913). Amidst the changes experienced over the past 15 years that have been associated with revised institutional visions, strategic plans, national mandates, responsibilities, government and public expectations, legislation, international conventions and frameworks, such as the Convention on Biological Diversity (CBD), the *Global Strategy for Plant Conservation* (GSPC) and the *International Agenda for Botanic Gardens in Conservation*, SANBI's eight national botanical gardens have had to continuously adjust to different circumstances, expectations and responsibilities. The basis of the gardens' activities through the years, and the core thread that has run through the history of the national botanical gardens and associated institutional changes, is their focus on the cultivation, propagation and conservation of South Africa's



Left: Rescue of the succulent *Aloe castanea* (Asphodelaceae) from a granite mine by horticultural staff of SANBI's Pretoria National Botanical Garden (Photo: Linette Ferreira)

indigenous plants, and compliance with the internationally accepted definition of botanic gardens as 'institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education' (Wyse Jackson, 1999).

The globally adopted *International Agenda* and widely publicised GSPC have prompted botanic gardens worldwide to reconsider the value, conservation role and significance of their living collections. SANBI formally registered its commitment towards implementing the *International Agenda* in 2001, both as an institution and as eight individual national botanical gardens. As part of SANBI's commitment to implementing the *International Agenda* and raising public awareness, a dedicated poster encouraging public support for each garden's plant conservation programme was developed in 2003 for display at the gardens' visitor centres

and entrances. In addition, as part of a 5-year institutional review of SANBI, the progress by each national botanical garden in the implementation of the *International Agenda* was internally reviewed in October/November 2004. This review used a spreadsheet created by David Galbraith of the Royal Botanical Gardens, Hamilton, Canada, and endorsed by BGCI. The intention of the spreadsheet is to enable individual institutions to judge whether they are engaged in a particular recommendation ("Doing"), might do so in the future ("Considering") or are not doing it now nor contemplating such action in the future ("Not Doing") (Galbraith, 2003).

Results from this review, submitted to BGCI, indicate that South Africa's eight national botanical gardens are, on average, implementing 53% of the 211 activities listed in the *International Agenda*, considering implementing 26% and not doing 21% of the activities. Kirstenbosch National

Right: Starting young.....the sponsored Kirstenbosch Bus has exposed thousands of visitors, both young and old, to the Kirstenbosch National Botanical Garden (Photo: SANBI)



related to the GSPC's 16 goal-oriented targets. Although not all the GSPC's targets are included in the Strategy, SANBI has made an attempt to develop realistic but challenging targets for its national botanical gardens over the next five years, up to 2010. Targets within this Plant Conservation Strategy must still be adapted to take into consideration the *2010 Targets for botanic gardens* (see page 4).

With 2,300 Red Listed plant species in South Africa, the challenges facing South Africa's NBGs are immense, and they have been forced to prioritise their efforts to make a meaningful contribution to the conservation of the country's indigenous flora. Integration of ex situ and in situ conservation efforts must be a priority for NBGs holding conservation collections over the next five years.



Above: *Didymaotus lapidiformis* (Mesembryanthemaceae), one of the flagship threatened plants selected for cultivation by the Karoo Desert National Botanical Garden (Photo: Christopher Willis)

Botanical Garden (NBG), as SANBI's flagship garden with the largest horticultural staff complement, nursery infrastructure and volunteer support, is currently implementing 70% of the listed *International Agenda* activities and considering implementing 20%. Whilst the degree of implementation of activities differed between gardens, those areas of activities that were generally not being implemented by South Africa's NBGs included biotechnology, aspects of sustainable development and sustainable use of biodiversity, national strategies on the conservation of biodiversity, access to genetic resources and benefit sharing, research, and technology transfer.

Areas that are generally being adequately addressed by the national botanical gardens include those of ex

situ conservation, identification and monitoring, information exchange, training and capacity building, public education and awareness, impact assessment and mitigation, technical and scientific co-operation, cultural heritage, and networking/relationships with other sectors.

Various listed activities (such as contribution towards the preparation of the National Biodiversity Strategy and Action Plan) are in fact being implemented by other sections of SANBI, such as the Research Directorate and Biodiversity Policy and Planning Directorate, and not specifically by the Gardens Directorate, which manages the national botanical gardens. There is regular collaboration between sections of the Institute on various projects, and SANBI produces an internal conservation newsletter, *The Conservation Leaflet*, which attempts to showcase conservation programmes and activities within the organisation. This provides an important communication and information medium in an organisation that is geographically widespread.

South Africa's national botanical gardens have recently developed a Plant Conservation Strategy to guide their plant conservation efforts. Included in this Strategy are targets

The monitoring and evaluation of the conservation role of each national botanical garden in South Africa is one of the Key Performance Indicators in SANBI's Corporate Strategic Plan (SANBI, 2005). The development of appropriate partnerships (at local, national and international levels) and support for their conservation programmes a *sine qua non*. SANBI does indeed have a much broader and very challenging mandate beyond the NBGs to monitor and report regularly to the Minister of the Department of Environmental Affairs and Tourism on the conservation status of all listed threatened and protected species (both plant and animal) in South Africa.

South Africa's NBGs are involved in a variety of plant conservation projects. Each project involves various partners and funding sources. Examples of these projects include involvement with the Millennium Seed Bank Project funded by the Royal Botanic Gardens, Kew and the National Lottery (U.K.), the Threatened Species Programme (currently producing a new Red List for South African plants as well as supporting various student research projects and provincial conservation efforts) and the associated CREW (Custodians of Rare and Endangered Wildflowers) Project, projects on specific threatened plant taxa (such as cycads, *Gerbera aurantiaca* and *Aloe*



albida) as well as the development of demonstration gardens that highlight not only threatened indigenous South African plants but also those South African plant taxa that have become invasive weeds in other parts of the world (such as *Carpobrotus edulis*, *watsonias* and various grasses). The CREW project is an exciting component of the Threatened Species Programme that focuses on involving civil society volunteers in the monitoring and conservation of threatened plant populations. In collaboration with the local and provincial conservation authorities, various NBGs are also involved in the rescue of indigenous plants from sites scheduled for development, restoration of various natural areas, as well as providing repositories for confiscated plant material.

NBGs are also working closely with SANBI's Environmental Education Directorate in supporting outreach greening programmes in disadvantaged schools and local municipalities. These projects, funded by the National Lottery and the government's Expanded Public Works Programme, provide opportunities for job creation and skills transfer to unemployed people within South Africa.

Many opportunities for the development of strategic and co-operative partnerships still exist for SANBI, such as collaboration and support of local municipalities in the implementation of their Integrated Development Plans, contribution towards restoration and rehabilitation projects, closer integration and co-operation between SANBI's operational units involved in conservation projects, the integration of plant conservation

activities with appropriate animal and ecosystem conservation activities, and the promotion of greater public awareness of the national botanical gardens' conservation efforts. Priority over the next couple of years will be, amongst others, to (a) develop an efficient information system on the NBGs' plant collections, and (b) develop effective monitoring and evaluation systems for plant conservation efforts within SANBI.

As stated in the IA, it would be impossible for every botanic garden to achieve all the key tasks and recommendations outlined in the Agenda. The Agenda also rightly states that the successful implementation of the *International Agenda* will be dependent on each botanic garden carefully considering and formulating its own response to the Agenda. SANBI does not profess to have all the answers, nor is it implementing all 211 of the listed activities. By making plant conservation activities 'core' business and through developing strategic partnerships and challenging but realistic targets (bearing in mind constraints in terms of resources and capacity), significant progress and contributions can be made by institutions in halting the loss of plant species and their associated genetic diversity.

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Left:
 Community members of the Harmony Flats Working Group monitoring populations of threatened fynbos plants on the Cape Flats, Western Cape (Photo: SANBI)

Below: CREW volunteers play an important role in the monitoring of threatened indigenous plants in the Western Cape, South Africa (Photo: SANBI)





The conservation of threatened plants by Cuban botanic gardens: achieving the objectives of the *International Agenda* as a contribution towards the GSPC

Top right: Observing a new adult individual of *Coccothrinax crinita* found in the wild (Photo: A. Palmarola).

Top left: A field meeting of the scientific staff working in the *Coccothrinax crinita*'s conservation project with the authorities, forest guards and technicians of the locality that are already working in the in situ conservation of the very threatened palm (Photo: A. Palmarola)

In 1998, the *Conservation Action Plan for Botanic Gardens of the Caribbean Islands* (Burbidge and Wyse Jackson) was published; the result of a series of meetings of representatives of Caribbean botanic gardens organised by BGCI. The text of this Action Plan was closely related to the text of the Convention on Biological Diversity (CBD) itself, to highlight botanic garden conservation action within the CBD. Later, the *International Agenda for Botanic Gardens in Conservation* was published to outline the practice and priorities for botanic gardens in conservation and the *2010 Targets for botanic gardens* (see page 4) were developed to help measure the achievements of the *International Agenda* as a contribution to the *Global Strategy for Plant Conservation* (GSPC).

Cuba is the largest insular territory of the Caribbean. Its varied soils and the topography have led to the high endemism of its flora and the varied vegetation. In the last four years (2001-2004) the Cuban Network of Botanic Gardens (Red Nacional de Jardines Botánicos de Cuba) has implemented a national project financed by the Ministry of Science, Technology and Environment to ensure the conservation of their rich flora.

The Cuban botanic garden network (12 gardens) provides an excellent example of the practice of conservation as described in the *International Agenda* particularly Sections 2.3-2.6. It also clearly illustrates the importance of

working with other sectors and organisations both nationally and internationally (Section 2.19), raising public awareness about the work of the garden (Section 2.10) and implementing the training and capacity building section of the *International Agenda* (Section 2.9).

This work contributes to the achievement of the Targets of the GSPC which are added to the text below.

Understanding and documenting plant diversity

Target 1 GSPC

The Cuban botanic garden network has used its facilities and expertise to support the development of a working list of known plant species. During the past four years, staff from three botanic gardens have contributed to four volumes of the new Cuban Flora which covers 25 families (Greuter *et al.*, 2004). This is the result of collaboration between the National Botanic Garden, Havana, the Berlin-Dahlem Botanic Garden and Museum, Germany, the Institut für Spezielle Botanik der Universität Jena, Germany and the Institute of Ecology and Systematics, Cuba, with Prof. Dr. Werner Greuter, as the main Editor of the Flora.

Target 2 GSPC

Botanic garden staff have long been active in the assessment and conservation of the unique flora of Cuba. This is essential for developing

priority conservation activities.

The staff have worked closely with IUCN/SSC's Conservation Breeding Specialist Group (IUCN/SSC CBSG) in their Conservation Assessment and Management Programmes (CAMPs) (IUCN, 2004). In 2003, the IUCN/SSC Cuban Plant Specialist Group was created specifically to continue to work on the assessment of the Cuban flora using the IUCN Red List Categories and Criteria (IUCN, 2001):

A conservation assessment of the species most in need of conservation has been undertaken in the following areas:

- 164 taxa were assessed for IUCN Red Data Categories in two Camp Workshops sponsored by the National Botanic Garden, Havana and IUCN/SSC CBSG
- the conservation status of 150 tree species were re-evaluated with the collaboration of the IUCN-SSC Global Tree Specialist Group/Fauna & Flora International (Lazcano Lara *et al.*, 2005).
- field work was undertaken to assess the conservation status of seven palms by Las Tunas and the National Botanic Garden with support from the Global Trees Campaign.
- a national workshop on the conservation status of cacti was sponsored by the National Botanic Garden with the support of BP Conservation Programme (González-Torres *et al.*, 2005).

This work led to the recent publication of the *Red List of Cuban Vascular Flora*, with the collaboration of the Atlantic Botanic Garden of Gijón, Spain, accounting for 1414 categorised taxa (20% vascular flora), and from them, 997 are threatened (14% total vascular flora) (Berazaín Iturralde *et al.*, 2005).

Conserving plant diversity

Target 7 GSPC

The garden network has also collaborated in identifying the flora of five protected areas:

- Orchid flora of Pinar del Río province (316 taxa)
- Orchid flora of the mountains Cienfuegos province (89 taxa)
- Fern flora of the Banao mountains in Sancti Spiritus province (254 taxa)
- Flora and vegetation of La Isleta of Las Tunas province (300 taxa vascular plants in seven vegetation types)
- Flora and vegetation of Monte Cabaniguán in Las Tunas province (287 taxa vascular plants in 10 vegetation types)

This work included a survey of threatened palms (38 taxa) in the national system of protected areas and the monitoring of 19 species in different ecosystems.

The garden network collaborates with national authorities managing the protected area system in Cuba in supplying this information. Collaboration with all sectors both locally and nationally is a key recommendation of the *International Agenda* for coordinating plant conservation initiatives.

Target 8 GSPC

Ex situ conservation of wild plants is a central and unique role of botanic gardens and contributes to Target 8 of the GSPC '60 per cent of threatened plants in accessible ex situ collections . . . preferably in the country of origin;'. Gardens have the necessary botanical and horticultural knowledge to undertake species recovery plans and in situ conservation through the use of their collections.

A total of 83 endemic and threatened taxa have been cultivated for the first time in Cuban botanic gardens. The most important collections are ferns, boxwoods and species from the serpentine vegetation of Villa Clara and Nipe.

A genetic field bank of western Zamiaceae: *Microcycas calocoma* (156 individuals), *Zamia amblyphyllidia* (26), *Zamia integrifolia* (177), *Zamia ottonis* (40) and *Zamia pygmaea* (35) has been established in the National Botanic Garden.

All possible genetic diversity was gathered in the collection processes, as well as the correct documentation of plants.

Species recovery plans have been produced for 18 threatened species: *Acacia cupeyensis*, *Acacia roigi*, *Annona elliptica*, *Annona havanensis*, *Ayenia cajalbanensis*, *Broughtonia cubensis*, *Broughtonia ortgiesiana*, *Coccothrinax crinita subsp. crinita*, *Colpotherinx wrightii*, *Catesbaea gamboana*, *Euphorbia cubense*, *Ginoria koehneana*, *Harpalyce macrocarpa*, *Maytenus buxifolia subsp. cajalbanense*, *Plinia rubrinervis*, *Rondeletia gamboana*, *Spathelia brittoni* and *Trichilia pungens*. For each species, all the recommended issues of species recovery programmes were taken into account, as identified in BGCI's *A handbook for botanic gardens on the reintroduction of plants to the wild* (Akeroyd and Wyse Jackson, 1995) and repeated in the Annex 6 of the *International Agenda*.

This work will contribute to Targets 8 and 9 of the 2010 *Targets for botanic gardens*: '50 per cent of threatened plants included in accessible botanic garden ex situ conservation collections, including cultivated and genebank material, preferably in the country of origin' and 'Botanic gardens support and participate in recovery and restoration programmes for 5 per cent of the world's threatened plant species;'.

Promoting education and awareness about plant diversity

Target 14 GSPC

The education staff members of the Cuban botanic gardens held four workshops to develop the general

programme. Each garden also developed specific education programmes for the threatened species in the locality and the target groups involved. This work supports Target 14 for promoting education and awareness about plant diversity.

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The role of botanic gardens in the conservation of crop wild relatives

Right: *Allium* sp.
An example of a
CWR that is also
grown for
ornamental
purposes
(Photo: BGCI)



they contain over 6 million plant accessions and an estimated 80,000 plant species (Wyse Jackson, 1999). Many botanic gardens are playing an active role in both the in situ and ex situ conservation of crop wild relatives.

Botanic Gardens Conservation International (BGCI) focuses on the conservation of wild plant species. As a partner in a GEF-funded project on the in situ conservation of crop wild relatives, BGCI is already contributing to their conservation. Through its extensive network of botanic garden partners, BGCI also aims to promote the long-term conservation of valuable CWR germplasm.

CWR in botanic garden collections

Socio-economically important plant species include food, fodder and forage crops, medicinal plants, spices, ornamental and forestry species, as well as plants used for industrial purposes, such as oils and fibres. Many of these species, especially medicinal and ornamental plants, are widely grown in botanic gardens and form an important part of the ex situ conservation collections of such gardens. The role that botanic gardens are playing in the conservation of wild relatives of major food crops however is less clear. This paper provides the results of an initial investigation into the conservation of wild relatives of food crops by botanic gardens.

Introduction

Crop wild relatives (CWR) include taxa that are closely related to species of direct socio-economic importance as well as the ancestors of modern crops. Genes from CWR make a direct contribution to increasing the quantity and quality of our food supply and the species themselves form a vital part of both natural and agricultural ecosystems. Promoting the conservation of wild crop relatives constitutes one of the 20 agreed activities of the Food and Agriculture Organization's *Global Plan of Action for*

the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Agriculture (FAO, 1996). The conservation of crop wild relatives is an important component of the implementation of the International Agenda for Botanic Gardens in Conservation (Section 2.8) and contributes to several targets of the Global Strategy for Plant Conservation (Targets 8, 9 and 13).

Botanic gardens play a major role in the conservation of plant genetic resources. There are over 2,500 botanic gardens in existence worldwide and collectively

For this survey, only those crops included in Annex 1 of the *International Treaty on Plant Genetic Resources for Food and Agriculture* were considered (CGRFA, 2001)(Table 1). The Treaty, which came into force in June 2004, aims to ensure that plant genetic resources for food and agriculture, which are vital for human survival, are conserved and sustainably used and that benefits from their use are equitably and fairly distributed. The Treaty represents a multilateral system of facilitated access and benefit sharing for the crops and forages most important for food security. The crops listed in Annex 1 are those considered not only to be of highest value for food security but are also those for which there is a high degree of interdependence among countries with respect to their genetic diversity.

In order to carry out the survey, two main databases were consulted: BGCI's PlantSearch database (http://www.bgci.org/conservation/plant_search.html) and the SINGER (System-wide Information Network for Genetic Resources) database maintained by the International Plant Genetics Resource Institute (IPGRI) (<http://singer.grinfo.net/>).

CWR species in botanic garden collections

A survey was carried out to identify the number of species per food crop genus recorded in botanic garden collections using BGCI's PlantSearch database. This database currently includes 130,000 taxa from over 600 botanic gardens worldwide.

The survey revealed that species of all 50 genera are present in botanic garden collections, and in some cases large numbers of species are recorded. For example, 107 species of breadfruit (*Artocarpus*), 82 species of *Lathyrus* and 122 species of the *Brassica* complex, are listed in the database (Table 1).

A comparison was made with the number of species recorded in the SINGER (System-wide Information Network for Genetic Resources) database for the same set of species (Table 1). It can be seen that in many cases the two databases are

complementary, in that a number of genera with large numbers of species recorded in botanic garden collections, have few species recorded in the SINGER database. Taking the examples listed above, it can be seen that SINGER includes only 5 species of *Artocarpus*, 46 species of *Lathyrus* and 33 *Brassica* complex species. In other cases, many more species are recorded in SINGER than in BGCI's database. For example BGCI records only 85 species of *Ipomoea*, while SINGER has 340 and records for *Vigna* are 12 and 88 species respectively.

It can be seen from Table 1 that botanic garden collections hold a total of 1,283 species of selected crop plants – this compares with 1,453 species listed in SINGER – a database that contains only crop data. Given that the BGCI PlantSearch database presently holds records for only 600 or so gardens, out of the over 2,400 gardens that exist in the world, it is clear that botanic gardens are an important source of crop wild relative germplasm.

Rare and threatened CWR

The direct link between the BGCI PlantSearch database and the IUCN Red Lists from 1997 (Walter and Gillett, 1998) and 2004 (IUCN, 2004), allowed an analysis to be made of how many rare and threatened CWR species are included in botanic garden collections. As shown in Table 1, according to the 1997 data, a total of 73 rare and

threatened species can be identified in botanic garden collections out of a total of 593, whereas using the 2004 data (based on changed IUCN Red Listing criteria), this falls to only three species out of 65. This reflects the relatively limited capture of data on the global conservation status of plant species post 1997. IUCN is currently addressing the need to increase the rate of Plant Red Listing and BGCI is becoming increasingly involved in this activity. It will be important to prioritise useful plant species for Red Listing as recognised by IUCN and other partners in the Global Partnership for Plant Conservation (GPPC) (GPPC, 2005).

Other roles of botanic gardens in the conservation of CWR

Botanic garden collections can be a useful source of plants that are of local importance, even if not listed as rare and threatened. It can be seen from Table 1 that 9 botanic gardens have yams included in special collections. These include species such as *D. dumetorum*, *D. hispida* and *D. pentaphylla*, species that are used in times of famine. Other yam species found in botanic garden collections include *D. floribunda* and *D. balcanica* (a European species) that are useful sources of the steroid diosgenin – a source material for oral contraceptives.

A number of botanic gardens around the world are involved in extensive research and conservation on crop



Left: Artichoke wild relative growing in situ in Sicily, Italy (Photo: BGCI)

Top right:
Sections of 3
species of
breadfruit: from
left: *Artocarpus
camansi* (spiny,
many seeds),
middle, seeded
and seedless
forms of *A. altilis*
and right, seeded
A. mariannensis.



at the Breadfruit
Institute, National
Tropical Botanical
Garden, Hawaii
(Photo: Jim
Wiseman,
Breadfruit
Institute, NTBG)

Right:
Breadfruit
(*Artocarpus
altilis*) at the
Breadfruit
Institute, National

Tropical Botanical
Garden, Hawaii
(Photo: Jim
Wiseman,
Breadfruit
Institute, NTBG)

Below: Kiwi or
Chinese
Gooseberry
vines (*Actinidia*)
at Wuhan
Botanical
Gardens, China
(Photo: BGCI)



species. These include for example, the Fairchild Botanical Garden in Florida, U.S.A. which maintains an extensive collection of mango germplasm. As well as conserving mango diversity, Fairchild works to raise public awareness about this diversity through its annual mango festival and is working on the commercial development of the crop.

Other examples of botanic gardens with special crop-based programmes include:

- The National Tropical Botanic Garden, Hawaii, U.S.A. – breadfruit collection (*Artocarpus*)
- Wuhan Botanic Garden, China – kiwi conservation (*Actinidia*) (62 of 66 species are in China) – conservation and breeding
- Jardín Botánico de Chacras de Coria, Mendoza, Argentina - wild populations of tomatoes and potatoes, *Solanum ruiz-lealii*, *Solanum kurtzianum*
- Proyecto Jardín Botánico de la Ciudad Universitaria, Argentina – collections of *Phaseolus vulgaris* var. *vulgaris* and its wild relative *P. vulgaris* var. *aborigineus*

- Jardín Agrobotánico - Universidad Nacional de la Plata, Buenos Aires, Argentina - research and breeding on maize using its wild relatives

Conclusions

It is clear that botanic gardens are playing an important role in the conservation of a wide range of CWR. This includes not only the conservation of diversity, but also research and breeding to provide new crops and raising public awareness about the importance of CWR. Botanic gardens are also important players in the overall task of conserving CWR through the horticultural and taxonomic expertise they can provide and in many cases as repositories of indigenous knowledge – especially about the crops and their relatives that grow in the locality of the garden.

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Table 1. CWR in botanic garden collections (PlantSearch) and the SINGER database based on the crops included in Annex 1 of the International Treaty on Plant Genetic Resources for Food and Agriculture compared with the number of species in each genera given in the Plant Book (Mabberley, 1997) (see text for further information). (Brassica genera include Brassica, Armoracia, Barbarea, Camelina, Crambe, Diplotaxis, Eruca, Isatis, Lepidium, Raphanobrassica, Raphanua, Rorippa and Sinapis)

Crop	Genus	Number of species			Number of rare and threatened species				Number of gardens
		Mabberley, 1997	PlantSearch	SINGER	IUCN, 2004	IUCN 1997 (Walter and Gillett, 1998)	PlantSearch/IUCN 2004	PlantSearch/IUCN 1997	Number of gardens with special collections
Breadfruit	Artocarpus	50	107	5	5	5	1	1	5
Asparagus	Asparagus	140	86	2	1	13	0	6	2
Oat	Avena	25	14	19	0	3	0	0	2
Beet	Beta	13	5	10	0	5	0	2	1
Brassica	13 genera	370	122	33	2	118	0	31	7
Pigeon Pea	Cajanus	37	2	19	0	2	0	0	0
Chickpea	Cicer	40	16	43	0	6	0	2	1
Citrus	Citrus	16	18	21	1	3	0	0	20
Coconut	Cocos	1	9	1	0	0	0	0	3
Major aroids	Colocasia	8	11	2	0	0	0	0	3
	Xanthosoma	57	25	3	2	1	0	0	
Carrot	Daucus	22	7	1	0	3	0	0	0
Yams	Dioscorea	850	60	72	4	68	0	4	9
Finger millet	Eleusine	9	4	6	0	0	0	0	0
Strawberry	Fragaria	12	16	1	0	1	0	0	4
Sunflower	Helianthus	50	36	18	0	18	0	1	1
Barley	Hordeum	20	17	26	0	2	0	0	1
Sweet potato	Ipomoea	650	85	340	1	45	0	0	0
Grass pea	lathyrus	160	82	46	0	24	0	2	2
Lentil	Lens	4	2	6	0	0	0	0	0
Apple	Malus	55	62	20	3	5	1	3	48
Cassava	Manihot	98	15	104	0	69	0	1	2
Bannana	Musa	35	51	22	0	3	0	1	13
Rice	Oryza	18	5	27	0	3	0	0	0
Pearl Millet	Pennisetum	130	23	32	0	5	0	0	0
Beans	Phaseolus	36	28	53	3	2	0	1	0
Pea	Pisum	2	2	4	0	0	0	0	1
Rye	Secale	3	6	4	0	5	0	1	1
Potato	Solanum	1700	190	250	43	129	1	9	1
Eggplant	Solanum								1
Sorghum	Sorghum	24	15	19	0	2	0	0	0
Triticale	Triticosecale		0	0	0		0	0	0
Wheat	Triticum	4	23	17	0	3	0	2	3
	Agropyron	15	9	17	0	9	0	0	
	Elymus	150	36	43	0	11	0	0	
Faba Bean/vetch	Vicia	140	77	75	0	23	0	5	0
Cowpea et al.	Vigna	150	12	88	0	4	0	0	0
Maize	Zea	4	5	4	0	3	0	1	0
Total		5098	1283	1453	65	593	3	73	131

Botanic gardens in the age of restoration: supporting Target 8 of the GSPC



Above and top: Argyle Diamond Mines (Rio Tinto) are the biggest producer of natural diamond in the world. Research by Kings Park scientists resulted in the first restoration of spinifex (*Triodia* spp.) at the minesite (Photo: KPBG)

Is there a role for botanic gardens to use their horticultural and scientific capacity to partner with the mining industry for capacity building restoration science? In this article I explore how Kings Park and Botanic Garden (KPBG) linked and partnered with the mining and natural resource sector to support restoration research which is difficult to fund from other sources – ultimately leading to public good benefits in restoration and conservation of biodiversity.

This work combines the skills of the botanic garden for integrated conservation (Section 2.6) and in particular research (Section 2.7) as part of the International Agenda for Botanic Gardens in Conservation. Restoration programmes support Target 8 of the Global Strategy for Plant Conservation (GSPC). Further, there is a specific target for restoration programmes in botanic gardens which highlights this role: Target 9: 'Botanic gardens support

and participate in recovery and restoration programmes for 5 per cent of the world's threatened plant species;' (see page 4).

Natural resource companies (e.g. minerals, coal, stone, sand, gravel, oil, gas, timber) worldwide struggle to match the pace of landscape alterations with the generation of robust, science-based restoration and ecosystem reinstatement. This is no more apparent than in biodiverse ecosystems of Western Australia, such as the global biodiversity hotspot of south western Australia, or the resource 'hot-spot' in the Pilbara region of Western Australia where the impact of the mining sector on landscape-level changes and species losses is significant. And with \$53 billion earmarked in the next 5 years for resources development in Western Australia the task of matching science with ecosystem restoration is daunting.

A recent analysis of one company's mining restoration in biodiverse heathland communities in the south west of Australia indicated that at most, only 17% of the pre-mined species diversity was being reinstated. For large scale impacts such as in the Pilbara region of Western Australia, now one of the world's leading areas for the production of iron ore, dominant understorey species such as the ubiquitous spinifex grasses (*Triodia* species) are rarely if ever being effectively reinstated in post-mined sites.

For global mining houses the challenge remains - providing effective, on-site post-mined restoration which match corporate environmental goals. For many mining operations there is a conspicuous absence of ecologically rigorous and sustainable restoration, underpinned by scientifically robust completion criteria that guarantee restored ecosystems remain resilient and species comparative. Mining companies more than ever, need to embrace science-based ecological restoration particularly if they operate in biodiverse wildlands.

For biodiverse ecosystems there is often little or limited knowledge of restoration ecological principles. Although restoration ecology is now a core discipline taught at many levels and there are restoration ecologists the world over, it is still only decades old as a discipline. The science for effective and sustainable restoration ecology is now one of the fastest growing areas in the natural sciences. The world conference on ecological restoration (under the auspices of the Society for Ecological Restoration International) held in Spain (September, 2005) was testament to the extraordinary diversity and breadth of research being undertaken in the restoration sciences (SER, 2005).

Is there a role for botanic gardens in aligning their science programmes with the demands and needs of global mining restoration ecology? KPBG developed a partnership with the

mineral sands (titanium) extraction industry in 1984 when the company was attempting to restore the hidden beard heath (*Leucopogon obtectus*, Ericaceae) a rare species threatened by their mining operation. The research programme spanning a decade, resulted in an improved understanding of the genetic diversity, seed biology, specialised ericoid mycorrhiza and role of fire in the recruitment of the rare species. Importantly the programme developed into larger research programmes involving restoration ecology of Ericaceae across many other companies in the mining industry in Australia. Significant and lasting benefits of the programme included improved methods for topsoil handling to optimise mycorrhiza and species recovery. With mining industry support there was capacity for KPBG scientists to establish conservation principles and management for rare and threatened Ericaceous species in non-mining situations.

Today KPBG has established restoration ecological programmes with the mining sector resulting in a broad raft of research competencies in the conservation and restoration sciences. Core disciplines that have continued to evolve and develop in partnership with the mining sector include – provenance delineation for seed collection programmes; propagation science including tissue culture of recalcitrant species; mycorrhiza science particularly in restoration of orchids; seed science and technology including dormancy alleviation, optimisation of broadcast seeding technology and principles for seed-banking. Benefits of these associations with industry have extended to developing scientific capabilities for managing the conservation estate. For example, KPBG's considerable restoration skills with industry was part of the logic in 1998 in bringing under their management and control one of the more significant urban bushland reserves at Bold Park. Significant portions of this 437 ha reserve were in an advanced stage of degradation due to loss of native species cover and weed encroachment. Using the seminal science developed with the mining sector, KPBG scientists have adapted outcomes to suit the unique issues facing urbanised conservation reserves.

A critical factor in deriving a successful research partnership is the principle of 'adaptive management'. Essentially 'learning by doing', adaptive management provides a mechanism where industry endusers enlist scientists to work on a restoration issue. By installing experiments where the outcomes are then tested by minesite operators, the results are then returned to the scientists. Scientists then adapt and modify the next series of experiments on the basis of the new 'field knowledge'. Adaptive management challenges scientists to fast-track research and interact with field operators to achieve field capable and practical solutions.

The mining sector can provide benefits to develop and enrich research programmes in botanic gardens. However the association requires a mature appreciation by industry that scientific solutions to complex biodiverse restoration issues require dedicated and often substantial funding within realistic timeframes. Equally, it behoves botanic gardens scientists to fairly represent to industry the critical and necessary science to deliver effective restoration outcomes.



Left: Restoration being undertaken by KPBG on Airlie Island off the northwest coast of Australia for Apache Energy who run an oil facility on the island. The pernicious weed, buffel grass (*Cenchrus ciliaris*) was successfully controlled using selective herbicides and reintroducing native species (Photo: KPBG)

Only through partnerships with scientists, particularly those in botanic gardens where the focus in research is practical solutions to global and local conservation issues, will the mining industry achieve environmental outcomes to match the expectations of the communities in which they operate.

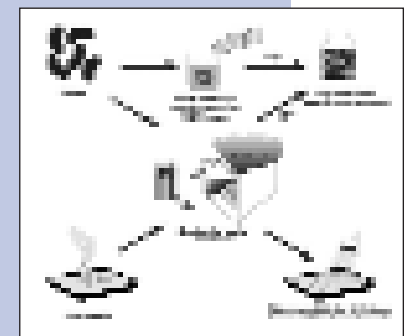
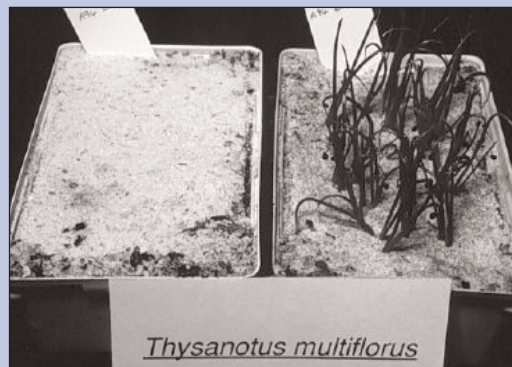
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Smoking for Restoration

Support by the mining sector was critical in the early research programmes by KPBG that established smoke as a key agent in germination of Australian native species. Ultimately the research led to the discovery in 2004 by a team from the botanic garden and local universities of the key chemical agent in smoke responsible for eliciting germination. Global agrochemical company Dupont is now evaluating the benefits of the discovery for improving seed performance in agricultural species.



Smoke application to seeds of the Western Australian fringed lily (*Thysanotus multiflorus*). Smoke deposited during a bushfire stimulates germination of a wide variety of native species. By applying contact adhesive (adhesive paper) to the soil surface after a fire, the single layer of adhering soil contains sufficient germination stimulant to germinate seed. Without (left) and with (right) (Photo: KPBG)

Above: Smoke can be applied in a number of ways to stimulate seed germination for mining restoration

Developing an Invasive Plant Policy at a botanic garden: lessons learned



Above and top, page 23: *Aquilegia caucasica* (page. 23) and *Campanula latifolia* (above) were collected in the Republic of Georgia, passed weed risk assessment and have been added to the collection (Photos by Boyce Tankersley)

With the publication of the *Global Strategy for Plant Conservation* (GSPC), the profile of plant conservation and the role of gardens in achieving conservation targets have been raised. Many botanic gardens and arboreta have adopted conservation as part of their mission and are evaluating their practices through this prism. For gardens that are developing or maintaining collections from geographically diverse regions, the potential of introducing an invasive species has become a major concern. Like many gardens, the Chicago Botanic Garden's horticultural collection includes species appropriate for our climate from around the world. To build the collection, the Garden has participated in exploration trips to countries in Asia and Europe, as well as other parts of the United States, to bring back new plants with horticultural merit. Because imported species may become invasive (escape cultivation and have a negative environmental impact), the Garden has developed and implemented an invasive plant policy. In this article, I present some suggestions for gardens developing invasive plant policies based on our experience.

This work supports the *International Agenda for Botanic Gardens in Conservation* which addresses the problem of invasive alien plants (Sections 2.9 and 2.11 and GSPC Target 10. This specific concern of botanic gardens is highlighted in the *2010 Targets for botanic gardens* which requires that 'All botanic gardens carry out invasive species risk assessments of their collections and management practices' (Target 11) and 'Botanic gardens contribute to best practice for control programmes for at least 100 major invasive species that threaten plants, plant communities and associated habitats and ecosystems' (Target 12) (see page 4).

Building a team and setting parameters

In developing our team, we found it beneficial to bring all the "stakeholders" to the discussion. This allowed the policy we developed to be accepted by everyone. The process involved members of the senior staff (important for conflict resolution) and representatives from the horticulture, collections, conservation science and ornamental plant research departments.

In developing our policy, we found it useful to explicitly define the species about which we were concerned. For our policy, we use the following definitions:

- **Native** (indigenous) – a species that was present in North America prior to European settlement or has arrived since through natural means of dispersal.
- **Non-native** (exotic, alien, introduced) – a species that was brought to North America by humans, either deliberately or accidentally.
- **Naturalised** – a non-native species, or native species from another region of the country, that has become established in disturbed areas and/or native communities.
- **Weedy** – a species that readily spreads, especially in disturbed areas, but generally does not pose a threat to the integrity of native plant communities.
- **Invasive** – a species, usually non-native, that is able to establish itself within existing native plant communities and is posing a threat to the integrity of the community.

We focused on plants that are known to be invading, or likely to become invasive in the Chicago area and defined our region of concern as the 22 county areas used in our local flora, *Plants of the Chicago Region* (Swink and Wilhelm, 1994).

Making a list and checking it twice

We began by reviewing several invasive plant lists from the upper Midwest and through a series of discussions, and occasionally photo documentation for proof, came to a consensus on a list of



plant species that we believe are invasive in our region. We review our list annually, making additions and deletions as new information becomes available. Most of the species on our list were not in our collection. For those that were found on our grounds, one of three courses of action was assigned: remove, phase out, or evaluate. Species that we felt posed the greatest threat have already been removed and replaced. Species that pose a lesser invasive risk and form significant structural features in landscape are being phased out over the next five to ten years. We will evaluate, through our plant evaluation programme, any taxa where invasiveness is suspected, but the risk posed by each cultivar is not known. In total, less than 0.3% of taxa in our collection are being removed, and replacement offers the opportunity to expand our collection.

Preventing new invasions

It was important that our policy also addressed assessing the risk of new introductions. Plants enter our collection through plant exploration trips, from commercial sources and from *Index Semina* (seed exchange)



orders. Our list serves as the first screen; no species or cultivar (unless it is a documented sterile cultivar) of an invasive species on our list is added to the collection. For taxa new to the Chicago region, the Garden performs a risk assessment (Figure 1) using a slightly modified version of Widrlechner's revision of the Reichard and Hamilton (1997) model (Widrlechner, USDA-ARS, pers. comm.). Any species new to the United States undergoes in ground evaluation for at least four years after reaching reproductive maturity in addition to the risk assessment.

Spreading the word

It is important that all garden staff understand and follow our policy. We have posted the policy on our website and sent information about invasives to all departments. We have distributed our invasive list to all instructors in our education programs to ensure they don't recommend an invasive species. The invasive team reviews catalogues for plant sales and the gift shop, including materials used in dried flower arrangements. We have also discontinued our *Index Seminum* programme, recognising that our native plants may become invasive elsewhere.

It can be both challenging and rewarding to develop a botanic garden invasive policy. We are confident that we have substantially minimised the risk of any

Chicago Botanic Garden plantings causing environmental problems for our community, thus strengthening our conservation mission without compromising our horticultural display.

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For further reading

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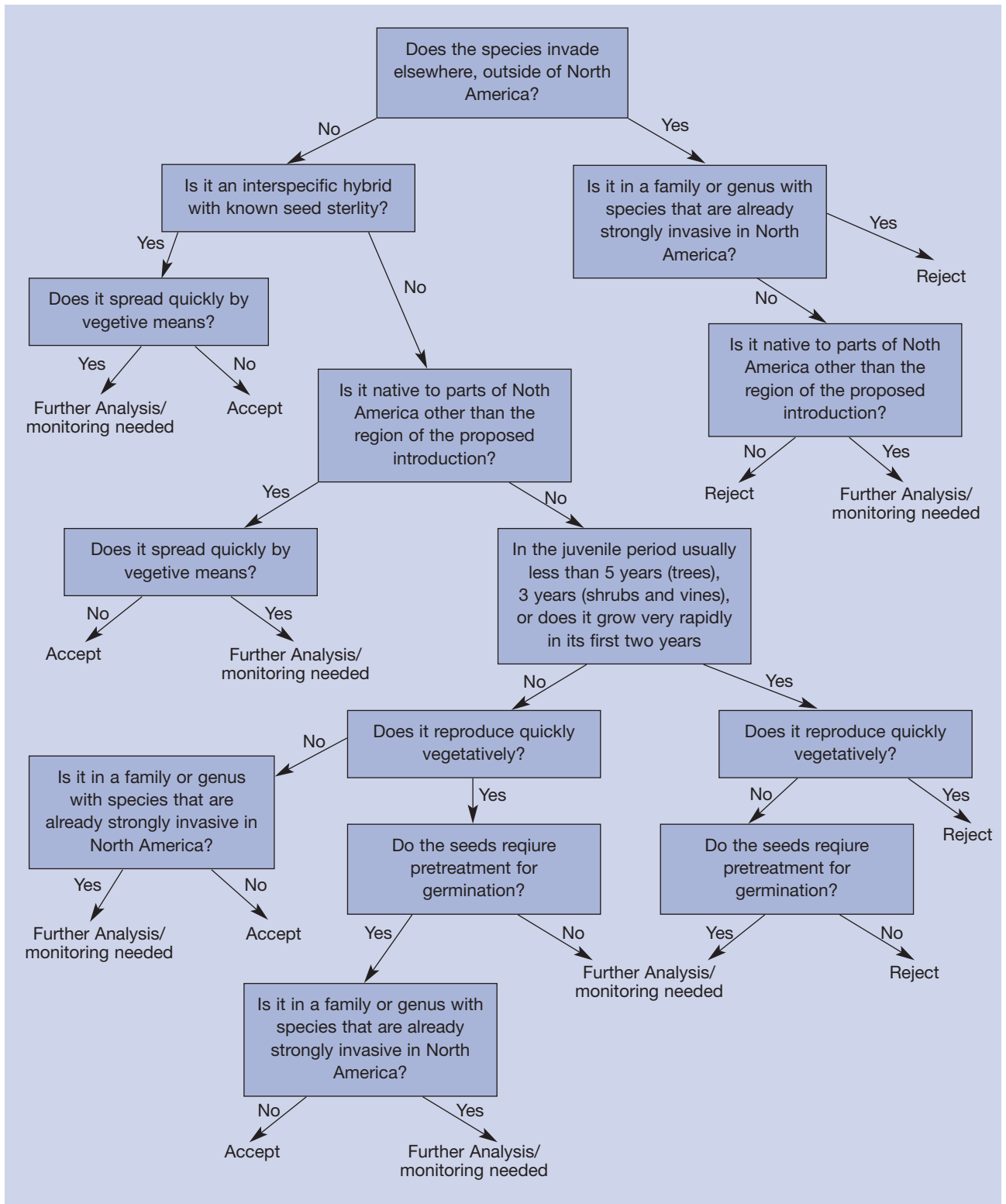
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Left:
Buckthorns
(*Rhamnus cathartica*. [pictured] and *R. frangula*) are on the Garden's "Remove Immediately" list. Both are illegal to plant deliberately in Illinois. Continuing efforts will be required to prevent recolonisation of both species in minimally-managed areas of our grounds (Photo: Chicago Botanic Garden)

Bottom left:
Elderberry
(*Sambucus ebulus*) failed our plant evaluation due to prolific spread by rhizomes; shows excavated rhizomes produced by three individuals in one growing season (Photo: Mark Rudy)

Figure 1. Decision tree from Reichard and Hamilton (1997). Our modifications, based largely on those of Mark Widrlechner, USDA-ARS, Ames, Iowa (pers. comm.), include:

- If a species requires further analysis and is not from a region with a similar climate (based on Koppen Climate Classification (Koppen, 1936), then accept.
- If a species requires further analysis and has fleshy bird-dispersed fruits, then reject.
- If a species is rejected from the right side of the tree and does not have fleshy bird-dispersed fruits, then requires further analysis.



Training and capacity building for conservation in Asia: implementing Target 15 of the GSPC



The *International Agenda for Botanic Gardens in Conservation* explicitly states that 'Botanic gardens have an important role to play in building capacity for the maintenance of biodiversity' (Section 2.9). This includes building the capacity of their own staff, sharing skills with other gardens and developing training programmes for national and international courses.

The achievement of the targets of the *Global Strategy for Plant Conservation* (GSPC) will require very considerable capacity building in both training and access to adequate facilities for plant conservation. The *2010 Targets for botanic gardens* highlight the importance of 'Appropriate resources and facilities developed to enable botanic gardens in every country of the world to achieve the targets of the *International Agenda* and the GSPC' with two sub-targets: 'Botanic gardens develop programmes to deliver training and capacity building in plant

conservation' and 'Double the number of trained botanic garden staff working in conservation, research and education' (Target 19, see page 4).

Since the publication of the *International Agenda* botanic gardens have provided not only training but also the appropriate facilities for promoting education and awareness about plant diversity and the recovery and restoration of plant diversity.

A significant aspect of BGCI's *Investing in Nature* programme in the Asia region has been the provision of training programmes at an in-country and regional level to increase their capacity for conservation. In doing so, we have sought to provide training relevant to identified priority areas, obtain good regional and local support and provide opportunities for participants to effectively network. The latter has happened both during the courses and often more importantly during the breaks. In developing the training programmes, BGCI has not only sought to involve the botanic garden community but also other organizations and individuals that are doing work relevant to the training.

An important aspect of all training workshops is that they must address a specific need in improving skills and a measurable outcome. While the provision of information alone can be useful, it is still necessary to give participants guidelines on how to use the information they are being given

and fully explain its relevance. This can sometimes result in the repetition of information, but that can often assist in ensuring that the information is understood.

The following three case studies are of training courses that were run to achieve a specific in-country outcome.

Case Study 1: Interpretation in Chinese Botanic Gardens

Botanic gardens are visited by over 200 million people a year which provides a good opportunity to raise public awareness about the importance of plant diversity and the need for its conservation among their visitors. As a part of the *Investing in Nature* programme, BGCI funded exhibitions to be hosted by different botanic gardens in China, where visitor numbers are rapidly growing as botanic gardens take on the public education role. At the commencement of this programme, a training workshop was held at the Shanghai Botanic Gardens in 2003 to assist botanic garden staff to develop plans for their exhibitions. The exhibitions are intended to highlight the importance of China's botanic gardens, Chinese plants (economically, culturally and aesthetically), links between plants and local communities in China and the threats faced by plant diversity in China by presenting the plant conservation work undertaken by the garden. While this provided a good introduction to the subject of

Right: Visit to a sacred grove in the Western Ghats during the translocation workshop held at Pune, India (Photo: Tricia Hogbin)

Left: BGCI
*Investing in
Nature* Teacher
training course
in Bogor
Botanic Garden,
Indonesia
(Photo: BGCI)



interpretation, it was recognised that further training would still be required to ensure that the botanic gardens produced effective exhibitions.

In response to this, another training workshop was organised at the Nanjing Botanic Garden (Mem Sun Yat-Sen) in 2004. The objective of the workshop was to specifically equip the participants to plan and develop an interpretation display for their botanic garden. It was intended to make participants aware that effective interpretation involves the understanding of the target audience, themes and use of evaluation.

The workshop was a good opportunity for experience-sharing amongst botanic gardens staff and provided a stimulus to encourage botanic gardens to apply for exhibition funding.

The workshop was facilitated by staff from local gardens who shared their skills and experience. Ms Idy Wong and Sharon Chow, Kadoorie Farm and Botanic Garden, Hong Kong led the lively and interactive training at the workshop. Dr Jin Xiaobai (Beijing Botanical Garden) and Ms Li Mei (Nanjing Botanical Garden) provided case studies of interpretation projects from their gardens.

The thirty people from 18 Chinese botanic gardens who attended the workshop enjoyed the presentations, group activities and discussions. Most participants felt that they learnt how a botanic garden interpretative display could be produced with a minimal budget and how interpretation could

be evaluated. As a result of the workshop, there was also a noticeable improvement in the exhibition applications. The exhibitions produced after the workshop by the participants featured more cohesive themes and incorporated interactive activities which conveyed more effectively the plant conservation message. For example the Beijing Teaching Botanic Garden's exhibition on *Plants - the protector of the environment* included hands-on and sensory activities demonstrating the environmental functions of plants such as noise reduction, humidity control and pollution control. An evaluation of the exhibition conducted by the garden revealed that "80% of visitors could say that plants are ornamental, can be salt and alkaline resistant, conserve and purify water, reduce noise and be used to monitor changes in the environment".

Case Study 2: Teacher training in Indonesian Botanic Gardens

Building on the important and recognised education role for botanic gardens, effective interpretation is important as highlighted by the success of public exhibitions. Equally important is training for school teachers who use botanic garden visits in their teaching programmes.

The *Investing in Nature* programme in Indonesia has included several training courses to assist school teachers to make effective use of botanic gardens in Indonesia. The aims of such courses are to encourage teachers of nearby schools to use the gardens as outdoor

classrooms for students, and to foster closer ties between the teachers and botanic gardens staff, thereby paving the way for future garden-school collaborations. These programmes have a multiplier effect in that the teachers who are trained by garden staff will teach many classes during their career.

The course held in 2005 at the Bogor Botanic Gardens, Java, involved 43 biology teachers from 6 of the subdistricts in the immediate Bogor area. They included equal representation from private and government schools, and elementary and junior high schools. The informal nature of the course sessions and the environmental games in the gardens helped the teachers network and interact with each other and the staff of the garden and several NGOs. The latter included organisations such as Rimbawan Muda Indonesia, a well-established organisation focusing on children's environmental education, who gave a session on children's games, and Klub Indonesia Hijau, an organisation focusing on biodiversity conservation, who gave instruction on bird watching during the garden tour. The *International Agenda* encourages networking at all levels to achieve their goals in maintaining plant diversity and ensuring sustainable living (Section 2.19).

Almost all of the teachers had previously visited the Bogor Botanic Gardens with their students, but the great majority had no clear idea of the functions of botanic gardens and their roles in conservation and education. The course not only imparted information and facts to the teachers, but gave them direct experience in how to show the gardens and collections to their students.

Similar teacher training courses held at another Indonesian garden, the Cibodas Botanic Gardens, have greatly increased school participation in the Pepeling Programme (children's environmental education) run by the Cibodas Botanic Gardens staff. The first course at Cibodas was held in 2003. Before the Teacher Training Courses were conducted, 220 students from 22 schools participated in the Pepeling Programme in 2002. In 2003, 470 students from 47 schools

participated in the same programme and in 2004, 1,280 students from 128 schools participated in the same programme! Another tangible benefit of this improved teacher-botanic garden relationship was the conducting of school outreach by staff of the Cibodas Botanic Gardens in 2005. Three elementary schools in the surrounding regencies were visited, and the schoolchildren were introduced to the importance of plants and participated in planting trees in their school compounds.

In a written survey at the end of the course, all the participants indicated that they had benefited from the course and desired continuation and follow-up meetings or courses in the future. All expressed the need for more cooperation between schools, teachers, botanic gardens and other stakeholders. They noted that two of the biggest problems facing the teachers are the lack of motivation and support for environmental programmes on the part of the government education departments and that Indonesian society has a deeply-ingrained culture of not caring for the environment and having a minimal awareness of the environment.

Courses such as these run at the Bogor and Cibodas Botanic Gardens are providing teachers with the skills and facilities for engaging students who will become the future environmental stewards and decision makers regarding matters of the environment and education in Indonesia.

Case Study 3: Translocation by Indian Botanic Gardens

In India, BGCI has, as a part of the *Investing in Nature* programme, been offering small grants to botanic gardens to assist them develop practical conservation activities as identified in the *International Agenda* (Sections 2.4-2.6). Applicants undertaking ex situ conservation were also requested to look at possible translocation (reintroduction) projects on threatened plants. This work supports the (GSPC Target 8) which includes a target of '10 per cent of them [threatened plant species] included in recovery and restoration programmes'.

To complement this work, an especially focused workshop entitled *Plant Translocation – enriching India's flora by returning rare plants to nature* was held in Pune in September, 2005. The purpose of the workshop was to provide support for those botanic gardens planning to carry out plant translocations, enable them to make best use of their research and horticultural facilities for effective plant restoration.

To focus the content of the workshop, a text prepared by the Australian Network for Plant Conservation, *Guidelines for the Translocation of Threatened Plants in Australia* (Vallee, 2004) was used. Three of the authors, Tricia Hogbin, Leonie Monks and Maurizio Rossetto also agreed to be presenters. In addition, several presentations on Indian translocation projects were given.

In addition to the presentations, the workshop also included more intensive sessions looking at the translocation plans for six species included in the small grants projects and proposed for translocation. These not only assisted the development of the plans but also highlighted the vast differences that exist between different projects.

Twenty people from 15 different Indian organisations attended, representing government botanic gardens, community botanic gardens, universities, forestry institutes and NGO's. Participants commended the very focused nature of the workshop and its immediate usefulness in terms of the work they were doing or proposing. One of the species identified for translocation was *Dipterocarpus bourdillonii*, a critically endangered tree species growing in southern India. Discussions held during the workshop not only assisted in reviewing the work that had been done to date, but also identified the opportunity for another of the organisations that attended the workshop to provide financial support for its implementation.

The workshop also provided a good opportunity to test whether guidelines that had been primarily prepared for use in another country were readily applicable to the situation in India.

In general, it was felt that they were, but had benefited greatly from the addition of the Indian case studies.

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Above: BGCI
Investing in Nature
Education
workshop held
in Nanjing, China
(Photo: BGCI)



International Agenda for Botanic Gardens in Conservation: Registration update

We are delighted to announce that since the 20th May, 2004, a further 153 organisations from 33 countries, have registered their commitment to use the *International Agenda for Botanic Gardens in Conservation (International Agenda)* as a framework for developing institutional policies and programmes for plant conservation (see Box overleaf). We are pleased that this includes organisations from nine countries that are new to the list: Azerbaijan, Honduras, Japan, Jordan, Kazakhstan, Senegal, Slovakia, Switzerland and Tajikistan.

This brings the total of organisations which have registered to 443 from 82 countries (16 December 2005). This figure will more than achieve BGCI's strategic objective and operational milestone for 2005 which was 400 gardens registered as participants in the *International Agenda for Botanic Gardens in Conservation* and illustrates the increasing awareness of the importance of botanic gardens for the conservation of plants and sustainable living.

The *International Agenda* has been widely welcomed by many conservation and botanic garden organisations and institutions worldwide. This has included the Convention on Biological Diversity (CBD) which has recognised the *International Agenda* as representing the botanic garden community's

response and contribution to the achievement of the *Global Strategy for Plant Conservation* (GSPC).

As proposed in the *International Agenda*, BGCI will not only record those organisations which have registered their commitment to the *International Agenda* but also their contributions to the achievement of GSPC as measured by the 2010 Targets for botanic gardens (see page 4).

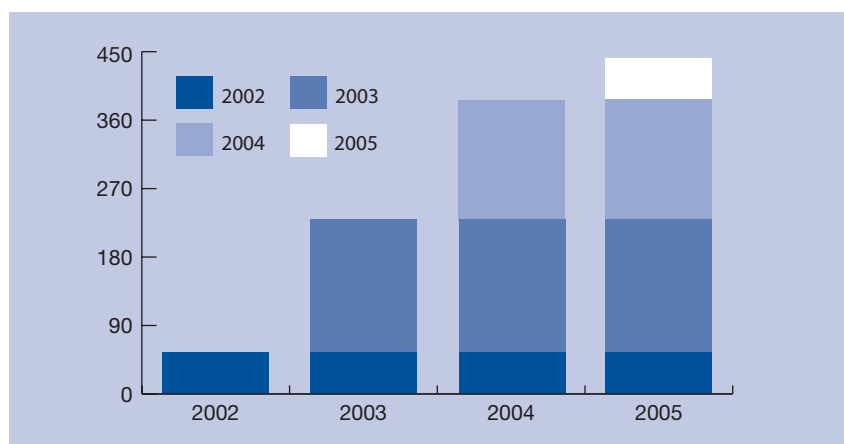
This work can be supported by BGCI publications such as the *Darwin Technical Manual for Botanic Gardens*, *Environmental Education in Botanic Gardens: Guidelines for developing individual strategies and A Handbook*

for Botanic Gardens on the *Reintroduction of Plants to the Wild*, many of which have been translated into other languages.

In this way, the activities outlined in the *International Agenda* will implement the 2010 Targets for Botanic Gardens and the GSPC.

If you have not already registered, please take the opportunity to complete the registration form (at the back of this issue of *BGjournal*) and send by mail or fax to: The Secretary General, Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond, Surrey TW9 3BW, U.K. Fax: +44 0208332 5956.

Number of signatories to the *International Agenda in Conservation*



Organisations which have registered their participation in implementing the International Agenda for Botanic Gardens in Conservation - 20th May, 2004 – 16th December, 2005.

Africa	Kenya	Kitale Nature Reserve, National Museums of Kenya Multiplant International Medicinal Conservation			Facultad de Ciencias Forestales, Universidad Nacional de Misiones Fundación Cultural Argentino Japonesa Jardín Agrobotánico de Santa Catalina Jardín Biológico de América Jardín Botánico "Carlos Thays" Jardín Botánico "El Viejo Molino" Jardín Botánico "Gaspar Suarez", Universidad Católica de Córdoba Jardín Botánico "Tierra del Sur"		
	Senegal	Jardin d'Expérimentation des Plantes Utiles			Jardín Botánico de Chacras de Coria Jardín Botánico de Córdoba Jardín Botánico de la Ciudad de Corrientes Jardín Botánico de la Facultad de Agronomía de Azul		
	Uganda	Entebbe Botanic Gardens Tooro Botanical Gardens			Jardín Botánico de la Facultad de Ciencias Agrarias de Esperanza Jardín Botánico de la Facultad de Ciencias Forestales de la U.N.S.E. Jardín Botánico de la Fundación Miguel Lillo Jardín Botánico de la Patagonia Extra-andina Jardín Botánico de la Universidad Nacional de San Luis Jardín Botánico EMETA Chemical Jardín Botánico Ezeiza Jardín Botánico Pillahuincó		
Asia	Azerbaijan	Central Botanical Garden of National Academy of Sciences of Azerbaijan			Jardín de Acimatación del Arido Patagónico Jardín de Cactus Catamarca Museo de Ciencias Naturales "Augusto G Schulz"		
	India	Bhagalpur University Botanical Garden					
		Centre for Biodiversity & Biotechnology					
		Jiwaji University Charak Garden					
		Maharaja Sayajirao University Botanic Gardens					
		Sahyadri Medicinal Plant Garden					
	Japan	State Forest Research Institute, Itanagar					
		Tropical Forest Research Institute, Jabalpur					
		Botanical Garden, Tohoku University					
	Jordan	Setsuman University Medicinal Plants Garden					
		The University of Tokyo Botanical Gardens					
	Tsukuba Botanical Garden National Science Museum						
Royal Botanic Garden							
Zhezkazgan Botanic Garden							
Penang Botanic Gardens							
Siit Arboretum Botanical Garden							
Botanical Garden of State National University of Tajikistan							
Peninsular Botanic Garden - Thung Khai							
Australasia and Oceania	Australia	Royal Tasmanian Botanical Gardens St.Kilda Botanical Garden			Brazil	Bosque Rodrigues Alves Jardim Botânico da Amazônia Fundação Jardim Botânico de Pocos de Caldas Instituto Agronômico - Núcleo de Pesquisa e Desenvolvimento do Jardim Botânico Jardim Botânico de Pipa Jardim Botânico de Porto Alegre Jardim Botânico de São Paulo Jardim Botânico do IB, UNESP, Botucatu Jardim Botânico do Recife Jardim Botânico Municipal de Bauru Jardim Botânico Municipal de Paulínia "Adelelmo Piva Jr" Jardim Botânico Municipal Francisca Maria Garfunkel Rischbieter Museu de Biologia Mello Leitão Museu Paraense "Emílio Goeldi" Parque Botânico do Ceará	
Europe	Denmark	Arboretum, Royal Veterinary and Agricultural University			Chile	Parque Botánico Omara	
	France	Jardin des Plantes - Muséum national d'Histoire naturelle			Costa Rica	Jardín Etnobotánico Dominga	
		Jardin d'Oiseaux Tropicaux			Cuba	Jardín Botánico Nacional	
	Ireland	L'Arboretum de Chevreloup - Muséum national d'Histoire naturelle			Honduras	Jardín Botánico y Centro de Investigación Lancetilla	
		Kilmacurragh Arboretum			Mexico	Alta Cima Botanical Garden Jardín botánico "Dr Alferdo Barrera Marin" Jardín Botánico "Ignacio Rodríguez de Alconedo" Jardín Botánico "Jerzy Rzedowski Rotter" Jardín Botánico "Rey Netzahualcōyotl" Jardín Botánico Campo Experimental "Todos Santos" Jardín Botánico Comunitario Jardín Botánico de Acapulco Jardín Botánico Francisco Javier Clavijero Jardín Botánico Regional "Cassiano Conzatti" de CIDIR-IPN-Oaxaca Jardín Botánico Regional "El Soconusco" Jardín Botánico Regional de Cadereyta "Ing. Manuel González de Cosío" Jardín Botánico Regional Xiitbal nek' Jardín Etnobotánico "Francisco Peláez R" Jardín Etnobotánico Museo de Medicina Tradicional y Herbolaría del INAH Jardín Etnobotánico Tzapoteca Proyecto Jardín Botánico del Desierto Chihuahuense	
	Museo di Storia Naturale della Calabria ed Orto Botanico						
	Poland	Forest Inspectorate Kudypy					
		Ogród Roślin Leczniczych Instytutu Roślin i Przetworów Zielarskich Śląski Ogród Botaniczny					
	Russian Federation	A.G. Genkel Botanical Garden of Perm State University					
		Arboretum of All-Russia Scientific Research Institute of Agricultural & Forest Melioration					
		Botanical Garden of A.M. Gorkiy Ural State University					
		Botanical Garden of B.M.Kozo-Polyansky Voronezh State University					
		Botanical Garden of Belgorod State University					
		Botanical Garden of Biology Institute, Komi Scientific Centre of Ural Branch of RAS					
		Botanical Garden of Kaliningrad State University					
		Botanical Garden of Omsk Agricultural University					
		Botanical Garden of Rodniki Anti-Tuberculosis Health Centre					
		Botanical Garden of Rostov State University					
Botanical Garden of Russian Scientific Research Institute of Medicinal and Spice Plants							
Botanical Garden of Samara State University							
Botanical Garden of Scientific Research Institute of Agricultural Problems of Hakasia							
Botanical Garden of Udmurtija State University							
Botanical Garden of Volgograd State Pedagogical University							
Dendrological Garden of North Scientific Research Institute of Forestry							
Dendrological park "Forest Steppe Experimental Plant Breeding Station"							
Dendrological Park of Novosibirsk Experimental Forestry							
Pyatigorsk Ecological Botanical Station							
Sakhalin Botanical Garden of Far Eastern Branch of RAS							
V.N. Rzhavitin Botanical Garden of Mordovia State University							
V.N. Sukachev Forest Institute of Siberian Branch of RAS							
V.V. Skripchinskiy Stavropol Botanical Garden of Stavropol Science Research Institute of Agriculture							
Volgograd Regional Botanical Garden							
Zabaikalskiy Botanical Garden							
Slovakia	Arboretum Mlynavy Slovak Academy of Sciences						
Spain	Jardín Botánico de Córdoba						
	Real Jardín Botánico Juan Carlos I						
Switzerland	Bern Botanical Garden						
	Conservatoire et Jardin Botaniques de la Ville de Genève						
Ukraine	Botanical Garden of Ukrainian State Forestry University						
	Krivoy Rog Botanical Garden of National Academy of Sciences of Ukraine						
	The State Dendrological Park "Alexandria" of National Academy of Sciences of Ukraine						
United Kingdom	Bristol Zoo Gardens						
	Chelsea Physic Garden						
	Glasgow Botanic Gardens						
Latin America and The Caribbean	Argentina	Administración de Parques Nacionales					
		Arboretum Guayacolec y Arboretum de la Facultad de Recursos Naturales					
		Asociación Civil Los Algarrobos					
		Bosque Autóctono "El Espinal"					
Northern America	Canada	Biodôme de Montréal					
		Calgary Zoo and Botanical Gardens					
		Canadian Museum of Nature					
		Columbia Valley Botanical Gardens					
		Harriet Irving Botanical Gardens					
		Jardín Roger-Van Den Hende					
		Jardins de Metis - Reford Gardens					
		Milner Gardens and Woodland					
		Musée de la nature et des sciences					
		The Niagara Parks Commission - Botanical Gardens and School of Horticulture					
		Toronto Zoo					
		Université de Montréal					
University of British Columbia Botanical Garden							
United States of America	United States of America	Adkins Arboretum					
		Association of Zoological Horticulture, Inc.					
		Bernheim Arboretum and Research Forest					
		Butterfly Pavilion and Insect Center					
		Chicago Botanic Garden					
		Heard Natural Science Museum					
		Reiman Gardens - Iowa State University					
Zoological Society of San Diego							

Book Notices

Juan Manuel López and David Bramwell, 2005

El Medio Natural terrestre de Gran Canaria
Cabildo de Gran Canaria, Spain

This attractive illustrated A4 booklet describes the natural history of Gran Canaria and its maintenance. It has been written by David Bramwell, Director of the Botanic Garden Viera y Clavijero and Member of the Board of Directors, BGCI together with Juan Manuel López. It is a useful public relations document which gives a clear message that the natural environment is an important resource for the community which, in this case, is being well-managed by the local government.

Ian Swingland (ed) 2004

Capturing Carbon and Conserving Biodiversity: the market approach
Earthscan, London, UK. 250 pp.
ISBN 1853839515 Price: £24.95
Contact: Earthscan, 8-12 Camden High Street, London NW1 0JH, U.K.
Tel: +44 (0)20 7387 8558,
Fax: +44 (0)20 7387 8998,
E-mail: orders@earthscan.co.uk,
Internet: www.earthscan.co.uk

This book argues that the 'flexibility mechanisms' of the Kyoto Protocol (1997) offer an opportunity to use a market approach to reduce emissions and sequester carbon as well as conserve biodiversity and create sustainable livelihoods. In this way the true value of the biosphere and the services will be appreciated through the free market. The known facts about carbon, climate, biodiversity and people are presented in an unbiased way by contributors from biologists and climatologists to lawyers, financial specialists, and corporate fund managers. All topics are discussed critically with careful thought to unintended consequences and recommendations for further quantitative studies. This book has been updated since it was first printed in 2003 and it has an introduction which discusses the most recent arguments especially those concerning carbon sinks. It is divided into three parts. The first on carbon and climate change covers the

global carbon cycle, the changes in the use and management of forests, an overview of the free market approach to public goods to achieve an optimal use of resources, the role of multilateral institutes such as The World Bank, other options for electricity generation, measuring, monitoring and verification of carbon benefits from the implementation of forest-based projects. The second part on environmental services covers the impact of land-cover on climate sources and sinks, the potential for agriculture to sequester carbon, proposal for defining the process and assignment of forest-carbon-sinks entitlements for indigenous people through land rights, the economic value of tropical forests, nature-based tourism, markets for 'green' products and developing markets for forest-environmental services especially in making the markets work for the poor. The final part on the Future Model provides a legal analysis, examines the efficacy of the existing legal frameworks to protect terrestrial ecosystems and discusses carbon and greenhouse-gas-trading markets.

Unfortunately, the Kyoto Protocol, at present, does not explicitly support biodiversity. Reforestation with monoculture plantations might result in more biodiversity loss in pasture lands or in degraded lands which would lose the potential for recreating the original ecosystem. Further, the Protocol includes afforestation and reforestation but not the protection of threatened native forests which means forests in developing countries are more vulnerable to degradation and clearing. However, many carbon trading schemes have been set up and botanic gardens might be in a position to monitor carbon benefits and help broker land-use projects. Gardens could also be beneficiaries of emission-trading programmes for projects such as restoring native forests.

This book provides many useful insights into increasing carbon stocks or avoiding carbon emissions for agricultural lands and forests. For example, sustainable management practices can increase

carbon stocks through zero tillage methods (increases the soil organic matter) and arable agro-forestry (increases woody biomass) and reduction of direct and indirect energy use (commercial fertiliser, pumped irrigation and mechanical power) will reduce emissions.

Russell A. Mittermeier, Patricio Robles Gil, Michael Hoffman, John Pilgrim, Thomas Brooks, Cristina Goettsch Mittermeier, John Lamoreux, and Gustavo A.B. da Fonseca, 2005

Hotspots Revisited: Earth's Biologically Richest and Most Threatened Terrestrial Ecoregions

Conservation International, Washington, DC, U.S.A. ISBN: 9686397779 (English)
ISBN: 9686397787 (Spanish)
Price: \$65.00 (includes postage in continental USA)

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E-mail: j.lucena@conservation.org,
Internet: <http://www.conservation.org>

This book presents the results of a four year re-analysis of the biodiversity hotspots, which originally appeared in the original *Hotspots* book in 1999, and provides updated information, and refines and reconfigures the hotspot boundaries. *Hotspots Revisited* identifies 34 regions worldwide, increased from the original 25 in the 1999 study. A hotspot has to contain at least 1500 species of vascular plants as endemics and has to have lost at least 70% of its original vegetation. Hotspots have been added because the threats have increased or there is new information on the flora and vegetation. The authors estimate that 150,000 species of vascular plants - half the world's plants - are confined to hotspots.

Identifying hotspots is only a beginning and Conservation International has defined a planning process to establish 'targets of conservation outcomes' at the

species, site and landscape levels. This moves from the global to the local scale where botanic gardens are involved in the conservation assessment of species for conservation planning.

Conservation International also has an informative website on the hotspot regions which includes the numbers of endemic plant species and references. However, this folio-sized book has such spectacular illustrations that it would be a welcome addition to any botanic garden library to highlight our conservation challenge.

Artyom Parshin, 2005

Solovki Garden: Russia's monastery, gulag and botanic garden on the edge of the Arctic Circle
Moscow, Russia 52pp. English version £7.95 (including postage and packing) from IBLF Solovki Garden Project, 28 Stratford Villas, London NW1 9SG, U.K. E-mail susan.causey@iblf.org. Russian version available

Artyom Parshin, the deputy director of the Peter the Great Apothecary Garden of Moscow State University has produced a very attractive book describing the Makarievskaya Pustyn Botanic Garden on the Solovki archipelago in the White Sea northwest of Arkhangelsk. Solovki is a World Heritage Site of natural and cultural importance and the garden and its historic features are being studied, restored and interpreted. This will include the extension of plant collections, research on Solovki's natural environment and education programmes on the need to preserve this unique environment. This book is supported by the Prince of Wales International Business Leaders Forum's 12-year programme of support for Russian culture; it was produced with the help of a grant from the Norwegian Barents Secretariat and HRH The Prince of Wales, who visited the garden in 2003.

Stephen Bass, Hannah Reid, David Satterthwaite, and Paul Steele (eds), 2005. *Reducing poverty and sustaining the environment: The politics of local engagement*. Earthscan, London. 318 pp. ISBN 987 1 844071 16 6 or 1 84407 116 2 (paperback) Price: £19.99 plus postage £3.50 U.K., £5.00 Europe, £7.50 North America and rest of world. Earthscan, 8-12 Camden High Street, London, NW1 0JH, U.K. Tel: +44 (0)20 7387 8558, Fax: +44 (0)20 7387 8998, E-mail: orders@earthscan.co.uk, Internet: www.earthscan.co.uk

Many of our most pressing conservation problems occur in areas of human deprivation. This book focuses on the role of politics in tackling these situations. It contains ten case studies which highlight the kind of issues faced in 'real life' situations, and how these can be addressed. These studies have been carefully selected to describe a range of situations, with low- to middle-income countries, many aspects of poverty, a range of actors, and a range of levels of political influence.

This book illustrates that political processes are often seen to cause problems, but rather than complain, we should engage with these processes to achieve both poverty alleviation and conservation. It also emphasises the need to adopt a long-term perspective, and to understand and work with stakeholders at the community level.

It is valuable in stressing the importance of considering politics for project success, a subject which perhaps is sometimes neglected. Therefore, it will be useful for anyone involved in conservation and/or development projects. However, readers are recommended to ensure they first have some understanding of the subject's context and concepts, such as exposure to ideas like institutional analysis, or a general understanding of issues in conservation and development.

Ruth Kiew, 2005.

Begonias of Peninsular Malaysia. Natural History Publications (Borneo) Sdn.Bhd. and Singapore Botanic Gardens 308 pp. ISBN 983 812 086 3 Price: US\$53.00. Natural History Publications (Borneo) Sdn.Bhd., A913, 9th Floor, Phase 1, Wisma Merdeka, PO Box 15566, 88864 Kota Kinabalu, Sabah, Malaysia. Tel: +60 088 233098, Fax: +60 088 240768, E-mail: info@nhpborneo.com, Internet: www.nhpborneo.com

Begonias of Peninsular Malaysia is a beautifully illustrated guide with colour photographs, line drawings and paintings of all 52 native species of this important horticultural genus. Thirteen species and one variety are described for the first time in the publication. Although the Begonias commonly cultivated in Malaysia are all exotics, the illustrations indicate the horticultural potential of native species. *Begonia jiewhoei*, a newly described species and one of the most beautiful begonias with "velvety malachite-green, silver-spotted leaves", is considered a good candidate for hanging baskets. The

case for conservation is also strongly made. Half the species of Peninsular Malaysia are considered to be Critically Endangered. Three of these species are of immediate concern as their forest habitats are threatened by agriculture and recreational activities. The author reaffirms that in situ conservation is always the best because it conserves the total community including the insect pollinators, soil micro-organisms and the precise conditions of micro-climate that favour the plant. However, ex situ conservation is also very necessary for Peninsular Malaysia's Begonias. Cultivation in botanic gardens will not only provide an insurance mechanism for the future of these plants but also draw attention to their attractiveness and urgent conservation needs.

Jose Luis Vivero, Ensermu Kelbessa and Sebsebe Demissew (comp.) 2005.

The Red List of Endemic Trees and Shrubs of Ethiopia and Eritrea
Fauna & Flora International, Cambridge, U.K. 23 pp. ISBN 1 903703 18 0. For further information, please contact Fauna & Flora International, Great Eastern House, Tenison Road, Cambridge CB1 2TT, U.K. Tel: +44 (0) 1223 571000, Fax: +44 (0) 1223 461481, E-mail: infor@fauna-flora.org, Internet: www.fauna-flora.org, www.globaltrees.org

The collection of information on tree species of conservation concern is vital for planning conservation action, especially in countries such as Ethiopia and Eritrea which possess a rich assemblage of plants. This Red List is one of the first in a planned series being produced by the IUCN/SSC Global Tree Specialist Group.

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International Agenda for Botanic Gardens in Conservation Registration Form

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*Generally applies to institutions in less developed countries

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*Contents of the Botanic Garden Management Resource Pack: *The Darwin Technical Manual for Botanic Gardens*, *A Handbook for Botanic Gardens on the Reintroduction of Plants to the Wild*, *A CITES Manual for botanic gardens*, *BGjournal - an international journal for botanic gardens (2 past issues)*, *Roots - environmental education review (2 past issues)*, *The International Agenda for Botanic Gardens in Conservation*, *Global Strategy for Plant Conservation*, *Environmental Education in Botanic Gardens*, *BG-Recorder (a computer software package for plant records)*.

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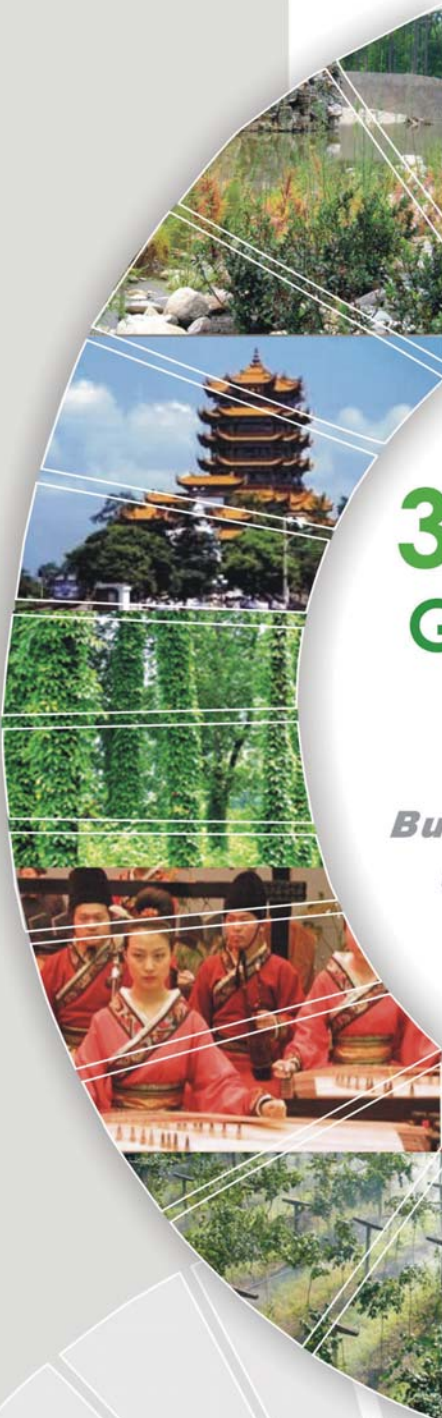
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3rd Global Botanic Gardens Congress

*Building a sustainable future:
the role of botanic gardens*

Wuhan Botanical Garden, China

April 16-20, 2007

Organized by

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