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**From policy to action:
the Global Strategy for Plant Conservation –
a conservation success story**



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EDITORIAL:

THE GSPC – A CONSERVATION SUCCESS STORY



In this International Year of Biodiversity, the challenges of global plant conservation remain immense. The threats to plant diversity continue to rise whilst the financial resources and skills available to tackle the problems are decreasing. In this issue of *BGjournal* we focus on the *Global Strategy for Plant Conservation* (GSPC) of the CBD. What has it achieved over the past eight years and what can we expect for its development and implementation in the future?

The greatest value of the GSPC has been to provide a well thought-out framework for plant conservation action at global to local levels. With a clearly articulated rationale and measurable targets, the Strategy was groundbreaking when it was agreed in 2002. Anyone and everyone can support the Strategy and it is truly remarkable the extent to which plant conservation agencies including botanic gardens and

NGOs have aligned themselves with the Targets. Ultimately implementation of the GSPC is the responsibility of the 188 Governments that have ratified the CBD. An increasing number of countries have developed specific responses to the GSPC – significantly raising the agenda for plants. The paper by Gustavo Martinelli in this issue highlights how a new National Centre for Plant Conservation in Brazil is addressing key targets of the GSPC. But in Brazil, as elsewhere in the world, the conservation of plant diversity remains a somewhat marginal issue and strengthened dialogue between scientists and policy makers about the urgency for action remains a priority.

BGCI continues to support the implementation of the GSPC by seconding a member of staff, Stella Simiyu, to the CBD Secretariat to act as GSPC Programme Officer. We act as the Secretariat for the Global Partnership for Plant Conservation, mandated by the CBD to coordinate and promote implementation of the Strategy at an international level and we have been closely involved in revision of the GSPC to take into account the impacts of rapid global change. The GSPC informs our own work programmes with BGCI being directly involved in implementation of Targets 2, 3, 5, 7, 8, 11, 14, 15 and 16. At a global level, we remain the lead facilitating organisation for Target 8 relating to *ex situ* conservation and restoration and I look forward to the publication of our major report on GSPC Target 8 in time for the 10th Conference of the Parties to the CBD in Nagoya in October this year. We also remain lead facilitating agency for Target 14 relating to education and public awareness – another target of great relevance to botanic gardens.

Botanic gardens are vitally important agencies for plant conservation worldwide, making major contributions to the GSPC as highlighted in this issue. The 4th Global Botanic Gardens Congress to be held in Dublin in June will be an excellent opportunity to renew our collective commitment to plant conservation for the next decade. We will discuss a revised version of the *International Agenda for Botanic Gardens in Conservation* and how this relates to broader initiatives of plant conservation in a time of rapid global change.

Despite all our work, huge challenges remain in raising the profile of the importance of plant diversity and the need to generate financial resources to prevent extinction on an unprecedented scale. BGCI is launching a new international Plants for the Planet Campaign, calling on individuals worldwide to sign up to support the GSPC. We aim to remind policy makers that plant conservation is important in every country of the world – please add your commitment to the Campaign at www.plantsfortheplanet.com.

Thank you

Sara Oldfield
Secretary General, BGCI

BOTANIC GARDENS AND THEIR RESPONSE TO THE *GLOBAL STRATEGY FOR PLANT CONSERVATION*

The GSPC has provided a framework for conservation action by botanic gardens from global to local level.

Introduction

It is generally recognised that botanic gardens, coordinated and supported by BGCI, played a significant role in the development of the *Global Strategy for Plant Conservation* (GSPC) and its ultimate adoption by the Parties to the Convention on Biological Diversity (CBD) in 2002. Since then the GSPC has provided a framework for action and stimulated new initiatives for botanic gardens, enabling an internationally coordinated approach to plant conservation (Wyse Jackson and Kennedy, 2009). It has also informed and influenced the work of BGCI and is a major focus of BGCI's outreach and communications with its membership. It is clear that botanic gardens have responded to the GSPC in various ways

and at different levels and there is no doubt that their actions, individually and collectively, at local, national and international levels have contributed to the achievement of many of the targets. This paper looks not only at the role botanic gardens have played in the implementation of the GSPC, but also investigates the impact the GSPC itself has had on the activities of botanic gardens, drawing on the results of a global survey carried out recently by a PhD student from Bangor University, Wales, coordinated by BGCI.

The global response to the GSPC

A shared rationale and framework for the global conservation work of botanic gardens has existed since well before the adoption of the GSPC, with BGCI publishing the *Botanic Gardens Conservation Strategy* in 1989. This was followed in 2000 by the *International Agenda for Botanic Gardens in Conservation*, which aimed to address the need for botanic gardens to become active participants in the implementation of the CBD and to contribute to sustainable development programmes nationally and internationally. In 2003 an *International Agenda* registration system was introduced, allowing botanic gardens to formally 'register' their commitment to plant conservation. Over 450 gardens from 83 countries have made such a commitment. Through implementation of the *International Agenda* botanic gardens contribute to



Preparing herbarium samples in Ecuador (Missouri Botanical Garden)

the achievement of the 16 targets of the GSPC. However, in order for this contribution to be more explicit, efforts were made to link the International Agenda directly to the GSPC and BGCI developed a series of global botanic garden targets closely aligned with the GSPC targets (Wyse Jackson, 2004). The *International Agenda* targets were adopted by botanic gardens in 2004 as a mechanism to monitor the global botanic garden contribution to the GSPC. These targets subsequently also provided guidance for the development of national and regional targets for botanic garden networks, for example in Mexico (see p 20-23) and in the North American region (Galbraith and Kennedy, 2006).

Botanic garden networks and the GSPC

Botanic garden networks exist at national and regional levels worldwide (see www.bgci.org/global/networks/). For many of these networks, the GSPC and the associated *International Agenda* targets proved to provide an ideal framework for the development of



Juttadinteria albata: propagation from cuttings in Namibia (H. Kolberg)

national and regional botanic garden strategies and action plans. Examples from Brazil and Mexico are provided in this issue (see p 8 and 20). While some networks address all 16 targets of the GSPC, others focus on specific targets, particularly Target 8. In the UK for example, PlantNetwork (the Plant Collections Network of the UK and Ireland) adopted a plan with eight targets aimed at the conservation of all the endangered plants in Britain and Ireland by 2010 (Jebb, 2005). The plan focuses on linking *ex situ* with *in situ* conservation and includes strong elements of protocol development, public awareness, education and partnership development, thus addressing GSPC Targets 3, 7 14, 15 and 16 as well as Target 8.



Examining plants at the National Botanic Garden of Wales

At the regional level, the *North American Botanic Garden Strategy for Plant Conservation* published in 2006 attempted to harmonise the GSPC, *International Agenda* and the Plant Conservation Alliance's *National Framework for Progress*. The North American Strategy brought together for the first time the American Public Garden Association (APGA), the Centre for Plant Conservation (CPC), BGCI, the Canadian Botanical Conservation Network (CBCN) and the Association of Mexican Botanic Gardens (Asociación Mexicana de Jardines Botánicos AMJB) in a strategic contribution to plant conservation. It was hoped that the Strategy would help to demonstrate the collective impact that botanic gardens in North America could have on the protection and conservation of native plants and plant communities. It was felt that by setting outcome-oriented and

measurable targets, botanic gardens in Canada, the United States and Mexico would be able to contribute significantly to the ultimate goal of halting the loss of plant diversity.

“ This North America Strategy will help to further progress toward the goal of providing a richer, more diverse world, one with greater resilience and more beauty than could be achieved in any other way. ” Peter Raven.

The GSPC and individual botanic gardens

At the individual level, many botanic gardens have embraced the GSPC and in some cases specific targets have been mainstreamed within their programmes. The in-depth review of the GSPC carried out by the CDB Secretariat in 2007-8, noted the success of the GSPC in allowing botanic gardens to engage in the work of the CBD (Secretariat of the Convention on Biological Diversity, 2009) and gardens such as the Royal Botanic Gardens, Kew and the Missouri Botanical Garden have produced publications highlighting their contributions to the GSPC. However the extent to which the large number of smaller and less well-resourced botanic gardens around the world have engaged

with the GSPC, and the influence it has had on their programmes is less well understood. For this reason, BGCI, together with Bangor University and RBG Kew, recently carried out a GSPC survey of botanic gardens.

Surveying botanic gardens

The survey was developed as part of a PhD research project focusing upon the role of botanic gardens in plant conservation. The aim of the survey was to collect information on botanic garden activities that contribute to the GSPC, with two specific objectives in mind:

- To investigate the degree of influence the GSPC has had upon individual botanic garden activities;
- To assess what activities botanic gardens are currently undertaking that contribute to each of the GSPC targets.

Over the past 10 years, BGCI has widely promoted the GSPC to its members and has supported many GSPC-related activities amongst its global membership. The leadership role of BGCI in relation to the GSPC has been recognised by the CBD and has been reported elsewhere (Leadley, 2005; Secretariat of the Convention on Biological Diversity, 2009). A further aim of the survey therefore, was to assess the extent to which BGCI's promotion of the GSPC has been reflected in action on the ground by its membership and to identify areas for greater focus in the future.

Box 1: Conserving species *in situ* – botanic gardens contributing to GSPC Target 7

Westonbirt Arboretum in the United Kingdom is well known for its world class collection of exotic trees and shrubs, many of which are rare or endangered in their native habitats. What is less well known is that the arboretum also includes areas of semi-natural habitats, managed to conserve their rare native species and thereby support the GSPC. These habitats include lowland broadleaved woodland and calcareous grassland, both of which are included in the UK Biodiversity Action Plan as Priority Habitats. Rare species such as the spreading bellflower (*Campanula patula*) and green-winged orchid (*Orchis morio*) are being conserved through active management of their habitats, particularly restoration of coppicing and traditional grazing.

As part of the international movement for the conservation of threatened plants, the staff of the **Albury Botanic Gardens in New South Wales, Australia** assist in the management and monitoring of the local population of the endangered Crimson Spider Orchids (*Caladenia concolor*). A fencing grant has enabled the area where the plants grow to be safeguarded from the impacts of vehicles and cattle. Staff assist with field work and further surveys, as well as dismantling unauthorised mountain bike trails, that some enthusiasts build in the garden's protected box-gum woodland. The local community has been involved with the project from the start and have always enjoyed the annual surveys for new plants in various locations.

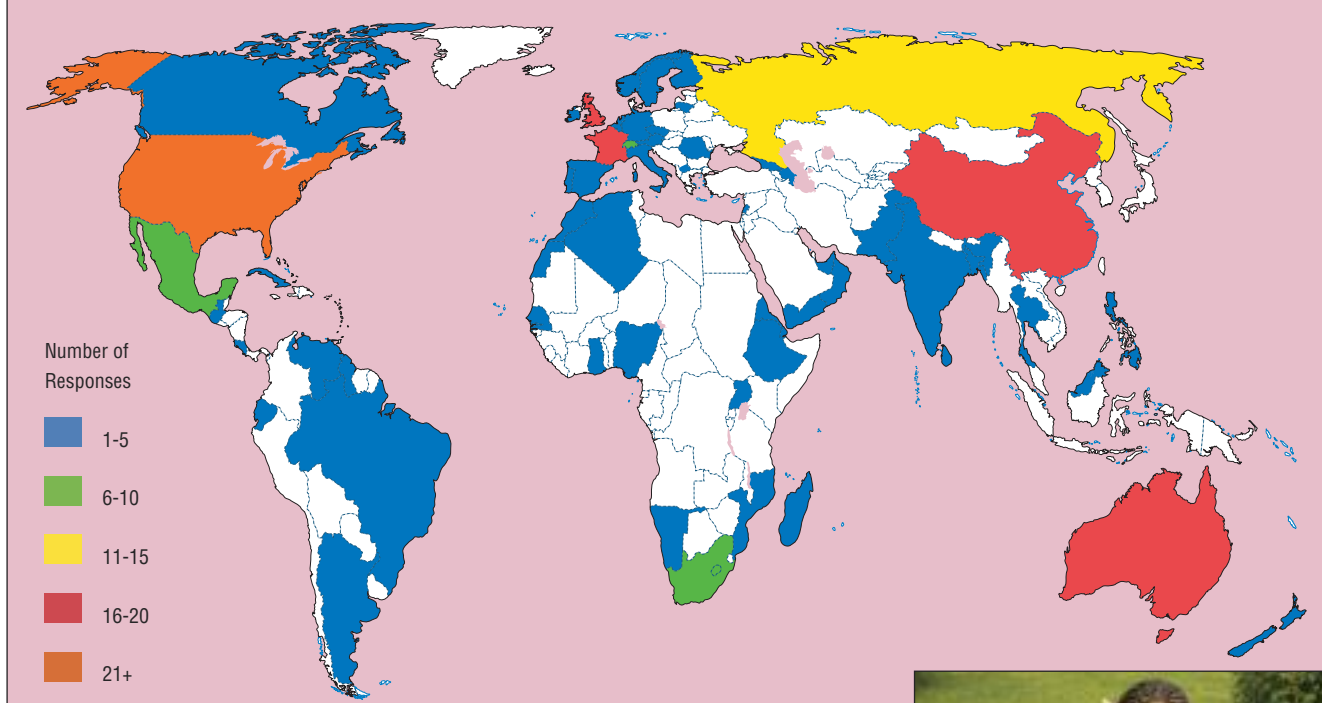


Figure 1. Number of responses to the GSPC survey by country

Method

The survey was developed online (www.surveymonkey.com) and a pilot study of ten botanic gardens was conducted. The questions were refined and the survey was distributed to BGCI members around the world, totalling 505 botanic gardens. The survey was translated into Spanish, French, Russian and Chinese and was publicised through the Kew On Course magazine, BGjournal and on the BGCI website. The results were submitted online and analysed using the statistical package R (Version 2.9.2).

Preliminary results

The response to the survey was excellent with information being provided by 252 botanic gardens, representing all continents (Figure 1). This has provided us with a comprehensive global overview of BGCI member gardens' activities in relation to plant conservation.

How influential has the GSPC been upon botanic garden activities?

The majority of botanic gardens indicated that the GSPC has been either very influential or fairly influential to their activities, with only around 25% indicating that the GSPC has had no influence (Figure 2). The next stage of this research will focus on identifying any common factors associated with a garden stating that the GSPC is not relevant to their activities.

Which targets are most relevant for botanic gardens?

To gain insight into the GSPC targets most frequently implemented, the Gardens were asked to provide examples of their projects contributing to each target. Figure 3 shows that almost all the targets are addressed by at least one botanic garden in each region of the world and illustrates the wide range of conservation activities being undertaken by botanic gardens (See Boxes 1-3). This encouraging finding indicates that the global botanic garden network coordinated by BGCI is actively contributing to all aspects of the GSPC.

The survey results indicate that Target 14 is the most frequently implemented target. This is not surprising as education



Enthusiasing children about plants

and public awareness programmes are often cited as a key role for botanic gardens. There are a substantial range of approaches to addressing Target 14, with the focus of many awareness projects on children's education. Academic education within botanic gardens is a feature of many of the larger gardens but also in some smaller gardens, particularly those affiliated with a University. For example, Rajshahi University Botanical Gardens in Bangladesh coordinates a plant conservation lecture and seminar programme for students of the Department of Botany at the Rajshahi University. The botanic garden has a very limited budget and small number of staff, but views their education work as a priority.

A roughly equal number of botanic gardens are implementing Targets 1, 8 and 16 (Figure 2). In relation to Target 1, several large botanic gardens (namely RBG Kew, Missouri and New York Botanical Gardens) are playing the lead role in synthesising a global working list of the known plant species, but many other botanic gardens are also contributing to this target at a more local or regional level. (See the example from



Caladenia concolor (R. G. Fleming)



Caladenia concolor (Jenny Benjamin)



Children in Rio de Janeiro Botanic Garden
(Brent Stirton - Getty Images WWF-UK)

Brazil on p. 8). Target 8 (*ex situ* conservation and restoration) is one of the two targets for which BGCI is the key facilitating agency and is generally considered to be the main 'responsibility' of botanic gardens. As a means to monitor progress towards this target, BGCI developed its PlantSearch database and to date, over 700 gardens around the world have contributed data to this. The work of individual botanic gardens in conserving threatened species *ex situ* not only contributes to the achievement of the target globally, but in many countries, this is being done in the context of national targets. For example, the role of Chinese botanic gardens in conserving Chinese species is discussed on pages 14-19 in this issue.

“Japan’s botanic gardens agree a target to conserve 50% of threatened Japanese plant species by 2012.”

Japanese Association of Botanic Gardens, 2007.

It is also clear that botanic gardens provide a significant contribution towards developing and maintaining networks for plant conservation (Target 16) and it is exciting to see botanic gardens continuing to create new networks. For example one new initiative led by the Gullele Botanic Garden in Ethiopia is the Horn of Africa Environmental Network. This project aims to develop a centre for training and networking, based at the Gullele Botanic Garden and involving six countries; Sudan, Eritrea, Ethiopia, Djibouti, Somalia/Somaliland and Kenya.

Box 2: Developing propagation protocols at the National Botanic Garden in Namibia - a contribution to GSPC Target 3

The National Botanic Garden of Namibia has over the past years become increasingly involved in the rehabilitation and restoration of mined areas. As part of this undertaking, propagation protocols for several rare and threatened indigenous species have been developed, for example *Juttedinteria albata*, which is endemic to the lower Orange River basin in Southern Namibia and *Salsola nollothensis*, a dune-stabilising shrub that occurs along the Southern Namib coastline.

Targets 6, 9 and 12 are the least frequently implemented by botanic gardens. These targets address the conservation and sustainable use of socio-economically plant species. As conservation resources are limited, and botanic gardens need to prioritise their activities, these targets may not fall within their remit. There are also other institutions that are more specifically addressing these targets. However, as many of the newest botanic gardens are located in the global south where these targets are more relevant and urgent, they may consider playing a greater role in contributing to these targets in the future.

Survey constraints

The response rate to the survey was over 50% of those directly informed (BGCI members), and as such, produces a very positive picture of the plant conservation work being carried out by many gardens, large and small, around the world. These gardens, as BGCI members, are well placed to both learn about and contribute

to the GSPC. However, it can be seen from Figure 3 that the response rate from the global south, and especially from Africa and India, was low and gardens from Europe and North America constituted 60% of the responses. Given that many new botanic gardens are being established in the south and although they may have limited infrastructure and funding, they do have the ability to contribute to the implementation of the GSPC (Chen *et al.*, 2009), this is clearly an area where BGCI may consider focusing more attention in the future.

Furthermore, the survey focussed on which GSPC targets botanic gardens are currently implementing, providing a useful assessment of the current situation. No efforts were made to assess or evaluate the success of such projects, and it is clear that ultimately measuring the outputs of projects is important to assess their impact (Kapos *et al.* 2009). Further research, using this survey as a basis, could provide a more detailed view of the success of botanic garden conservation projects in contributing to the achievement of GSPC targets.

Conclusions

The GSPC has provided a framework for the conservation activities of botanic gardens and their networks around the world and the recent survey has provided a 'snapshot' of relevant ongoing activities. There are a huge diversity of approaches being taken by botanic gardens to implementing the GSPC, but one of the clear findings of this research is that the global botanic garden community is playing a significant role in conserving threatened plant species. In this paper we have provided some examples of the work being carried out by botanic gardens

Campanula patula (Simon Toomer)



Box 3: Addressing the GSPC at the Jardín Botánico Regional de Cadereyta, Mexico

The work of this botanic garden contributes to several GSPC targets:

- Field work and the collection of herbarium samples, as part of a project entitled 'The flora of Bajío and its adjacent regions' - Target 1.
- Developing protocols for the propagation of 100 native species, 20 of which are threatened, in association with the local community – Target 3.
- *In situ* protection of 5 species of threatened endemic cactaceae, representing 25% of the total threatened cacti of the state of Queretaro – Target 7.
- *Ex situ* conservation of 25 species which are threatened in the region, 40% of which are endemic to the region, and 5 of which are involved in recovery programmes - Target 8
- Artificial cultivation of 7 species from the region listed under Appendix I of CITES – Target 11
- Talks and workshops aiming to increase the awareness of thousands of people each year – Target 14
- Maintaining, strengthening and increasing working relations with government bodies, academics and the private sector – Target 16.

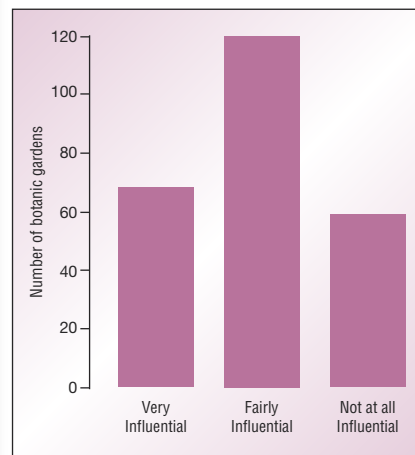


Figure 2: The influence of the GSPC on botanic garden activities

and have highlighted the importance of this work in meeting the 2010 GSPC targets. With the amendment of the GSPC targets for 2010-2020, we hope the contribution of botanic gardens will continue to be as active and vibrant.

Acknowledgements

Case studies highlighted in the text and in Boxes 1-3 are based on information provided during the GSPC survey, with additional details provided by Simon Toomer, Paul Scannel and Silke Rügheimer. We are grateful to these individuals and to everyone else who completed the survey.

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Traditional management of grassland in the UK (Simon Toomer)

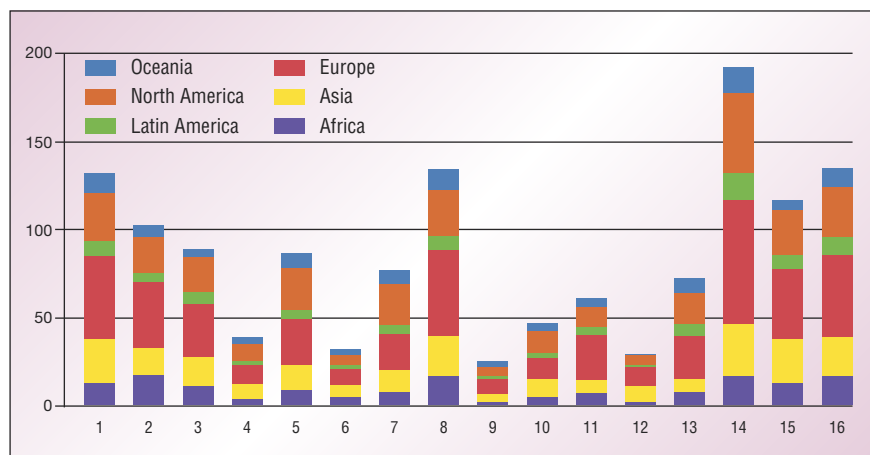
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Figure 3: The number of botanic gardens implementing the GSPC targets in different regions of the world





Worsleya rayneri – a critically endangered narrow endemic (Rio de Janeiro Botanic Garden)

CONTRIBUTIONS OF RIO DE JANEIRO BOTANIC GARDEN TO BRAZIL'S NATIONAL GSPC MAINSTREAMING PROCESS



Annatto is produced from the achiote tree (Bixa orellana) in Brazil

The National Centre for Plant Conservation is coordinating efforts to understand, document and conserve Brazil's plant diversity.



Introduction

At 202 years of age, the Rio de Janeiro Botanic Garden Research Institute (JBRJ) has a long history of contributing to the development of scientific knowledge and plant conservation frameworks, protocols and actions. Several initiatives can be highlighted, such as the creation of the first Brazilian National Park in 1937 - the Itatiaia National Park, formerly a field research station of the JBRJ. More recently, the establishment of important botanical collections, such as the RB Herbarium, the DNA bank, the live collection and the institutional seed bank represent major steps towards effective conservation. For more than two centuries, JBRJ has protected in itself the memory of the Brazilian natural landscapes and its transitions, preserving plants introduced during colonial times, while at the same time, investing in scientific advances for the challenge of plant diversity conservation.

Working in the herbarium at Curitiba Botanic Garden

In order to mainstream national efforts with international initiatives towards plant conservation, the National Centre for Plant Conservation – CNCFlora, was created in December 2008, under the JBRJ infrastructure. The Centre's mission is to coordinate national efforts, and to understand, document, and conserve plant diversity in Brazil, in collaboration with research institutions and environmental agencies worldwide. The challenge is being developed according to the framework provided by the *Global Strategy for Plant Conservation* (GSPC), prioritizing the targets that meet national priorities and capacities.

“ Mainstreaming national conservation policies with the GSPC framework is of great importance. ”

Targets being addressed

CNCFlora has focused efforts on achieving advances in five specific GSPC targets: a) a widely accessible working list of known plant species, as a step towards a complete world flora (Target 1); b) a preliminary assessment of the conservation status of all known plant species, at national, regional or international level (Target 2); c) development of models with protocols for plant conservation and sustainable use, based on research and practical experience (Target 3); d) the number of trained people working with appropriated

facilities in plant conservation increased, according to national needs, to achieve the targets of this strategy (Target 15); and e) networks for plant conservation activities established at national, regional and international level (Target 16).

Target 1

Due to high rates of biodiversity and endemism in Brazil, GSPC Target 1 has always been considered a challenge and several previous actions have already failed. The JBRJ has been working for 2 years on the development of the Official List of the Brazilian Flora. CNCFlora has brought together 480 researchers from national and international institutions through an online platform, specially designed in association with the *Centro de Referência em Informação Ambiental* (CRIA), to organize coordinators, collaborators, attributions and personal contributions. The process used the Species2000 protocol, and generated a species list composed of c. 45,000 taxa, to be launched in April 2010. This represents a major achievement for the botanical community, since a huge proportion of the world's plant diversity occurs in Brazil and is under constant threat due to unsustainable land use practices.

Target 2

In the absence of an Official List of the Brazilian Flora, achievements towards GSPC Target 2 are limited, but still significant. Considering the need to improve conceptual and methodological definitions to address endangered species conservation status



Palms in the Botanic Garden (Rio de Janeiro Botanic Garden)

assessments in Brazil, CNCFlora has been engaged in the process of diagnosing the present system of endangered species management and identifying globally emerging trends in plant conservation. A series of technical meetings are scheduled for this year in order to consolidate a formal proposal to be forwarded to the Environment Ministry, with the specifications of a modern and adequate system of endangered species management, mainstreamed to the GSPC framework. Besides that, 12 recovery plans are being elaborated under the coordination of this Centre. Eight recovery plans for Orchidaceae, one for Amaryllidaceae and three for Lauraceae species. It is important to note that this represents more than the number of recovery plans ever developed in Brazil for endangered plant species, and constitutes an important step in plant conservation policy towards a more proactive approach.

“ The Brazilian Official List of Endangered Species includes 472 species. 92 endangered species are in the ex situ collection of JBRJ. ”



Rio de Janeiro Botanic Garden (Peter Wyse Jackson)

Target 3

Advances in the targets mentioned have been possible due to extensive research and discussion on conservation protocols adopted by different countries, their strengths and weaknesses, and appropriateness to the Brazilian biodiversity situation and institutional capacity. During its two years of operation, CNCFlora staff have been reviewing all literature on the subject and consolidating a document to be forwarded to the Environment Ministry and all responsible government institutions, in order to standardize national efforts for plant conservation. The document will be presented in late 2010 and will address GSPC Target 3 recommendations.



The team from the Brazilian National Centre for Flora Conservation (Rio de Janeiro Botanic Garden)

Target 15

To guarantee the long term sustainability of CNCFlora and its actions, investments in capacity building for the conservation of plant diversity has been a priority since the Centre's creation. Therefore, the CNCFlora Grant Program was established. This already supports 11 professionals, 3 undergraduate, 1 graduate and 5 post-graduate students. Alignment between the JBRJ Research Institute and the Brazilian National School of Tropical Botany – ENBT, has been strategic to assure the necessary infrastructure to increase the number of trained people in plant conservation.

Target 16

However, the most challenging task might be to guarantee proper communication among actors involved in the plant conservation process, avoiding by that, redundant efforts. In this way, CNCFlora has been investing time in establishing working agendas with all government institutions related to biodiversity and plant conservation,



*CNCFlora team looking for remnant population of *Glaziophyton mirabile* (Rio de Janeiro Botanic Garden)*

in order to consolidate an effective network. Despite people's good will, and existing guidelines for plant conservation, the Brazilian institutions seem to be unsupported in implementing their conservation agendas. This Centre has played a key role in articulating actors and focusing efforts on the recommendations of GSPC Target 16, related to building networks.

Conclusions

Notwithstanding the recent creation of CNCFlora, the significant progress made to date on the targets listed above evidences the importance of botanic gardens participating in plant conservation all over the world, leading the way and working as models for other scientific institutions and environmental agencies. Mainstreaming national conservation policies with the GSPC framework is of great relevance. Since biodiversity does not respond to political boundaries, the conservation strategies for plants must be transversely and globally implemented, in order to assure effectiveness of actions.

To face the new challenge of plant conservation worldwide and halt biodiversity loss, new integrative approaches are needed. It is necessary to establish communication among actors involved in this process, and botanic gardens can play a key role. Science itself cannot address all related matters. Therefore it is important to consider political, economical and social aspects of the actions undertaken, establishing a permanent communication channel between scientists and decision makers. The Rio de Janeiro Botanic Garden is highly committed to the challenge and has already consolidated important contributions for the National GSPC mainstreaming process.

Box 1: Brazilian Botanic Gardens Action Plan

The *Brazilian Botanic Gardens Action Plan* was published by the Brazilian Botanic Garden Network in 2004. The *Action Plan*, which was developed in a consultative process with Brazilian botanic garden staff, indicates the challenges, priorities and future responsibilities, both individual and collective, for Brazilian botanical gardens. It was developed as a national response to the *International Agenda for Botanic Gardens in Conservation* and the *Global Strategy for Plant Conservation* and includes 20 key goals for botanic gardens in Brazil to achieve by 2014. A number of short, medium and long term action points are identified for the achievement of each of the key goals.

Copies of the *Action Plan* can be downloaded from: www.rbjb.org.br

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EUROPEAN NATIVE SEED CONSERVATION NETWORK

WORKING TOGETHER TOWARDS GSPC TARGET 8

Co-ordinated by the Royal Botanic Gardens, Kew, the European Native Seed Conservation Network (ENSCONET) started its activities as a European Commission's Sixth Framework Programme project in 2004. Before its inception, staff from seed banks storing wild species (mainly in botanic gardens) met only occasionally, for example at conferences. There was little co-ordination of action at national and international level, and no common protocols and standards existed. The ENSCONET network has been transforming the way that the seeds of Europe's wild plant species are conserved. Now a community exists where data, expertise, problem solving and facilities can be shared. There is co-ordination across and within boundaries and common protocols have been jointly developed. While the European Commission funding ran out in October 2009, the 31 project partners from 20 European countries have built a strong community of cooperation and collaboration through which ENSCONET flourishes today.

ENSCONET's impact towards GSPC Target 8

One example of the successful cooperation on the European level is the network's impact towards the Global Strategy for Plant Conservation (GSPC). ENSCONET has been targeting four key seed banking activity areas: Collecting, Curation, Data Management and Dissemination. It is through the successful cooperation in the Collecting activity area that ENSCONET has made a significant impact on GSPC Target 8. ENSCONET is also recognised as a lead partner in the updated version of the

ENSCONET's 31 project partners have made great progress in seed banking Europe's native plants and building conservation capacity across the region.



Meeting of ENSCONET members in Valencia (D. Lazaro-Gimeno)

European Plant Conservation Strategy (EPCS) for Targets 3.1 and 8.1. In the EPCS document, ENSCONET is mentioned as a 'Key Success' in European plant conservation.

Up until 2009, the first objective for the Collecting activity area has been to prepare a detailed, co-ordinated and prioritised seed collection programme for the European native flora, with the aim to contribute to the targets of the GSPC and to the objectives of the European Commission's Sixth Biodiversity Action Plan. A second objective has been to develop a common, high standard for seed collecting of European native plants which maximises the genetic diversity (effectiveness) and longevity of

collected seed material. ENSCONET has been achieving these objectives in a number of ways.

Europe-wide collecting plan

The ENSCONET project partners have developed collecting plans at four different geographical (local, national, bio-regional and continental) levels. In an innovative approach, the biogeographical regions as defined by the European Environment Agency were used in much of the co-ordination between the individual plans. This method reflects the nature of species' boundaries much better than political borders would do in a country-by-country approach (see examples in Boxes 1 and 2).



Seed collections at the Millennium Seed Bank (Board of Trustees of the Royal Botanic Gardens, Kew)

The advantages of planning seed collecting activities collaboratively at the bio-regional instead of the local or national level include:

- Avoidance of duplication (making collections with no added value).
- Improved geographic and genetic representation of sampled accessions.
- Ease of adding or amending data following large initial input.
- Increased communication between partners and the means to build trust and strengthen working relationships.

The development of the ENSCONET project partners' local collections plans has allowed institutes to prepare for the future and have a basis for planning specific scenarios for different future resources. Additionally, these detailed plans are valuable when approaching potential funders of future seed conservation activities and can be used as a tool to secure additional financial support. But the ENSCONET planning approach has a wider application. It can be applied to "shared/ overlapping regions" at different geographical scales and can be implemented to co-ordinate shared conservation responsibility of, for example, waterways, nature reserves or marine areas. The project's Collecting Plan Report documents the method used (www.ensconet.eu/Download.htm).

The ENSCONET seed collecting protocol

One of the most important achievements of the collaboration between the 31 project partners is the *ENSCONET Collecting Manual for wild species*.

The manual was jointly developed through a number of targeted workshops and extensive field-testing across European countries. It synthesises the current state-of-the-art knowledge and documents best practice protocols for collecting seed from Europe's native plant species including planning collecting expeditions, sampling, collecting techniques, identification and documentation, care of collections and data collection. A data passport form is included which will help to ensure that accurate and detailed data is collected in the field. Prepared in nine languages (English, French, Greek, German, Hungarian, Italian, Polish, Portuguese and Spanish) and made freely available on-line (www.ensconet.eu/Download.htm), the manual has a wide distribution across and even beyond Europe. The manual will be of use to, amongst

others, botanic garden staff and horticulturists, seed conservationists, ecologists, natural reserve managers and researchers involved in habitat restoration and rehabilitation.

Monitoring progress towards GSPC Target 8

ENSCONET has produced a comprehensive list of seed bank holdings of native plant species. It is providing improved online access to these holdings data through its 'Virtual Seed Bank', ENSCOBASE (<https://enscobase.maich.gr>). For some seed banks, this is the first time that their collections have been made accessible via the Internet.

The 'Virtual Seed Bank' is being used to assess progress towards GSPC Target 8. At this moment, the Virtual Seed Bank stores data from 29 European seed banks on almost 42,000 seed collections representing just under 9,300 taxa from 40 countries. Looking at threatened plant species only, the 'Virtual Seed Bank' stores 27% of seed bearing plants (spermatophytes, i.e. gymnosperms s.l. and angiosperms) of the BGCI European Threatened Taxa list and 44% of the seed plants on the Annex II list of the European Community Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). Although the network's focus is on seed bearing plants, the 'Virtual Seed Bank' database has also collated data on pteridophytes. For them, it holds 5% of the species

BOX 1: Kerner White Buttercup *Callianthemum kernerianum* Freyn.

ex Kern. (Ranunculaceae) is a highly threatened narrow endemic species in the European Alps. In a preliminary IUCN assessment, it has been assigned CR. It is of conservation concern because it has a very restricted distribution, occurring only at the summit of Monte Baldo east of Lake Garda in NE Italy. Changes in land use and tourism development are currently heavily impacting on its population.



(C. Bonomi)

The seed set is extremely low, its fruits are heavily predated and the longevity of its seeds in *ex-situ* conservation are expected to be very low. Climate change might also have a devastating potential impact on its populations considering their isolation and poor dispersability. Its successful conservation is dependant on a good understanding of its reproductive biology which is currently being investigated jointly by two Italian ENSCONET partners.

mentioned in the BGCi European Threatened Taxa list and 26% of the species listed in the Habitats Directive Annex II list.

The Virtual Seed Bank shows that the percentage of threatened plant species safely stored in seed bank collections is not equal for all countries. The plant species growing in the UK and Spain are particularly well represented. The database has also been used to produce lists of threatened plant species requiring duplication to mitigate loss of collections long term.

Outlook

Having built significant dialogue and momentum in Europe, a key aim is to maintain this in the future. The conservation of wild plants in Europe has never been more important. In a world where land conversion for human use continues apace and the effects of climate change have yet to be quantified with certainty, seed collections will prove to be an essential resource in finding solutions



Seed collections at the Millennium Seed Bank (Board of Trustees of the Royal Botanic Gardens, Kew)

to these pressures. However, for seed banks to store and provide the most valuable collections, there will also need to be much greater dialogue with end-users for example with researchers and habitat restoration ecologists. At the moment, seed banks for wild plant species often collect material on the basis of the threat status. Although this is very important, a challenge for future collecting



Seed collections in the drying room of the Millennium Seed Bank (Board of Trustees of the Royal Botanic Gardens, Kew)

BOX 2: *Onosma stridii* Teppner (Boraginaceae) is an endemic plant species from Greece. It was described as a new species twenty years ago and can only be found on one mountain massif in the Greek region of Sterea Ellada. It grows only on serpentine rock which is high in nickel, chromium and cobalt and therefore toxic to most plant species. Due to small population sizes and its limited area of distribution, *Onosma stridii* had been classified as Vulnerable in

the Greek Red Book. A large part of its population has recently been destroyed due to a road construction project; its conservation status needs to be reassessed. One of the Greek ENSCONET partners, the National and Kapodistrian University of Athens, is planning to collect seeds of this narrow endemic. A portion of the collected seed material will be used to better understand the reproductive biology of this plant and its requirements for *ex situ* propagation.



(E. Kalogeropoulos)

efforts will be to balance the conservation and utilitarian requirements and desires for collecting. Through a collaborative approach ENSCONET will provide the support European seed banks need to achieve conservation of its most threatened species in the most effective way, thus continuing to contribute to GSPC Target 8. At the same time it also hopes to facilitate the wider European research area with the provision of quality seed collections of useful plant species.

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EX SITU PLANT CONSERVATION: A KEY ROLE OF CHINESE BOTANIC GARDENS IN IMPLEMENTING CHINA'S STRATEGY FOR PLANT CONSERVATION

Chinese botanic gardens have prioritized the conservation of rare and threatened species and are progressing rapidly towards GSPC Target 8.

Introduction

China is home to approximately 10% of the world's plant diversity and more than half of its 33,000 species are endemic (MEP, 1998; MEP, 2007). This tremendous plant diversity encompasses a huge number of species of bryophytes (c. 2,200 species), pteridophytes (c. 2,600 species), gymnosperms (c. 250 species), and angiosperms (>30,000 species). Furthermore, a long history of agricultural civilization and crop plant

domestication in China has generated an enormous number of cultivars of important crops, vegetables, fruits and ornamentals (CSPCEC, 2008).

However, plant diversity in China is increasingly threatened, with some 4,000-5,000 plant species thought to be at risk of extinction. The timely launch of *China's Strategy for Plant Conservation* (CSPC) in 2008 aims to tackle the urgent issues of plant conservation and demonstrates China's firm commitment to the environment, aligned with the

Global Strategy for Plant Conservation (GSPC), as well as China's international obligations as a signatory to the Convention on Biological Diversity (CBD). Chinese botanic gardens have made great progresses in the implementation of *China's Strategy for Plant Conservation*.

“China's Strategy for Plant Conservation is an action plan to provide overall guidance for Chinese plant diversity conservation.”

Status of Chinese botanic gardens

Ancient Chinese gardens can be dated back probably to the Xia dynasty (2100-1600 BC) when unimproved wild species were used as ornamentals. Even before then, c. 2800 BC, the legendary Shennong established a medicinal garden, currently regarded as the earliest botanic garden in the world (Xu, 1997; Lopez-Pujol *et al.*, 2006). The first western concept botanic gardens, designated for plant introduction and botanical research, were established during 1920's -1930's but development was slow until the mid-1970s. Since then there has been rapid growth, up to a total of 160 botanic gardens in existence today (He, 2002) (Fig 1).

145 of the 160 botanic gardens in China are located in temperate and subtropical regions, with the majority being located in eastern and south-central China. Only 10% of the gardens can be found in western China. In the past 10 years, more efforts have been put towards to the establishment of botanic gardens in



Camellia nitidissima - a national prioritized protected species (SCBG)



Garden view (SCBG)

southern and southwestern China where centers of plant diversity and high plant endemism occurs.

Management of Chinese botanic gardens differs considerably with the different government agencies they are administered by. Most *ex situ* conservation programs are conducted by the botanic gardens that fall under the administration of the Chinese Academy of Sciences (CAS). Gardens under the Ministry of Housing and Urban-Rural Development (MHURD), State Forest Administration (SFA), Ministry of Health (MOH) and state universities, etc. do conduct some *ex situ* conservation activities, but their priorities are more focused on landscaping, tourist attraction, and public education. The overall coordination of the national plant conservation strategy and its implementation is provided by the CAS Botanic Garden Working Committee and the Chinese Botanic Garden Society.

The botanic gardens of the Chinese Academy of Science

The Chinese Academy of Sciences (CAS) is the principal national academic organization in natural science and its affiliated botanic gardens are designated as essential organizations dedicated to the exploration, utilization and conservation of strategic plant resources. There are a total of 16 botanic gardens (arboreta) under the management of CAS or jointly managed by CAS and local government:

- South China Botanical Garden (SCBG),
- Xishuangbanna Tropical Botanical Garden (XTBG),
- Wuhan Botanical Garden (WBG),
- Beijing Botanical Garden (BBG),
- Nanjing Botanical Garden (NBG),
- Lushan Botanical Garden (LBG),
- Guilin Botanical Garden (GBG),
- Kunming Botanical Garden (KBG),
- Turpan Botanical Garden (TBG),

- Qinling Botanical Garden (QBG),
- West China Subalpine Botanical Garden (WCSBG),
- Fairy Lake Botanical Garden (FLBG),
- Chenshan Botanical Garden (CBG),
- Three Gorges Botanical Garden (TGBG),
- Shenyang Arboretum
- Dinghushan Arboretum

These 16 botanic gardens are distributed over 10 provinces (or autonomous regions) in China, occupying a total area of 14,000 hectares.

Ex situ conservation in Chinese botanic gardens

The combined living collections of the 10 main CAS botanic gardens consist of some 24,667 plant species (Table 1). These cover approximately 95% of the *ex situ* collections of all Chinese botanic gardens. It is estimated that approximately 80% of the species in these collections are native Chinese plants and 20% are introduced species. These collections provide an important reserve of plant resources for sustainable economic and social development in China.

Ex situ conservation is very important in Chinese botanic gardens. In 1998, China re-evaluated its global role in plant conservation and the sustainable use of plant diversity and CAS developed a new strategy for botanic garden research. As a result a 5-year master plan was formulated, taking CAS botanic

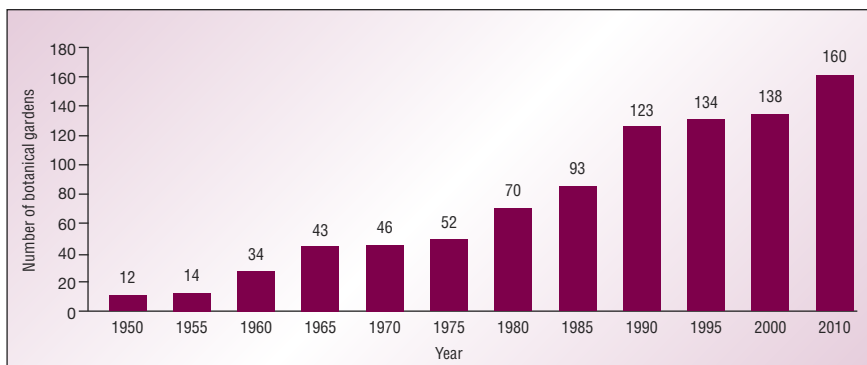


Fig. 1. Increase in the number of Chinese botanic gardens in past 60 years (updated from He, 2002)

Table 1: Analysis of *ex situ* conservation collections of China's 10 main botanic gardens (2009)

Botanic Garden	No. originally introduced taxa	No. verified taxa	No. verified species
South China Botanic Garden (SCBG)	13,053	11,512	7,898
Xishuangbanna Tropical Botanical garden (XTBG)	17,109	14,973	7,420
Wuhan Botanic Garden (WBG)	7,613	7,090	5,023
Beijing Botanic Garden-CAS (BBG)	5,001	5,001	3,463
Lushan Botanic Garden (LBG)	5,077	4,934	4,378
Nanjing Botanic Garden (NBG)	3,832	3,790	2,701
Turpan Botanic Garden (TBG)	506	506	490
Guilin Botanic Garden (GBG)	4,058	4,056	3,843
Kunming Botanic Garden (KBG)	4,276	4,276	3,330
Fairy Lake Botanical Garden (FLBG)	5,993	6,588	4,956
Total species records	66,518	62,726	43,502
Total number of individual species			24,667

garden development into the 21st century. Subsequently, CAS re-organized its botanic gardens and designated three National Core Botanic Gardens and also promoted the concept of Scientific Botanic Gardens. Botanic gardens were viewed as supporting platforms for innovation research in life science, and were developed in line with the leading international botanic gardens. CAS initiated a "Knowledge Innovation Program" at the three core gardens, XTBG, WBG and SCBG and this prompted the idea of establishing a National Scientific Botanic Garden in China.

The National Core Botanic Gardens

As the projects continue successfully, the capacity in science and technology innovation have shown great improvement in the three core botanic gardens. These gardens have reinforced their efforts in *ex situ* conservation and the collection and conservation of resource-plant species has been extensively enhanced. For example, XTBG increased the number of taxa under *ex situ* conservation from about 4,000 in 2002 to about 10,000 in 2005, of which 7,420 have been identified correctly. Thus XTBG became the first garden in China to conserve 10,000 plant taxa and one of the few botanic gardens in the world with such a large number of species in its living collections. SCBG increased its collection from about 4,500 taxa in 2002 to more

than 10,000 in 2006. WBG increased its *ex situ* collection from about 4,000 taxa in 2002 to about 8,000 today.

At the same time, a large number of specialized collections have been renovated and enhanced for botanical research and germplasm assessment. The most well known examples include SCBG holding the world's largest collections of Magnoliaceae with >130 species, Zingiberaceae with >120 species, Palmae with 382 species and China's largest collection of bamboo with >200 species; WBG holds the world largest collections of *Actinidia* with >52 species and aquatic plants with >800 taxa.

These core botanic gardens have become important centers in China for the conservation of strategically important plant resources. With their species conservation standards aligned to those of other international first-class botanic gardens, these core gardens also provide an important platform to support social and economic sustainable development in China.

Status of *ex situ* collections in China

China's botanic garden collections are extensive and representative of the different native flora across the regions of China. Indeed most botanic gardens have focused their collection and conservation work on the local flora or regional flora. However, the need for duplication of *ex situ* conserved plants across different gardens is also recognized as an important insurance policy to safeguard unpredictable losses. Of the 24,667 plants cultivated *ex situ* in the 10 main botanic gardens, 8,216 species (33.3%) are duplicated in at least in one other botanic garden, with 15.1% replicated in two gardens, 7.3% in three gardens, and 4.5% in four gardens (Table 2). However, a total of 16,451 species (two thirds of the total) are not duplicated in any of the 10 main gardens.

However, when considering the duplication rates of species on a garden-by-garden basis, the percentage of duplicated species ranges from 40% to 75%, with an average of 61.3%



Orchid ex situ conservation (SCBG)



Garden view (SCBG)

duplication. The percentage of species from each garden that are duplicated across the 10 botanic gardens ranges from 6% to 20%, with an average value of 11%.

Given that gardens have a focus on conserving local species, duplication at other gardens within the same region should also be treated as a priority, allowing plants to be duplicated in gardens with similar climates and environments. An assessment of such regional duplication reveals that duplication within each region ranges from 10% to 27% (Table 3)

Table 2: Duplication of species conserved *ex situ* between the 10 largest botanic gardens

10 BGs	9 BG	8 BGs	7 BGs	6 BGs	5 BGs	4 BGs	3 BGs	2 BGs	No duplication
14	76	169	287	381	659	1115	1795	3,720	16,451
0.06%	0.31%	0.69%	1.2%	1.5%	2.7%	4.5%	7.3%	15.1%	66.7%

Conservation of rare and threatened plants

Conservation of rare and threatened plants has been prioritized by Chinese botanic gardens. While *in situ*

conservation cannot save all threatened or rare plants, *ex situ* conservation offers an effective supplementary conservation activity (Hawkins *et al.* 2008). Work towards ensuring the *ex situ* conservation of rare and threatened

Table 3: Duplication of species conserved *ex situ* amongst the 10 largest Chinese botanic gardens

Region	South China			SW China		Central China		N China	NE China	NW China
	SCBG	FLBG	GBG	XTBG	KMBG	WBG	LBG			
No of species in gardens/region	12,074			9,779		7,740				
Botanical garden	SCBG	FLBG	GBG	XTBG	KMBG	WBG	LBG	BBG	NBG	TBG
No. of species	7,898	4,956	3,843	7,420	3,330	5,023	4,378	3,463	2,701	490
In one BG only	2,851	1,610	959	3,480	1,238	1,498	1,793	2,018	766	238
Duplicated in another garden	5,047	3,346	2,884	3,940	2,092	3,525	2,585	1,445	1,935	252
Duplicated % ^z	63.9%	67.5%	75%	50.1%	62.8%	70.2%	59%	41.7%	71.6%	51.4%
Average duplication %	61.3%									
Duplication % in 10 BGs ^y	20.5%	13.6%	11.7%	16%	8.5%	14.3%	10.5%	5.9%	7.8%	1.0%
Average duplication %	11%									
Duplicated within region	3,245	2,666	2,230	971	971	1,661	1,661			
Duplicated % within region ^x	26.9%	22.1%	18.5%	10%	10%	21.5%	21.5%			
Mean % regional duplication	22.5%			10%		21.5%				

^z Percent of duplicated species at each garden = number of duplicated species / total number of species at each garden

^y Percent of duplicated species across 10 gardens = number of duplicated species / total number (24,667) of *ex situ* conserved species in 10 gardens

^x Percent of species duplicated in the region = number duplicated within the region / number of species in the region



Palm collection (SCBG)



Gymnosperms collection (SCBG)

plants is guided by GSPC Target 8: “60% of threatened plant species in accessible *ex situ* collections, preferably in the country of origin, and 10% of them included in recovery and restoration programmes”. Significant progresses has been made by botanic gardens in China and it is estimated that all 388 species categorized for national protection (Fu, 1992) are included in the *ex situ* living collections of botanic gardens. However, extensive collection has not taken place for the 4,404 plant species included on a more recently published Red List (Wang & Xie, 2004) as this list is not widely accepted or finalized by the Chinese government conservation agencies.

Each of the 10 main botanical gardens currently holds between 26 and 710 rare and threatened plants (Table 4), accounting for an average 8.7% of their total *ex situ* living collections. Together these collections include 1,633 species, accounting for 37.6% of the 4,404 plants in the recent Red List. Further gap

analysis and re-evaluation of *ex situ* conservation strategies are still urgently needed to ensure that these collections act as a true safety net for endangered species.

A significant feature of the *ex situ* conservation of threatened plants in the botanical gardens is a high duplication rate across different gardens. The duplication of these species across the 10 main botanical gardens ranges from 57.7% at Turpan Botanical Garden to 95.1% at Nanjing Botanical Garden, with an average value of 79.8%. This provides a good measure of safeguard against unpredictable losses. The duplication within the same region also provides a safe backup at the regional level across China (Table 5).

When individual taxa are considered, 874 (53%) of the rare or threatened species maintained in botanical gardens collections have been backed up in at least one other gardens (Table 6). Gap analyses is now required to identify

selected groups of plant to be collected with a focus on strengthening existing collections and planning for the restoration of key species (BGCI, 2007).

Seed banking

While prioritization of *ex situ* living collections continues to be important, wide-scale seed banking efforts are also given priority, particularly in the face of climate change, where virtually all species may be at risk. The construction of national seed banks is therefore complementing the *ex situ* living plant collections. For example, the China Southwest Wildlife Germplasm Genebank project, operated by the Kunming Institute of Botany, CAS, at the end of 2009 included 31,199 accessions from 4,781 plant species belonging to 1,337 genera and 166 families. The goal of the genebank is to seed bank a total of 100,000 accessions from 10,000 plant species by 2020.

In relation to crop diversity, the need for *ex situ* conservation of diverse crop material has also been recognized as increasingly urgent – with a particular need to focus on crop wild relatives and local varieties of crops as a rich source of adaptive traits for extreme abiotic conditions. The Ministry of Agriculture has established a network of cold storage seedbanks to safely conserve crop genetic resources. These seedbanks, which possess long-term, medium-term and duplicate cold storage facilities, now include 390,000 accessions of seeds of

Table 4: Number of rare and threatened plant species conserved *ex situ* in the 10 largest Chinese botanic gardens

Botanical garden	SCBG	FLBG	GBG	XTBG	KBG	WBG	LBG	BBG	NBG	TBG
Total sp.	7,898	4,956	3,843	7,420	3,330	5,023	4,378	3,463	2,701	490
Red List sp.	710	441	445	571	423	652	229	177	263	26
Red List sp. %	9.0%	8.9%	11%	7.7%	12.7%	13.0%	4.6%	5.1%	9.7%	5.3%
Average	8.7%									
Total species	1,633									
% of redlist (2004)	37.6%									

Table 5: Regional duplication of rare and threatened species conserved *ex situ* among the 10 largest Chinese botanical gardens

Region	South China			SW China		Central China		N China	NE China	NW China
	SCBG	FLBG	GBG	XTBG	KBG	WBG	LBG			
No of species region (total 1633)	996			839		740				
Botanical garden	SCBG	FLBG	GBG	XTBG	KBG	WBG	LBG	BBG	NBG	TBG
No. of R & T species	710	441	445	571	423	652	229	177	263	26
In one BG only	123	34	89	188	92	140	41	28	13	11
Duplicated in another garden	587	407	356	383	331	512	188	149	250	15
Duplicated % ^z	82.7%	92.3%	80%	67.1%	78.3%	78.5%	82.1%	84.2%	95.1%	57.7%
Average	79.8%									
Duplication at a garden without region	435	336	280	155	155	144	144			
% duplicated within region ^y	43.7%	33.7%	28.1%	18.5%	18.5%	19.1%	19.1%			
Mean regional duplication %		35.2%		18.5%		19.1%				

^z Z Percent of duplicated rare and threatened species at each garden = duplicated number of R & T species/total number of R & T species at each garden

^y Percent of R & T species duplicated in the region = number duplicated within the region / number of R & T species in the region



Conservation nursery (SCBG)

crop germplasm belonging to 450 species, 160 genera and 28 families. In addition, 32 national field germplasm repositories designated for perennial and vegetatively propagated crops, mostly for fruit & nut crops and their wild relatives, include more than 1,300 species of rare and endangered plants (MEP 2008). These efforts have greatly enhanced the *ex situ* conservation capacity of crop diversity for food security.

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Table 6: Overall duplication of rare and threatened species conserved *ex situ* amongst the 10 largest botanic gardens

10 BGs	9 BG	8 BGs	7 BGs	6 BGs	5 BGs	4 BGs	3 BGs	2 BGs	None
0	9	25	46	60	90	147	183	314	759
	0.6%	1.5%	2.8%	3.7%	5.5%	9.0%	11.2%	19.2%	46.5%

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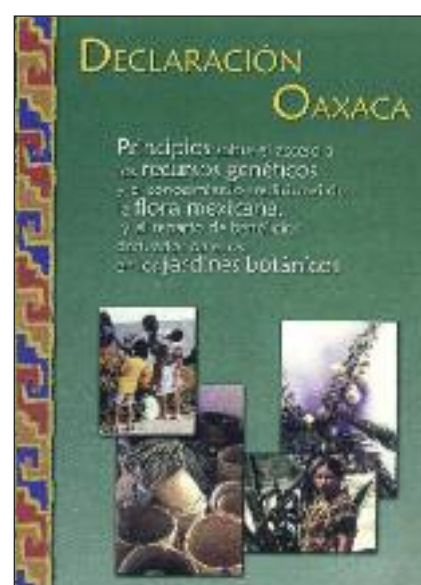
Herbarium (SCBG)

THE ROLE OF MEXICAN BOTANIC GARDENS IN THE IMPLEMENTATION OF THE GLOBAL STRATEGY FOR PLANT CONSERVATION

Mexican botanic gardens regularly review their contributions to the GSPC and have a clear focus on education and public awareness.



Representation of an indigenous household (Faustino Miranda Botanic Garden)



Introduction

Most of the botanic gardens in Mexico belong to the Mexican Association of Botanic Gardens (Asociación Mexicana de Jardines Botánicos - AMJB) which includes over 40 gardens.

Due to the variations in climate across the country and the differing origins of each of the gardens and their official status, the interests and activities that have been developed by each garden differ according to their capacities and needs.

The AMJB has adopted the GSPC as one of the main topics to be covered during its national meetings, which are held annually. Through this work the Association follows up on the way in which each garden contributes to the each of the GSPC's objectives.



fair and equitable sharing of the benefits derived from its use, through the development and effective application of administrative, economic and social incentives based on knowledge.

“ The Mexican flora includes over 23,000 species, over 10% of the world’s plant diversity. ”

The strategy has the following specific objectives; these are based on the objectives of the GSPC but adapted to the national situation:

1. Generation, integration and transmission of the knowledge and information necessary for the conservation of plant diversity
2. Conservation of plant diversity *in situ* and *ex situ*
3. Restoration and recovery of deteriorated or altered ecosystems
4. Prevention and control of threats to plant diversity
5. Sustainable use of plant diversity
6. Public policy instruments for the implementation of the Mexican Strategy for Plant Conservation
7. Education, awareness raising, institutional coordination, promotion and development of institutional capacities for the conservation of plant diversity

Mexican botanic gardens and the Mexican Strategy for Plant Conservation

Although botanic gardens cannot cover all the objectives of the Mexican Strategy, they do contribute significantly to many of them. In order to assess the situation and the capacity of Mexican botanic gardens, the annual meetings since 2007 have focused on different GSPC objectives as follows:



Propagation of Chamaedorea palms (Faustino Miranda Botanic Garden)

What has been done so far?

In 2000, the AMJB published the Conservation Strategy for Mexican Botanic Gardens. The main objectives of the strategy are:

- To develop an action plan for the conservation of threatened species of Mexican flora and form collections of live plants of these species.
- To promote conservation work for species located in each region of the country through *in situ* and *ex situ* activities.
- To strengthen inter-institutional and multidisciplinary work that will contribute to the development of integrated projects for threatened plants in their natural habitat through sustainability programs.
- To promote and support programs of scientific collection of biological material and information on uses of native plants.
- To promote the establishment of horticulture courses and/or study programs in universities.

The same document establishes an Action Plan with ten points, among which are the development of a collection of threatened plants, conservation programs at the regional level and the development of relationships between communities and environmental education programs.

The Mexican Strategy for Plant Conservation

In 2007, at the XX National Meeting of AMJB, a Coordinating Committee for the Mexican Strategy for Plant Conservation was officially established, involving government, academia, civil organizations and the AMJB. During this meeting the objectives of the Mexican strategy were presented to the botanic garden community and the importance of their role in its implementation was emphasised.

The mission of the Mexican strategy is to establish directives and actions for the conservation and sustainable use of plant diversity in Mexico, as well as the

Figure 1: Mexican Botanic Gardens and the GSPC

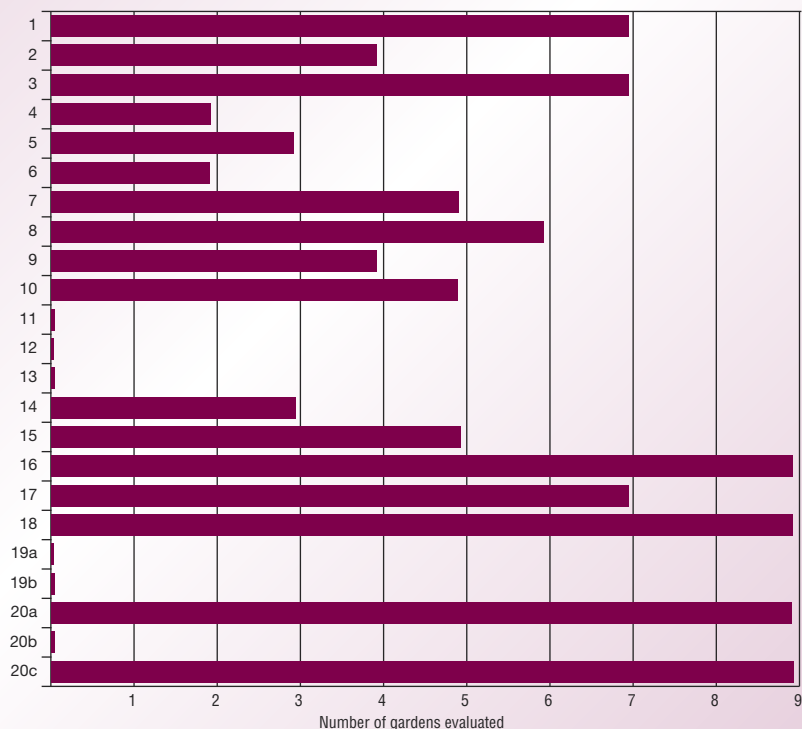
I. Understanding and documenting plant diversity:
Targets 1, 2, 3

II. Conserving plant diversity:
Targets 4, 5, 6, 7, 8, 9, 10, 11, 12

III. Using plant diversity sustainable:
Targets 13, 14, 15, 16

IV Promoting education and awareness about plant diversity:
Targets: 17, 18

V. Building capacity for the conservation of plant diversity:
Targets 19, 20a, 20b, 20c



Caballero, J. 2007. Jardín Botánico IB-UNAM. Presentation during the XX meeting

2007: What are Mexican botanic gardens doing in relation to the GSPC?

During this meeting an analysis was carried out to determine how the work of the botanic gardens relates to the different targets of the GSPC. This

allowed the botanic garden staff to identify that the main impacts are in the areas of *ex situ* conservation, knowledge and documentation of species, and environmental education. The results from this analysis are presented in Figure 1.



Traditional medicine workshop with indigenous communities in Chiapas (Yolanda Barrios)

2008: Priority species for Mexican botanic gardens:

The discussion of this point allowed a general overview of the current status of the collections in the gardens to be developed and identified the species where more emphasis is being placed. This helped to define information gaps and prioritise areas that need attention.

2009: Cultivating values and commitments for plant conservation:

Environmental education is one of the activities that is taking place in most of the gardens. The analysis of the work carried out in this regard noted differences in target audiences as well as in capacities and needs between gardens. This indicated a need to develop an Environmental Education Strategy for Botanic Gardens to standardize criteria and improve work tools. In 2009 the Commission of Education was formalized and so far two workshops have taken place to develop the strategy.

“ The demand for guided visits at the Botanical Garden of the National University of Mexico (UNAM), has increased to the point that we have had to devise new approaches to meet the public’s need. ”

How are we doing?

Figure 1 provides a summary of the situation of nine of the most important botanic gardens in the country. The analysis is based on comparing the work of these gardens with the *International*



Food culture workshops in Chiapas (Faustino Miranda Botanic Garden)



Workshops for children (Faustino Miranda Botanic Garden)

Agenda for Botanic Gardens in Conservation targets, published by BGCI in 2004 (Wyse Jackson, *BGjournal* vol. 1 No. 1).

Of the five objectives of the GSPC, Mexican botanic gardens contribute mostly to the objectives: I.) Understanding and documenting plant diversity and IV) Promoting education and awareness about plant diversity. To a lesser extent, they contribute to objective II) Conserving plant diversity, in particular regarding Target 8.

Special mention should be made of the activities carried out to conserve the traditional knowledge of indigenous communities. At least 50% of botanic gardens participate in this activity. In an effort to follow international treaties relating to working with local communities and after several discussions, AMJB published the "Oaxaca Declaration: principles on the access to genetic resources and the traditional knowledge of Mexican flora,



and the sharing of the benefits derived from them" in 2003. This declaration includes twelve points with ethical principles that must be respected in the fair and equitable distribution of benefits obtained from the use of traditional knowledge and confirms that the communities are the owners of these resources.

Regarding *ex situ* conservation of species, one of the most important activities being carried out is the promotion of regional and national collections. The botanic garden of the Biology Institute of the National Autonomous University of Mexico (UNAM) has national collections for the

Agavaceae and Crassulaceae families with the collection for wild cacti currently in progress. The Xochitla Botanic Garden has the collection of aquatic plants of the Valley of Mexico and the Francisco Javier Clavijero Botanic Garden has the national collections of Cycads and bamboos.

These collections are germplasm reservoirs that allow for propagation activities, in particularly of threatened species, for future programs of restoration of ecosystems or reintroduction to their original habitats.

Regarding the 981 species included in the Mexican red list (NOM-059-SEMARNAT-2001), that is, plants that are found in a risk category, approximately 50% are found in collections of the gardens and 30% have propagation programs.

Through these actions, Mexican botanic gardens are successfully implementing the Mexican and Global Strategies for Plant Conservation and are contributing to the conservation of plant diversity globally.

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MEASURING BOTANIC GARDENS' CONTRIBUTIONS

TO PLANT CONSERVATION AND EDUCATION IN THE UNITED STATES

BGCI's databases provide invaluable tools to measure and report on progress towards the GSPC in the USA.

Background

There is a remarkable amount of plant conservation and environmental education work being carried out efficiently and effectively by botanic gardens in the United States, and BGCI US is working to support this when and wherever possible. One area of focus in 2010 involves measuring and sharing the true collective impact of this work as progress towards two national strategies and the *Global Strategy for Plant Conservation* (GSPC).

In the United States, the primary national strategy is the Plant Conservation Alliance's (PCA) *National Framework*, adopted in 1995. The PCA is a multi-sector consortium of ten federal government Member Agencies and over 275 non-federal Cooperators (including 53 botanic gardens, as well as other non-profit organizations, foundations, and for-profit companies). This successful alliance provides funding for on-the-ground plant and habitat conservation and restoration projects via a matching funds grant program, acts as a forum for the exchange of ideas, sharing of best practices, and ultimately seeks to pool resources nationally while building capacity locally, eliminating duplication of effort and increasing program effectiveness.

An additional regional strategy related to the GSPC is the *North American Botanic Garden Strategy for Plant Conservation*,

published in 2006. A number of gardens have used one or more of these strategies to help guide their planning and activities. However, rather than discussing these strategies, this article focuses on what work is being done now, and how we can best measure and report on its combined impacts.

Measuring and reporting on progress

The topic of measuring and reporting the collective contributions of botanic gardens is not new (see Havens *et al.*, 2006 for an excellent example). However it is a pressing global challenge for BGCI

in 2010, as we work to demonstrate the contributions of the world's botanic garden community towards the many different targets of the Global Strategy for Plant Conservation (GSPC). It is also a subject whose importance extends well beyond 2010 and the GSPC, as it influences how we perceive ourselves as a community, impacts planning and how we work together in the future, and enhances how we present ourselves to individuals and organizations outside the botanic garden community.

As a step towards tackling this challenge, this article attempts to summarize the work of botanic gardens in the United States using information and tools currently at-hand. It also explains ongoing and upcoming projects BGCI US and its partners are working on that will increase our ability to summarize and report on the work taking place at botanic gardens across the United States.



Chicago Botanic Garden

PCA NATIONAL FRAMEWORK	GLOBAL STRATEGY FOR PLANT CONSERVATION (GSPC)	NORTH AMERICAN BOTANIC GARDEN STRATEGY FOR PLANT CONSERVATION
A. Build partnerships to cooperatively share resources and talents	GROW PARTNERSHIPS & RESOURCES 15. Increase trained plant conservation staff, facilities 16. Strengthen plant conservation networks (national, regional, international)	E1. Increase national and international capacity for conservation and sustainable use of plant diversity E6. Better share and promote existing information to achieve plant conservation objectives
B. Raise awareness about the importance of plant diversity and the need to conserve it	CONNECT PEOPLE & PLANTS 14. Promote education & awareness about plant diversity, need for conservation	D1. Communicate importance of plants to visitors D2, E4-5. Engage in public-awareness campaigns, advocate and build constituency for plant conservation
C. Promote ecosystem management to conserve and restore native plant communities	CONSERVE NATURAL RESOURCES 4. World's ecological regions conserved (10%) 5. High plant diversity areas protected (50%) 7. Threatened species conserved <i>in situ</i> (60%) 8. Threatened species in <i>ex situ</i> (60%) & recovery programmes (10%) 10. Manage major invasive species	B1. Work collaboratively on <i>in situ</i> conservation B2. Increase <i>ex situ</i> conservation efforts B3. Increase participation in formal recovery planning B4. Conserve economically/socially important plants B5. Recognize role in invasive species management and education
D. Encourage scientific research and technological development	ENCOURAGE RESEARCH 3. Develop research & experience-based models for plant conservation & sustainable use	B6. Expand support and contributions to basic and applied plant conservation research
E. Determine and encourage appropriate and sustainable use of native plants. Document indigenous knowledge	PROMOTE SUSTAINABILITY 6. Production lands managed sustainably (30%) 9. Maintain genetic diversity of valuable species 11. No endangerment from international trade 12. Plant-based products produced sustainably (30%) 13. Halt loss of plant resources, indigenous knowledge	C1. Support and contribute to sustainable plant use C2. Raise awareness, protect cultural and local indigenous knowledge and uses of plants E2, E3. Incorporate conservation and sustainability into operations, share best-practices
F. Coordinate and promote data-sharing and compatible, economical & efficient databases	GATHER, MAINTAIN & SHARE DATA 1. Working list of all known species towards world flora 2. Preliminary conservation assessment – all species	A1. Work toward complete list of North American flora A2. Review and contribute to conservation assessment of North American flora

Box 1. Relationship between three strategies for plant conservation in the United States

“ The work of your garden, regardless of size, shape or mission, is important, and we want to make sure it is counted. ”

BGCI's online databases – invaluable tools

The most comprehensive tools currently available to quantify the collective power of botanic gardens are BGCI's online GardenSearch and PlantSearch databases. Taken together, these databases provide an easy but powerful way of quantifying the positive impacts of botanic gardens. Here's how:

GardenSearch is the only global database of botanical expertise and resources in the world's botanic gardens. By searching on different keywords, the online interface of this database can be used to locate gardens in different countries with expertise in botanical research, conservation and education. Expanded off-line searching capabilities allow BGCI staff to perform more specific



Roof garden trial plots, Chicago Botanic Garden

searches, for example to identify contact information for gardens with research programs on invasive species biology and control in the United States.

PlantSearch is the only comprehensive global database of plant taxa growing in living collections. This makes it a powerful tool for the entire botanic garden community. If every garden were to upload a simple list of taxa growing in their collections to this database (a free and easy process; see Hird and Dosmann, 2010), we would be able to

determine exactly how much of the world's plant diversity is being safeguarded by botanic gardens. PlantSearch is also a useful tool for individual gardens, because any institution that uploads a list of taxa to this online database will automatically receive: (A) a free conservation assessment of their collections, (B) a way to identify potentially misspelled names in their database and (C) a way to directly connect their living collections with a global network of plant collections, botanic gardens and researchers.



Chicago Botanic Garden

What BGCI's databases reveal

Have you ever searched in vain for answers to questions like *how many visitors do US gardens collectively receive every year, or how much of the world's plant diversity is safeguarded in US botanic garden plant collections?* Answers to questions like this are difficult, if not impossible to come by and, when available, they are often a very rough estimate at best. Having a source of quantitative information that can provide answers to these questions would be incredibly useful for the entire botanic garden community.

In the section below we present summary data generated from information currently in BGCI's GardenSearch and PlantSearch databases (as of April 10, 2010). Unfortunately, these databases do not yet provide a comprehensive analysis of all botanic gardens or living collections in the United States, but data presented here is a first step in getting there: Currently, GardenSearch contains records for 455 botanic gardens in the US, as shown on the map below.

A closer analysis of data in the GardenSearch database yields an interesting array of statistics on education and conservation programs at botanic gardens and arboreta in the United States. For example, 121 U.S.



Botanic gardens and arboreta are located in every state, and in nearly every major ecosystem, across the United States. This is a powerful presence and a significant resource. (Mapalist.com)

gardens have indicated that they have an education program, and 50 of them reported how many education staff this program employs. All totaled, we can report that at least 383 employees at public gardens in the United States are involved in education programs. As we continue to gather and update data in the GardenSearch database this number will no doubt increase. See Tables 1 and 2 for additional summary information on education and conservation work currently available in BGCI's GardenSearch database for the US.

And what can data in the PlantSearch database tell us? Currently the entire database contains 611,000 records

representing 181,000 taxa growing in 700 botanic garden collections in 112 countries around the world. While this is a significant number, there is much room for improvement, particularly here in the U.S., as this number includes collections information for only 73 U.S. botanic gardens. See below for details on how we are working to remedy this in 2010 with the North American Collections Assessment.

How to use and contribute to BGCI's databases

As powerful as these databases are, they are only as useful as the data in them. BGCI tries to update information

Table 1: Education, training and outreach summary statistics for U.S. botanic gardens and arboreta

GardenSearch field	Summary data as of April 2010
Number of education staff	383 staff (N = 50 gardens)
Have an education program	121 gardens
Education programs for K-12 students	52 gardens
Education programs for university-level	35 gardens
Education programs for visitors	89 gardens
Number of visitors annually	over 17 million (N = 79 gardens)
Number of volunteers engaged in activities	20,000 volunteers (N = 69 gardens)
Amount of protected native habitat	6,000 hectares (N = 41 gardens)
Amount of managed public green space	32,000 hectares (N = 291 gardens)

Table 2: Plant conservation and research summary statistics for U.S. botanic gardens and arboreta

GardenSearch field	Summary data as of April 2010
Number of plant conservation and research staff	359 staff (N = 28 gardens)
Have an herbarium	32 gardens
Number of accessions in herbaria	over 15 million (N = 32 gardens)
Have a micropropagation/tissue culture facility	15 gardens
Have a seed bank	27 gardens
Plant conservation program	63 gardens
Plant ecology research program	31 gardens
Invasive species biology research program	28 gardens
Restoration ecology research program	21 gardens
Plant systematics/taxonomy research program	19 gardens
Floristics research program	17 gardens
Urban environment research program	15 gardens



Chicago Botanic Garden

in **GardenSearch** whenever possible, but with over 2,600 botanic gardens worldwide, this is a challenging task. We need your help to make sure information for your garden is correct. For this, we've made it easy for garden staff to get free access to their institution's online GardenSearch profile, regardless of BGCI membership. Do you have a Garden Editor account? If not, visit www.bgci.org/garden_apply.php to set one up. By updating information in your institution's profile, you can ensure your contributions are counted in global analyses and reports generated by BGCI summarizing the contributions of botanic gardens to the Global Strategy for Plant Conservation in 2010 and beyond. And once you have access to your institution's GardenSearch account, it is easy to upload a simple list of taxa in your collections to **PlantSearch** to make sure your collections are counted.

“ Apply to become a Garden Editor and create or update your garden's online BGCI profile! ”

Other projects and resources

North American Collections

Assessment: For gardens in the United States, Canada and Mexico, there has never been a better time to upload collections information to PlantSearch. In 2010, BGCI US is partnering with the United States Botanic Garden and the Arnold Arboretum to carry out this assessment, using PlantSearch as an easy way for gardens to make their collections count while getting important information in return. All gardens contributing information on living plant, seed bank or tissue culture collections before August 1st will ensure that their collections will count in (a) BGCI's report to the Convention on Biological Diversity as progress towards Target 8 of the



Wetland habitat at Chicago Botanic Garden

Global Strategy for Plant Conservation (60% of threatened plants in *ex situ* collections) and (b) an upcoming report on *Conserving North America's Threatened Plants*. For more information on this project, visit www.bgci.org/usa/makeyourcollectionscount. We are grateful for the contributions of collaborators on this project, including the Center for Plant Conservation, the American Public Gardens Association, Seeds of Success program, Canadian Botanical Conservation Network, and others.

Botanical Capacity Assessment

Project: In partnership with the Chicago Botanic Garden, BGCI US has been working to quantify the botanical resources and infrastructure present in the U.S. government, academic, and private sectors (including botanic gardens), to identify critical gaps in capacity and make recommendations to fill them. We are grateful to the nearly 100 staff from botanic gardens that joined over 1,500 others from across the nation in taking surveys developed for this project. Your responses helped demonstrate the vitally important role botanic gardens play in filling gaps in botanical education, training, research and application around the United States. Find more information on this project, including a recently-published report and executive summary, at www.bgci.org/usa/bcap.

Assessing contributions to the PCA

National Framework: In 2010, BGCI US will continue working with the Plant Conservation Alliance to assess



Colourful display at Chicago Botanic Garden

contributions to the PCA's National Framework to help guide its evolution in a changing climate. This nationwide, multi-sector project will utilize a combination of surveys, case studies and, for botanic gardens, information in GardenSearch and PlantSearch. This provides a fantastic opportunity to demonstrate the important contributions of botanic gardens, and is yet another reason to make sure information on your garden is up to date in these databases.

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Ladybird Johnson Wildflower Center

RESOURCES



Global Biodiversity Outlook 3

The third edition of Global Biodiversity Outlook (GBO-3), the flagship publication of the Convention on Biological Diversity (CBD) was launched

on 10 May 2010. Drawing on a range of information sources, including National Reports, biodiversity indicators information, scientific literature, and a study assessing biodiversity scenarios for the future, GBO3 summarizes the latest data on status and trends of biodiversity and draws conclusions for the future strategy of the Convention.

GBO-3 confirms that the world has failed to meet its target to achieve a significant reduction in the rate of biodiversity loss by 2010. It warns that massive further loss of biodiversity is becoming increasingly likely, and with it, a severe reduction of many essential services to human societies as several “tipping points” are approached, in which ecosystems shift to alternative, less productive states from which it may be difficult or impossible to recover. The document argues, however, that such outcomes are avoidable if effective and coordinated action is taken to reduce the multiple pressures being imposed on biodiversity.

The document outlines a possible new strategy for reducing biodiversity loss, learning the lessons from the failure to meet the 2010 target. It includes addressing the underlying causes or indirect drivers of biodiversity loss, such as patterns of consumption, the impacts of increased trade and demographic change.

A number of resources related to Global Biodiversity Outlook 3 are available on the CBD website.. These include:

- A short executive summary document which summarizes the main findings of GBO-3. This document is available in Arabic, Chinese, English, French, Spanish, Russian and German.
- All the figures and tables used in the report in both jpeg and illustrator format
- A short PowerPoint presentation on the main findings of GBO-3
- The Technical Series Reports and Good Practice Guidelines which were considered in preparing GBO-3
- The Global Biodiversity Outlook 3 Official video (available from YouTube).

For further information and to download the full report, visit: <http://gbo3.cbd.int/home.aspx>

Catalogue of Life 2010 Annual Checklist

A. F. Clewell and J. Aronson

The *Catalogue of Life* Special 2010 Edition is the world’s most complete and integrated species list. It has 77 databases feeding into an inventory of 1,257,735 species of plants, animals, fungi and micro-organisms associated with 2,369,683 names. Co-ordinated by the international Species 2000



organisation based at University of Reading, UK and the Integrated Taxonomic information System (ITIS) based in Washington DC, the *Catalogue* is widely used by major global and regional biodiversity portals. The intergovernmental Global Biodiversity Information Facility (GBIF) and the Encyclopedia of Life (EoL) rely on it as the bedrock of their taxonomic information.

The *Catalogue of Life* can be used to: check the scientifically accepted name, spelling, alternative names and distribution of a species; find the place of the organism in the taxonomic hierarchy; compile checklists of species in a particular area or taxonomic group; find basic bibliographic resources; and carry out biodiversity analyses.

Plant data in the *Catalogue* is derived from a number of databases, with the World Checklist of Selected Plant Families (<http://apps.kew.org/>) compiled by the Royal Botanic Gardens, Kew providing information on 97 families of seed plants, including an almost complete list of the world’s monocots. This data is supplemented by data from a number of other plant databases, including:

- Mosses from MOST (www.mobot.org/mobot/tropicos/most/checklist.shtml)
- Liverworts and hornworts from ELPT (www.early-land-plants-today.org)
- Conifers from Conifer Database
- Cycads and 6 flowering plant families from IOPI-GPC (www.ioipi.org)
- Brazil Nut family (LecyPages), (<http://sweetgum.nybg.org/lp/>)
- Cranesbills (RJB Geranium), (www.rjb.csic.es/Geranium)
- Crucifers (Brassicaceae), <http://www.cbif.gc.ca/pls/spec/brassicaceae>
- Custard Apple family (Annonaceae), (www.annonaceae.org/)

- Legume family (ILDIS), (www.ildis.org)
- Nightshade genus (Solanaceae Source), (www.solanaceaesource.org)
- Sundew family (Droseraceae Database),
- Sunflower family (Global Compositae Checklist - www.compositae.org/checklist)
- Waits Numi family (Lacistemataceae Holistic Database - www.lacistemataceae.org)

The Catalogue of Life contributes towards assembling "a widely accessible working list of known plant species" prioritised by the Global Strategy for Plant Conservation Target 1. Further information is available at: www.catalogueoflife.org

Plant Germplasm Conservation in Australia- Strategies and Guidelines for Developing, Managing and Utilising Ex Situ Collections

Eds: Catherine A. Offord and Patricia F. Meagher



Strategies to conserve Australia's unique native plant heritage depend on understanding how plant species function. The collection, storage and study of plant germplasm –

whether as seed, tissue samples, frozen samples, or whole plants – helps us gain this knowledge. It provides research material to unlock the secrets of seed dormancy in the lab and in the wild; it allows us to establish new wild populations of threatened species with the best chance of success; and it provides an 'insurance policy' of genetically representative samples, to guard against the risk of extinction and the new threat of rapid climate change.

Plant Germplasm Conservation in Australia includes the latest advances in *ex situ* germplasm conservation. Written by many of Australia's foremost experts, they place the conservation of this country's unique and varied plant life in a national and international context, outline the key conservation treaties and strategies and provide a practical knowledge-kit for programmes requiring germplasm collection, storage, research and utilisation. Content is relevant for both long-term conservation storage and short-term revegetation seed banking.

ISBN: 9780975219119

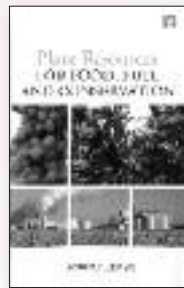
Published by the Australian Network for Plant Conservation in partnership with the Australian Seed Conservation and Research. October 2009

Available to purchase on-line from CSIRO publishing:

www.publish.csiro.au/pid/6188.htm

Plant Resources for Food, Fuel and Conservation

Robert Henry



Agriculture and food production have a large footprint on the landscape globally and compete for space with land for nature conservation. This book explores the competition between the food

needs of a growing human population and the conservation of biodiversity as intensified by the emerging use of crops for energy production.

As concern about the impact of greenhouse gas emissions on climate grows and oil prices increase, energy production from agricultural crops has become a significant industry. At the same time, growth in food demand due to population growth has been accelerated by growing affluence associated with economic growth in major developing countries increasing *per capita* consumption. Consumers are concerned that the price of food will continue to increase sharply as a result of this competition but a loss of biodiversity may be another major outcome. Drawing on his expertise in plant conservation genetics, the author provides a balanced appraisal of the potential for developing new or improved crops for food or bioenergy production in the context of climate change, while at the same time protecting biodiversity.

ISBN: 9781844077212

Published by Earthscan. December 2009

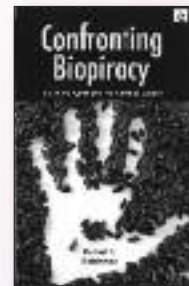
www.earthscan.co.uk

Confronting Biopiracy

Daniel F. Robinson

"Biopiracy" refers either to the unauthorised extraction of biological resources, such as plants with medicinal properties, and associated traditional knowledge from indigenous peoples and local communities, or to the patenting of spurious "inventions" based on such knowledge or resources without compensation. Biopiracy cases continue to emerge in the media and public eye, yet they remain the source of considerable disagreement, confusion, controversy and grief. The aim of this book is to provide the most detailed, coherent analysis of the issue of biopiracy to date.

The book synthesises the rise of the issue and increasing use of the term by activists and negotiators in the World Trade Organization (WTO) and the Convention on Biological Diversity (CBD), to form a critical understanding of the themes, implications and politics of biopiracy. Taking a case-study based approach, derived from interviews and fieldwork with researchers,



government, industry, local farmers, healers and indigenous people, the author sequentially documents events that have occurred in biopiracy and bioprospecting controversies.

Implications and ethical dilemmas are explored, particularly relating to work with local communities, and the power relations entailed. Detailing international debates from the WTO, CBD and other fora in an accessible manner, the book provides a unique overview of current institutional limitations and suggests ways forward. Options and solutions are suggested which are relevant for local communities, national governments, international negotiators, NGO and interest groups, researchers and industry.

ISBN: 9781844077229

Published by Earthscan. 2010

www.earthscan.co.uk

Please register your contributions to the *International Agenda for Botanic Gardens in Conservation*

International Agenda for Botanic Gardens in Conservation Registration Form

Name of Institution			
Type of Registration	Formal	Board Resolution or other form of approval from relevant governing bodies (e.g. university authorities, local, regional or national government)	<i>Please Tick</i> <input type="checkbox"/>
	Informal	E.g. by Director/Senior staff.	<input type="checkbox"/>

BGCI would welcome copies of any formal resolution, motion or other form of endorsement.

Name of responsible person			
Position			
Address			
Email		Date of Registration	

Declaration

This institution welcomes the International Agenda for Botanic Gardens in Conservation as a global framework for the development of institutional policies and programmes in plant conservation for botanic gardens.

Without imposing any obligations or restrictions (legal or otherwise) on the policies or activities of this institution/organisation, we commit ourselves to working to achieve the objectives and targets of the *International Agenda for Botanic Gardens in Conservation*.

Signed		Date	
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Please sign and detach this registration form and send it to The Secretary General, Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond, Surrey TW9 3BW, U.K.

Thank you for registering with the *International Agenda for Botanic Gardens in Conservation*.

Please keep a duplicate copy of this form for your records.

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*Contents of the Botanic Garden Management Resource Pack include: Darwin Technical Manual for Botanic Gardens, A Handbook for Botanic Gardens on the Reintroduction of Plants to the Wild, 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, additional recent BGCi reports and manuals. BG-Recorder (a computer software package for plant records) available on request.

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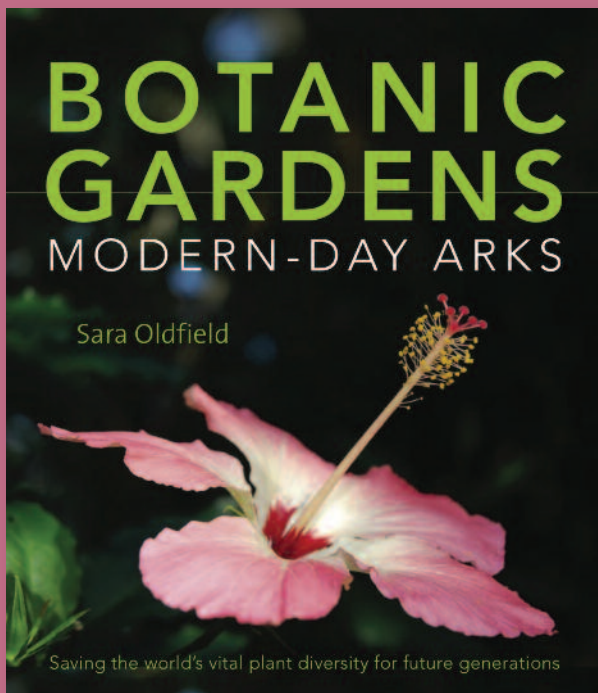
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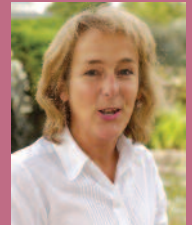
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BOTANIC GARDENS: MODERN-DAY ARKS

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