

International Agenda for Botanic Gardens in Conservation

2nd Edition

September 2012

Contributors

Maintain all on original list – and add new contributors to 2nd Edition

List of acronyms and abbreviations

ABS	Access to genetic resources and benefit sharing
BGCI	Botanic Gardens Conservation International
CBD	Convention on Biological Diversity
CEPA	Communication, education and public awareness
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPF	Collaborative Partnerships on Forests
FAO	Food and Agriculture Organisation of the United Nations
GMO	Genetically Modified Organism
GPA	The Global Plan of Action for the Conservation and Sustainable Utilization of PGFRA
GSPC	Global Strategy for Plant Conservation
GTI	Global Taxonomic Initiative
IFF	Intergovernmental Forum on Forests
IPF	Intergovernmental Panel on Forests
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
ITTA	International Tropical Timber Agreement
ITTO	International Tropical Timber Organisation
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
NGO	Non-governmental Organisations
PGRFA	Plant Genetic Resources for Food and Agriculture
REDD	Reducing Emissions from Deforestation and Forest Degradation
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

Botanic Gardens Conservation International

Plant diversity is essential for a sustainable future, critical for our supply of food, medicines, raw materials, fresh water and oxygen. Plant diversity is being eroded on a global scale with plant species going extinct at an ever increasing rate. Botanic Gardens Conservation International (BGCI) is a world leader in tackling this global and often over-looked biodiversity conservation crisis. We operate as a membership organization, representing and drawing on the extensive skills and expertise of botanic gardens around the world. Linking botanic gardens in 118 countries, BGCI forms the world's largest plant conservation network.

“Deforestation and forest degradation alone will likely cost the global economy more than losses in the 2008 financial crisis” United Nations Environment Programme, 2012

BGCI provides vision and leadership for the botanic garden and plant conservation communities and with the support of its world-wide network, is able to create significant global impact. Since our establishment 25 years ago, we have responded in a flexible manner to identified needs, taking into account global, national, and local priorities and circumstances. We work to ensure that plants are recognised as one of the world's most important natural resources, providing vital ecosystem services. We support the key roles of botanic gardens in plant conservation and environmental education helping to develop new botanic gardens where necessary and working with established gardens to address urgent issues of environmental concern. BGCI also recognises the beauty and social value of botanic gardens and promotes gardens as places of inspiration, learning and well-being for all.

BGCI's Vision: A world in which plant diversity is valued, secure and continues to support all life.

BGCI's Mission: To mobilise botanic gardens and engage partners in securing plant diversity for the well-being of people and the planet.

The context in which we work

The key international instrument for the conservation and sustainable use of biodiversity is the Convention on Biological Diversity (CBD). Biodiversity is a basic requirement in alleviating hunger and poverty and promoting human health and thus the CBD has a clear role in helping to achieve the Millennium Development Goals agreed by the international community at the Millennium Summit in 2000. Plant conservation is addressed by the CBD through the *Global Strategy for Plant Conservation* (GSPC), which was approved by 187 countries in 2002 and revised in 2010. BGCI was a driving force in the development and revision of the GSPC. BGCI continues to actively promote and implement the GSPC and it provides the ongoing rationale for our core conservation work. The 16 targets of the GSPC support the CBD's Strategic Plan for Biodiversity and the achievement of its 2020 Aichi targets

The *International Agenda for Botanic Gardens in Conservation* provides a broad framework for the work of botanic gardens and guidance on the role of BGCI. The *International Agenda* recognises the need for botanic gardens to play a major role in contributing to the targets of the GSPC that address:

- Halting the worldwide loss of plant species and their genetic diversity in the wild;
- Raising awareness of the importance of plants and the maintenance of biodiversity for the planet and human survival;
- Conservation needs and priorities within national, regional and local strategies on biodiversity conservation, the environment, sustainable development, economic and social policies, land use management and public education.

The *International Agenda* links the work of botanic gardens directly to international governmental policy and at the same time provides the botanic garden community with a unique common framework specific to their needs and skills. In this edition, explicit references to the GSPC are made, indicating where botanic garden activities can directly contribute to the implementation of the new GSPC targets for 2020.

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Foreword

The global loss of plant diversity has been acknowledged as a serious concern for the past forty years. Throughout this time botanic gardens have been amongst the most important agents for addressing the issue of plant loss. Individually and collectively botanic gardens have worked to prioritise the plants facing threat, take conservation action both *in situ* and *ex situ*, tackle over-exploitation of individual species, inform and educate visitors and the wider public, and champion plants in the policy arena. Of course botanic gardens do much more to connect people with the natural and cultural heritage, through science and the arts very broadly, but as the biodiversity crisis deepens the conservation work of botanic gardens becomes ever more a defining role.

In 1989, the *Botanic Gardens Conservation Strategy* was published. This linked to the *World Conservation Strategy* published by IUCN in 1980. The *World Conservation Strategy* was directed at government policy makers and advisers and others active in both conservation of the environment and sustainable development. Following extensive review of the *Botanic Gardens Conservation Strategy*, a new document, the *International Agenda for Botanic Gardens in Conservation* was published by BGCI in

2000. Both these important documents have helped to fundamentally shape the conservation work of botanic gardens worldwide and both linked this work to the broader policy framework for biodiversity conservation. Ten years later it was considered appropriate to develop an updated document for the botanic garden community. The urgent need for increased efforts to tackle biodiversity loss is for example expressed in the Millennium Ecosystem Assessment (see Box 1).

This second edition of the *International Agenda* builds on the two previous framework documents highlighted above and builds on the countless conversations within and between botanic gardens on how and why and for whom to save plant biodiversity. This document reflects the growing success of botanic gardens as a collective voice influencing the policy agenda. The publication of the *International Agenda* in 2000 directly influenced the formulation of the GSPC of the Convention on Biological Diversity – a global commitment by governments worldwide. Implementation of the *International Agenda* supports global efforts to implement the GSPC and therefore it was not felt appropriate to radically alter the document for this revised version. The changes made in this version reflect the success of the GSPC which has already been revised through an extensive consultation process. The second version of the *International Agenda* also reflects the wide range of other policy initiatives relating to biodiversity and human well being. We hope it provides a clear and concise framework that will be useful for all in the botanic garden community who are working against great odds to conserve the rich and diminishing diversity of plants that is essential to us all.

BOX 1 Key findings of the Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment (MA) was the largest assessment ever undertaken of the health of ecosystems, involving 1360 experts from 95 countries. It was called for by the UN Secretary General in 2000 and reports presented in 2005. The *Ecosystems and human well-being: Biodiversity synthesis* report of the MA (Millennium Ecosystem Assessment, 2005) has six key findings including those highlighted below.

Finding 1: Human actions are fundamentally, and to a significant extent irreversibly, changing the diversity of life on earth, and most of these changes represent a loss of biodiversity. Changes in important components of biological diversity were more rapid in the past 50 years than at any time in human history.

Virtually all of earth's ecosystems have now been dramatically transformed. Over half the 14 biomes assessed by the MA have experienced a 20-50% conversion to human use. The rate of loss of many biomes and their associated species is continuing with recovery limited to a few taxa and habitats that have been the focus of intensive management. Projected future changes are concentrated in the tropics, while limited recovery is expected in the temperate forests and woodlands.

With regard to species, humans have increased the species extinction rate by as much as 1,000 times over

background rates typical over the planet's history. Future projections, noted with a low degree of certainty by MA scientists, suggest that species extinction rates could increase to 10 to 100 times higher than in the recent past.

Finding 2: Biodiversity contributes directly (through provisioning, regulating, and cultural ecosystem services) and indirectly (through supporting ecosystem services) to many constituents of human well-being, including security, basic material for a good life, good social relations, and freedom of choice and action.

Finding 4: The drivers of loss of biodiversity and the drivers of change in ecosystem services are either steady, show no sign of declining over time, or are increasing in intensity

The main direct drivers of biodiversity loss are recorded by the MA as:

- Habitat transformation – particularly for agriculture
- Climate change
- Invasive alien species
- Overexploitation of species
- Pollution

Finding 5: Many of the actions that have been taken to conserve biodiversity and promote its sustainable use have been successful in limiting biodiversity loss but further significant progress will require a portfolio of actions building on current initiatives.

How to use the *International Agenda*

The *International Agenda* is a policy document for botanic gardens that links to the broad range of international biodiversity initiatives and particularly closely to the GSPC. Following the Introduction in Section 1, an overview of these international biodiversity initiatives and how they are linked is provided in Section 2. The key tasks and recommendations for botanic gardens are set out in Section 3. It would be impossible for every botanic garden to achieve all of the key tasks and recommendations outlined in this *Agenda*. However each botanic garden can use the *International Agenda* as a broad reference framework to guide its planning and develop its own role in conservation as appropriate to its region and resources. To implement a global mission for plant conservation, botanic gardens collectively need to undertake a broad but closely coordinated strategy in conservation, research and education. This *Agenda* not only provides a guide to support planning for individual gardens, but also indicates where actions undertaken by gardens directly contribute to the agreed international targets for plant conservation as provided by the GSPC.

SECTION 1

1. Introduction

1.1 Background

The first *Botanic Gardens Conservation Strategy* was published in 1989 by the Botanic Gardens Conservation Secretariat of IUCN (the precursor to BGCI) in collaboration with WWF (IUCN Botanic Gardens Conservation Secretariat, 1989). This document played an important part in guiding the developing role of botanic gardens in conservation throughout the 1990s. In 1998, it was felt that a fundamental revision of this document was required, involving input from many partners around the world. BGCI therefore launched an international consultation process to review and update the Strategy, taking into account the national and international policy framework in which botanic gardens were now operating. This consultation exercise also considered the new conservation techniques that were coming into effect in the areas of conservation biology, molecular studies and ecological research and the growing interest in environmental education and sustainability.

During the consultation period, numerous individuals, institutions and organisations helped to define the content and terms of the *International Agenda for Botanic Gardens in Conservation*, and this document was finalised and published in 2000 (Wyse Jackson and Sutherland, 2000).

The *International Agenda* aimed to provide a global framework for the development of botanic garden policies and programmes on the conservation of biodiversity, with a particular focus on responding to the relevant international treaties and national laws, policies and strategies. It provided a common agenda for all botanic gardens regardless of size, history and collections, providing guidance on how each garden could develop its own role in conservation, appropriate to its level of resources and local context. Although these aims remain unchanged, the context in which botanic gardens are operating has developed considerably over the past decade, both politically and environmentally, and a number of new initiatives have emerged.

This 2nd edition of the *International Agenda*, which has also been developed through an extensive consultation process involving the world's botanic garden community, provides an updated document to guide the conservation work of botanic gardens into the 21st century. New issues that are addressed in this edition include the GSPC and its 2020 targets, ecological restoration, the impacts of climate change and the political imperative to strengthen linkages between biodiversity conservation and human well-being.

It should be noted that updating has no impact on the registration system introduced by BGCI in 2003. Past registrations will continue to be recognised and valued by BGCI as a commitment by gardens to plant conservation.

1.2 Objective

The objective of the **International Agenda for Botanic Gardens in Conservation** is to assist in halting the loss of plant diversity by:

- i) Providing a common global framework for botanic garden policies, programmes and priorities in plant conservation.
- ii) Defining the role of botanic gardens in the development of global partnerships and alliances for plant conservation, especially in relationship to the implementation of the GSPC.
- iii) Stimulating the evaluation and development of conservation policies and practices in botanic gardens to enhance their effectiveness and efficiency.
- iv) Promoting the roles of botanic gardens in conservation.
- v) Providing guidance for botanic gardens on new and emerging issues in conservation.
- vi) Providing a mechanism for botanic gardens to record their commitment to plant conservation.

1.3 The current status of botanic gardens

There are currently over 3,000 botanic gardens and arboreta in existence in 180 countries around the world. Collectively they cultivate over 300,000 taxa, representing around 100,000 species (almost one third of all known plant species)¹. Representatives of nearly 90% of all vascular plant families and 54% of vascular plant genera can be found in botanic garden collections (Cullen and Wyse Jackson, 2008). Botanic garden collections are particularly rich in groups such as orchids, cacti and other succulents, palms, bulbs, conifers and temperate trees and shrubs. Many gardens also include extensive collections of medicinal plants and other species of socio-economic importance and in recent years, there has been an increasing focus on the conservation and display of native flora and threatened species. In addition, botanic gardens have a wealth of other collections, such as herbaria and seed banks.

There are now very few countries without at least one botanic garden. New botanic gardens are being established throughout the world – often as botanical resource centres supporting native plant conservation. However, although as many as half of all botanic gardens in existence today have been established in the last 50 years, there is still a need for more botanic gardens in the countries with the highest levels of plant diversity. Building the capacity of new and existing botanic gardens for conservation and education is a top priority in helping to ensure the maintenance of plant diversity.

¹ Data from BGCI's GardenSearch and Plantsearch databases

Box 2: Defining the botanic garden

'Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education'.

Wyse Jackson, 1999

Table 1. Global distribution of botanic gardens (August 2012)

<u>Region</u>	<u>Number of botanic gardens</u>
Africa and Indian Ocean	162
Asia	490
Australia and the Pacific	158
Central America and Caribbean	74
Central Asia	26
Europe	929
Middle East	38
North America	792
Russian Federation	109
South America	173
Total	2951

1.4 The global mission of botanic gardens

During the last few decades, botanic gardens throughout the world have acknowledged the challenge of global plant conservation. The mission as expressed in the first edition of the *International Agenda for Botanic Gardens in Conservation* (Wyse Jackson and Sutherland, 2000) remains valid today:

Box 3: The global mission of botanic gardens worldwide in conservation can be summarised as follows:

To stem the loss of plant species and their genetic diversity and prevent further degradation of the world's natural environment by:

- Raising public understanding of the value of plant diversity and the threats it faces.
- Implementing practical action for the benefit and improvement of the world's natural environment.
- Promoting and ensuring the sustainable use of the world's natural resources for present and future generations.

The achievement of this mission will require botanic gardens to undertake a broad programme of activities, as outlined in this Agenda. However, botanic gardens cannot achieve this mission on their

own. They should work in partnership with a wide range of bodies to achieve their targets, including governments; NGOs; scientific, technical and educational institutions; business and industries, communities and individuals.

1.5 Collective actions and strengths

Achieving the global mission will require botanic gardens to undertake a broad but closely coordinated cooperative strategy. Working together, the botanic garden community forms a powerful body that can address a number of important issues. Key amongst these are:

Halting plant extinction

- Support implementation of international policy especially the GSPC.
- Document the plant diversity of the world, including its present distribution in the wild, conservation status and trends, threats, use and preservation in protected areas and *ex situ* collections.
- Set agreed levels and standards in plant diversity conservation, integrating techniques in *ex situ* and *in situ* conservation.
- Maintain genetically diverse and accessible samples of the world's plant species in their collections.
- Develop, implement and participate in plans and actions aimed at the recovery of species and the restoration of ecosystems and their diversity.
- Develop and implement control measures for invasive alien plants that pose great threats to biodiversity.
- Support the development of global capacity for conservation through collaborative partnerships at all levels.

Addressing climate change:

- Monitor and share information and on the impacts of climate change on plants.
- Conduct relevant research on plants and climate change and share the results widely.
- Ensure conservation of species most susceptible to the effects of climate change.
- Provide information and raise public awareness through common messages.
- Support mitigation and adaptation responses – for example through forest conservation and restoration, city greening initiatives and trialling new plants for food and medicine.

- Influence policy at local, sub-regional, regional and international levels.

Supporting human well-being:

- Undertake research into the value of plants for human well-being.
- Pay special attention to the conservation and sustainable use of plant species that are of direct subsistence and economic importance to human societies.
- Ensure the fullest community and institutional participation in botanic garden programmes.
- Support sustainable local use of plants through gift shops, restaurants etc.
- Work with local communities to improve human well-being through the sustainable use of plants

Providing education and public awareness :

- Undertake public awareness programmes within the botanic gardens, and in the wider community, to raise awareness of the value of plant diversity, the human impacts that threaten its maintenance, and the steps that can be taken by all to prevent the loss of plant diversity.
- Develop partnerships and alliances with government and non-government organisations and community groups to promote awareness and understanding of the value of biodiversity.
- Assist in the development of public policies and priorities for environmental protection and biodiversity conservation.
- Work in partnership to incorporate the importance of plants and environmental conservation into formal curricula and informal education programmes.

1.6 Getting started

Some initial priorities for botanic gardens are to:

- Undertake a review of the mission and the capacity of the individual institution.
- Assess current activities and priorities and check the status of these against the key tasks outlined in the *International Agenda*.
- Develop a plan for the implementation of the *Agenda* including the specific roles that the institution will and will not undertake and consider the following:
 - access and benefit sharing
 - climate change
 - community development
 - conservation – *ex situ* and *in situ*
 - cultural heritage
 - national plant conservation strategies
 - networking/partnerships
 - public education and awareness
 - research
 - reintroduction of species

- ecosystem restoration
- identification and monitoring of plant diversity
- information exchange
- invasive alien species
- national strategies on the conservation of biodiversity
- sustainable development
- sustainable use of biodiversity
- technical and scientific cooperation
- technology transfer
- training and capacity building

- Develop partnerships and alliances to ensure an integrated approach to plant conservation.

The successful implementation of the International Agenda will continue to be dependent on each botanic garden carefully considering and formulating their own conservation response. The international registration system that has been developed and maintained by BGCI records the commitment of botanic gardens to the implementation of the Agenda. A list of registered institutions is available on the BGCI website: www.bgci.org.

By providing a global framework for botanic gardens in conservation, with a clear link to the GSPC and other international policy initiatives, it is hoped that the loss of plant species and their genetic diversity and the further degradation of the world's natural environment can be halted. This will therefore enhance the legacy of the world's biological resources handed on to future generations.

SECTION 2

International policies and legislation relevant to botanic gardens

The growing concern for the world's environment has led to a significant advance in international cooperation on development and environment issues in recent years. As part of this, comprehensive international frameworks have been developed to guide countries in their formulation of national policies and the allocation of resources to meet development and environment goals. The UN Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 led to three new international agreements: the Convention on Biological Diversity (CBD); the United Nations Framework Convention on Climate Change (UNFCCC); and the United Nations Convention to Combat Desertification (UNCCD). These three so-called Rio Conventions collaborate in a number of ways such as through a Joint Liaison Group. Agenda 21: Programme for Action for Sustainable Development was another major achievement of UNCED. Ten years later, the World Summit on Sustainable Development (WSSD) was held in Johannesburg. The WSSD evaluated progress achieved since UNCED and endorsed the Millennium Development Goals (MDGs) that were agreed by world leaders in 2000. The WSSD Plan of Implementation recognised the CBD as the key instrument for the conservation and use of biodiversity that is equitable and sustainable. In 2012, the UN's Sustainable Development Summit (Rio+20) reaffirmed the international commitment to the achievement of the three objectives of the CBD and the importance of implementing the Strategic Plan for Biodiversity 2011-2020, and its twenty Aichi targets (Annex 1), which were adopted by the Conference of the Parties to the CBD at their tenth meeting in Nagoya Japan in 2010.

Many of these international frameworks are relevant for botanic gardens and provide valuable mechanisms to stimulate and guide their work globally for plant conservation.

2.1 Convention on Biological Diversity (CBD)

Opened for signature at the Earth Summit in Rio de Janeiro in 1992, and entering into force in December 1993, the CBD is an international treaty for the conservation of biodiversity, the sustainable use of the components of biodiversity and the equitable sharing of the benefits derived from the use of genetic resources. With 193 Parties, the Convention has near universal participation among countries. The Convention seeks to address all threats to biodiversity and ecosystem services through scientific assessments, the development of tools, incentives and processes, the transfer of technologies and good practices and the full and active involvement of relevant stakeholders including indigenous and local communities, youth, NGOs, women and the business community. The tenth meeting of the Conference of the Parties to the Convention, held 2010, adopted a revised and updated Strategic Plan for Biodiversity 2011-2020, comprising five strategic goals and the 20 Aichi Biodiversity Targets (Annex 1). The Plan is the overarching framework on biodiversity, not only for the biodiversity-related conventions, but for the entire United Nations system.

The CBD is a binding international regulation for the countries that are Parties (signatories) to it. Their obligations are constantly evolving as Parties negotiate further decisions and legislation and policies are adopted and implemented at national level.

Botanic gardens' collections and the application of their skills in areas such as taxonomy, botanical research, conservation, horticulture and public education contribute significantly to the implementation of the CBD. They also provide a major link between *in situ* and *ex situ* conservation and are frequently involved in national planning processes such as the development of national biodiversity strategies.

Box 4: The ecosystem approach

The primary methodology for the CBD, adopted in 2000, is the 'ecosystem approach': a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way and so seeks to balance the three objectives of the CBD. It is based on the application of appropriate scientific methodologies focused on levels of biological organisation which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognises that humans, with their cultural diversity, are an integral component of many ecosystems.

Source: Davis, 2008.

The work of the CBD is divided into a set of seven thematic work programmes that correspond to the major biomes (forests, dry and sub-humid lands, agricultural lands, seas and coasts, inland waters, mountains, and islands) and a number of cross-cutting issues. The following cross-cutting issues are of particular relevance to botanic gardens:

- **Global Strategy for Plant Conservation** – see section 2.1.1
- **Access to genetic resources and benefit sharing (ABS):** The CBD confirms the sovereign rights of nations over their genetic resources acknowledging that governments have the authority to determine how such material is accessed. Furthermore, it calls for benefits derived from the use of genetic resources to be shared fairly and equitably with the country of origin. ABS policy is of fundamental importance to botanic gardens that acquire, curate, exchange and supply plant material internationally. For further information, see Section 3.10
- **Communication, education and public awareness (CEPA):** This work programme seeks to communicate the scientific and technical work of the CBD in accessible ways, to integrate biodiversity into education systems in all CBD Parties, and to raise public awareness of the importance of biodiversity to our lives and its intrinsic value. Botanic gardens offer unique opportunities for people to learn about and enjoy biodiversity and should ensure that every

opportunity is taken to engage with and inform the public about biodiversity. See also Section 3.8

- **Global Taxonomy Initiative (GTI):** The CBD recognises that taxonomy is crucial to the implementation of the Convention, and that progress is obstructed by the ‘taxonomic impediment’: there is not sufficient taxonomic knowledge, and there are not enough taxonomists worldwide. Botanic gardens with active taxonomic research programmes can contribute to GTI implementation through their national GTI Focal Point (see: www.cbd.int/doc/lists/nfp-gti.pdf).
- **Invasive alien species:** The spread of alien, or non-native, invasive species is one of the most important direct drivers of biodiversity loss and the CBD determines that Parties should prevent the introduction of, and control or eradicate those alien species which threaten ecosystems, habitats or species. Many invasive plants have been introduced as ornamental plants and therefore owe their introduction to gardens and nurseries. Botanic gardens can take a number of actions to tackle invasive species – see Section 3.6.
- **Sustainable use of biodiversity:** The sustainable use of biological resources is a pillar of the CBD. The Convention defines sustainable use as: *‘the use of the components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations’*. Botanic gardens can be powerful advocates for sustainable use of plant diversity by adopting sustainable management practices, by conducting research on potential sustainable uses of plants, and by raising public awareness of the issue generally. Further information is provided in Section 3.5.1.
- **Traditional knowledge, innovations and practice (Article 8j):** The protection of traditional knowledge is one of the most complex cross-cutting issues in the CBD. Article 8(j) sets out that, subject to national legislation, the knowledge, innovations and practices of indigenous and local communities relevant for conservation and sustainable use should be respected, preserved, maintained and promoted, with the approval and involvement of the knowledge holders, and that benefits from use should be shared equitably. Botanic gardens should value and respect traditional knowledge and work according to available principles, guidelines and codes of conduct.
- **Technology transfer and cooperation:** Technology transfer and cooperation are important means of achieving equitable benefit-sharing and improving countries’ abilities to carry out their own research and development. Botanic gardens make use of many technologies in their scientific and horticultural work and can help to implement the CBD’s provisions on technology transfer by offering technical advice, training opportunities, or funds for equipment and renovation to other gardens.

A CBD checklist for botanic gardens is provided in Annex 2.

2.1.1 Global Strategy for Plant Conservation (GSPC):

The GSPC, adopted by the Conference of the Parties (COP) in 2002, is a strategic framework for plant conservation action at global, regional, national and local levels, linking governmental and non-governmental partners and existing programmes. The GSPC aims to act as a catalyst for working together at all levels to understand, conserve, and use sustainably, the world's immense wealth of plant diversity, whilst promoting awareness and building the necessary capacity for its implementation. It sets out 16 outcome-oriented targets to be met by 2020 (see Box 5). The targets are being incorporated into the thematic programmes of work of the CBD, and also overlap with the work on cross-cutting issues, such as invasive alien species, Article 8j on traditional knowledge and the Global Taxonomy Initiative.

Botanic gardens were central players in the development of the GSPC and they are at the forefront of implementing many of the targets, particularly those on taxonomy, development of protocols for conservation and sustainable use, *ex situ* conservation, education and public awareness and capacity-building. Many gardens have now mainstreamed the GSPC targets within their ongoing work programmes and a number of botanic gardens act as national GSPC Focal Points (see: www.cbd.int/doc/lists/nfp-cbd-GSPC.pdf).

Botanic garden activities that contribute to the implementation of the targets of the GSPC are highlighted throughout Section 3 of this publication.

Box 5: The 2020 Targets of the Global Strategy for Plant Conservation

Target 1: An online flora of all known plants.

Target 2: An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action.

Target 3: Information, research and associated outputs, and methods necessary to implement the strategy developed and shared.

Target 4: At least 15 per cent of each ecological region or vegetation type secured through effective management and/or restoration.

Target 5: At least 75% per cent of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity.

Target 6: At least 75 per cent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity.

Target 7: At least 75 per cent of the world's threatened species conserved *in situ*.

Target 8: At least 75 per cent of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes.

Target 9: 70 per cent of the genetic diversity of crops, including their wild relatives and other socio-economically valuable plant species conserved, and associated indigenous and local knowledge respected [preserved] [protected] and maintained.

Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded.

Target 11: No species of wild flora endangered by international trade.

Target 12: All wild-harvested plant-based products sourced sustainably

Target 13: Indigenous and local knowledge, innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care.

Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes.

Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.

Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.

2.2 United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is an international treaty adopted by 193 parties in 1992 in an attempt to reduce global climate change. The Convention has the goal of preventing "dangerous" human interference with the climate system. In 2005 a number of nations approved an addition to the treaty: the Kyoto Protocol, which has more powerful (and legally binding) measures to reduce greenhouse gas emissions by 5% of 1990 levels by 2012. The Kyoto Protocol is generally seen as an important first step towards a truly global emission reduction regime that will stabilize greenhouse gas emissions, and provides the essential architecture for any future international agreement on climate change.

Box 6: Reducing emissions from deforestation and forest degradation (REDD)

Reducing Emissions from Deforestation and Forest Degradation (REDD) provides incentives and rewards for a reduction in deforestation and forest degradation and has the potential to make vast and immediate reductions to greenhouse gas emissions. The recently proposed REDD-plus, extends the objectives of REDD to include the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. Botanic gardens are well placed to assist countries develop and implement REDD-plus projects. Further guidance on REDD for botanic gardens is provided in Annex 3.

Adaptation to the effects of climate change is vital in order to reduce the impacts of climate change that are happening now and increase resilience to future impacts. Successful adaptation not only depends on governments but also on the active and sustained engagement of stakeholders, including national, regional, multilateral and international organizations, the public and private sectors, civil society and other relevant stakeholders.

In relation to the UNFCCC, botanic gardens are well placed to:

- Cooperate and work with other institutions to monitor and assess the impact of climate change on biodiversity, both *in situ* and *ex situ*.
- Contribute skills, expertise and knowledge to programmes designed to mitigate and adapt to climate change.
- Disseminate relevant information on climates, and climatic change under the Convention itself, to other bodies and the general public.
- Develop and implement educational and public awareness programmes on climate change and its effects on biodiversity and global sustainability.
- Adjust their daily operations to ensure that they work towards reducing their current contributions to global warming.

2.3 The United Nations Convention to Combat Desertification (UNCCD)

Combating desertification (i.e. the degradation of land in arid, semi-arid and dry sub-humid areas) is essential to ensure long term productivity of drylands and the biodiversity they support. The United Nations Convention to Combat Desertification was adopted in 1994 and aims to promote effective action through innovative local programmes and supportive international partnerships. The Convention calls on governments to focus on raising awareness, education, and training, both in developing and developed countries (Article 16).

Botanic gardens, in particular in dryland regions of the world, are contributing to combating desertification in several ways.

- Undertaking research and development of the plants of dry regions (Article 17).
- Working in partnership with other bodies to prevent and/or reduce land degradation and undertake rehabilitation and reclamation of degraded land.
- Improving the utilisation of land by the introduction and cultivation of appropriate plants.
- Improving knowledge of plants from dry regions and disseminating information about them.
- Conserving germplasm of dryland plants in their collections.
- Providing training in plant conservation techniques appropriate for the management of dryland plant resources and ecosystems.

2.4 The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES (also known as the Washington Convention) provides an international legal framework for the regulation of trade in those plant and animal species that are exploited commercially for international trade. This Convention, that came into force in 1975, is arguably the strongest biodiversity convention in that its provisions are translated into national legislation by Parties. The treaty operates through the

issue and control of export and import permits for a number of clearly defined species listed in three Appendices. CITES certifies sustainable trade in plant species that can withstand current rates of exploitation, but prevents trade in those that face extinction. Synergies between CITES and CBD are promoted in various ways at national and international levels including directly through targets of the GSPC.

Each member nation who has adopted the Convention is responsible for its implementation, including the appointment of Management and Scientific Authorities. Member states are required to have their own national legislation to implement the Convention and this may be stricter than the provisions of the Convention itself. CITES provides a baseline for the regulation of trade in wild plants, and some countries apply stricter rules, for example prohibiting all exports of their native wild plants.

Box 7:	CITES Appendices
Appendix I	lists plant species <i>threatened with extinction</i> , for which international trade must be subject to particularly strict regulation, and only authorized in exceptional circumstances.
Appendix II	lists species that are not threatened with extinction at present, but may become so if uncontrolled trade continues. Trade is permitted of both wild and artificially propagated material provided an appropriate permit is obtained.
Appendix III	lists species that are threatened locally with extinction through commercial exploitation and therefore subject to trade controls within certain nations. International trade in this material requires an export permit from the country that listed the species, or a certificate of origin.

Botanic gardens have a central role to play in improving the implementation and awareness of CITES for plants. They can actively protect taxa threatened with extinction through illegal or unsustainable commercial exploitation in several differing but complementary ways.

In relation to CITES, botanic gardens can:

- Register as a scientific institution with their CITES Management Authority facilitating exchange of material for non-commercial purposes.
- Provide advice and training to their country's CITES Management and Scientific Authorities, customs and legal authorities.
- Act as rescue centres for holding plant material confiscated by the statutory authorities.
- Provide an example to the public by setting ethical standards for their own conduct in collecting, displaying and using plants.
- Develop and implement public awareness programmes on CITES.

A CITES checklist for botanic gardens is provided in Annex 4.

2.5 Convention Concerning the Protection of World Cultural and Natural Heritage

The Convention Concerning the Protection of World Cultural and Natural Heritage (popularly known as the World Heritage Convention) emerged from a UNESCO meeting in 1972. The Convention arose from a need to stimulate international cooperation to protect and preserve the world's cultural and natural heritage for present and future generations.

The Convention defines the kind of natural and cultural sites that can be considered for inscription on the World Heritage List. The authenticity and integrity of the site and the way it is protected and managed are very important. A benefit of areas being included on the World Heritage List is the support that becomes available from the international community to protect, conserve and present the world's heritage as well as a heightened public profile of the area. The first botanic garden to be designated a World Heritage Site was Padua University Botanic Garden in Italy in 1997. Subsequently in 2003, the Royal Botanic Gardens, Kew was awarded World Heritage Site status in recognition of its fine landscape gardens and leading contribution to the study of plant diversity and economic botany around the world. The Cape Floral Region, a global priority for plant conservation, is recognized as a World Heritage Site made up of eight protected areas. Kirstenbosch National Botanical Garden in the outskirts of Cape Town, is included within the designation, as part of the Table Mountain National Park. It is the first botanical garden in the world to be included within a natural World Heritage Site.

Botanic gardens can benefit from and support this Convention in various ways.

- Consider application, through national government representatives, to be included on the World Heritage List.
- Promote and support applications for natural and cultural sites to be included on the World Heritage List.
- Work in partnership to counteract dangers that threaten natural and cultural heritage.
- Develop educational materials and undertake activities that enhance knowledge of, and respect for, important cultural and natural heritage sites and support the aims of the Convention.
- Undertake the preparation of inventories of plant diversity and other information for sites included in the 'List of World Heritage in Danger'.

2.6 The Convention on Wetlands of International Importance

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. It is the only global environmental treaty that deals with a particular ecosystem. The Ramsar Convention uses a broad definition of freshwater and near-shore marine wetlands and includes within its framework lakes, rivers, peatlands, oases, estuaries, mangroves, coral reefs, fish ponds, rice paddies, and reservoirs.

Botanic gardens can have a role in the implementation of this Convention in several ways.

- Working in partnership with other bodies to manage and restore local and regional wetland areas.
- Undertake research into the conservation, cultivation and biology of threatened aquatic and other wetland plants.
- Raise public awareness about the importance of wetland habitats through education programmes and activities.

2.7 The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGFRA)

In 1983, the Food and Agriculture Organisation of the United Nations (FAO) established an intergovernmental forum: the Commission on Plant Genetic Resources (now the Commission on Genetic Resources for Food and Agriculture). The Commission provides the only permanent forum for governments to discuss and negotiate matters specifically relevant to biological diversity for food and agriculture. The Commission aims to reach international consensus on policies for the sustainable use and conservation of genetic resources for food and agriculture and the fair and equitable sharing of benefits derived from their use.

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) – negotiated by the Commission, went into effect in 2004 and has been ratified by more than 120 countries. Through the Treaty, countries agree to establish a Multilateral System to facilitate access to genetic resources of 64 of our most important crops and forages (see Annex 5), and to share the benefits in a fair and equitable way. The Treaty provides for sharing the benefits of using plant genetic resources through information-exchange, access to and the transfer of technology, and capacity-building. It also foresees a funding strategy to mobilize funds for programmes to help, above all, small farmers in developing countries. This funding strategy also includes the share of the monetary benefits paid under the Multilateral System.

The Global Crop Diversity Trust, launched in 2004, spearheads international efforts to endow the world's most important collections of crop diversity. The Trust is an essential element of the Treaty's funding strategy, specifically supporting the *ex situ* conservation of crop genetic diversity.

The Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA) was adopted by 150 countries in 1996. It was subsequently endorsed by the Conference of the Parties to the Convention on Biological Diversity and by Heads of State and Government at the World Food Summit. The GPA is a framework for action at community, national, regional and international levels and it provides the priority basis for the funding strategy of the ITPGFRA. It seeks to create an efficient system for the conservation and sustainable use of plant genetic

resources, through better cooperation, coordination and planning and through the strengthening of capacities.

Botanic gardens have an important role to play in the conservation of plant genetic resources for food and agriculture. Their collections often include crop wild relatives and other groups of socioeconomically important wild plants, such as medicinal plants, that tend to be less well represented in traditional collections of PGRFA. However, in many countries linkages between the agricultural and environmental sectors are poorly developed and botanic gardens are not generally included in national plant genetic resources programmes or networks.

In relation to the conservation of PGRFA, botanic gardens should:

- Be aware of species in their collections that are included in Annex 1 of the *International Treaty* and use the appropriate Material Transfer Agreement for the exchange of germplasm of such species.
- Forge linkages with the agricultural sector to ensure their work is considered in relation to reporting on GPA implementation through national plant genetic resources networks.
- Be aware of and get involved in regional programmes for the *ex situ* conservation of PGRFA.

2.8 United Nations Forum on Forests (UNFF)

The UNFF was established in 2000 to promote the management, conservation and development of all types of forests and to strengthen long-term political commitment to this end. The UNFF is responsible for taking forward the work of the Intergovernmental Panel on Forests (IPF)/Intergovernmental Forum on Forests (IFF) which operated from 1995-2000. The WSSD called for accelerated implementation of the IPF/IFF proposals for action by countries and by the Collaborative Partnership on Forests (CPF). The CPF, established in 2001, is comprised of 14 international organizations including the Secretariats of the CBD, UNFCCC and UNCCD.

The Seventh Session of the UNFF adopted the landmark Non-Legally Binding Instrument on All Types of Forests on 28 April 2007. The instrument is considered a milestone, as it is the first time countries have agreed to an international instrument for sustainable forest management – agreement could not be reached on an international forestry convention at the Earth Summit in Rio but a “Statement of Forest Principles” was produced. The instrument is expected to have a major impact on international cooperation and national action to reduce deforestation, prevent forest degradation, promote sustainable livelihoods and reduce poverty for all forest-dependent peoples.

In relation to the sustainable forest management and conservation of forest biodiversity botanic gardens can:

- Expand and improve the quality of forest assessments.
- Undertake research into the conservation and sustainable management of forest resources including Non Timber Forest Products.
- Contribute to the development and implementation of Criteria and Indicators for Sustainable Forest Management.
- Increase public awareness of the importance of forests for biodiversity conservation and provision of ecosystem services; the threats they face and conservation solutions.
- Undertake or assist in forest restoration efforts.

2.9 The International Tropical Timber Organisation (ITTO)

ITTO is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. ITTO operates under the International Tropical Timber Agreement (ITTA) the first version of which was negotiated in 1983, as part of the Programme for Commodities of the United Nations Conference on Trade and Development (UNCTAD). ITTO is an action-oriented organization. It formulates policies relevant to its objectives and assists members to implement those policies through a programme of pre-projects (or scoping studies), projects and other activities. Most are implemented by national and local-level organizations, including those in government, civil society and the private sector. A small secretariat, based in Japan, supervises, monitors and evaluates the field programme under the direction of the International Tropical Timber Council. The ITTO is a member of the CPF and works closely with the CBD and CITES.

2.10 Millennium Development Goals

In September 2000, building upon a decade of major United Nations conferences and summits, world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets - with a deadline of 2015 - the Millennium Development Goals (MDGs). The MDGs provide a framework for the entire international community to work together towards a common end – making sure that human development reaches everyone, everywhere. The MDGs effectively provide an umbrella for the work of all international policies and procedures for biodiversity conservation and sustainable development.

Box 8: The Millennium Development Goals

- Goal 1: Eradicate extreme poverty and hunger
- Goal 2: Achieve universal primary education
- Goal 3: Promote gender equality and empower women
- Goal 4: Reduce child mortality
- Goal 5: Improve maternal health
- Goal 6: Combat HIV/AIDS, malaria and other diseases
- Goal 7: Ensure environmental sustainability
- Goal 8: Develop a Global Partnership for Development

The conservation work of botanic gardens particularly contributes to the achievement of Goal 7 which includes four targets:

Target 7a: Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources;

Target 7b: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss (the overall target of the CBD);

Target 7c: Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation;

Target 7d: Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020

In relation to the Millennium Development Goals, botanic gardens should:

- Raise awareness of the MDGs amongst their visitors and partners;
- Work with local communities to develop the sustainable use of plant resources to address issues of poverty, malnutrition and disease;
- Integrate the principles of sustainable development into their own policies and practices;
- Conserve plant diversity and work to restore degraded ecosystems and plant communities.

SECTION 3

The practice of conservation

Introduction

This section outlines the practice and priorities for botanic gardens in conservation. It highlights the importance of botanic gardens as the world's greatest resource for the cultivation and conservation of individual plant species and suggests ways in which botanic garden actions can be directed towards promoting integrated biodiversity conservation (combining and utilising *ex situ* and *in situ* techniques). It considers the contributions that botanic gardens can make to conservation and the sustainable use of plants through their research and educational activities and suggests ways in which cooperation and networking can enhance and multiply this effort by establishing or strengthening collaborative partnerships. In addition, it suggests ways in which botanic gardens can become models for best environmental practice through their own policies and practices, with the aim of promoting environmental awareness and sustainability to the general public.

3.1 Identification and monitoring

Knowledge about the world's biodiversity is fundamental to conservation. Identification and monitoring involve generating new data, gathering existing information and ensuring that accurate information is accessible and usable for conserving biodiversity. Botanic gardens, along with herbaria, museums, universities and protected areas are often amongst the major custodians of data, expertise and collections of biological diversity in their country. These can include collections of living specimens, seeds and other propagules, herbarium specimens and other plant materials, such as spirit collections, tissues, wood samples and ethnobotanical artefacts. For historical reasons, some large botanic gardens throughout the world contain vast collections and much expertise on the biodiversity of other countries and regions.

Activities carried out in relation to identification and monitoring relate to Targets 1 and 2 of the GSPC, which call for:

- Target 1: *An online flora of all known plants.*
- Target 2: *An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action.*

Botanic gardens should:

- i) Seek to ensure that their collections, data and expertise are organised, made available and utilised to the fullest extent possible to support the accurate identification and monitoring of biological diversity throughout the world.

- ii) Include new, and enhance existing, collections of botanical specimens in their living collections, herbaria and museums, where such samples can support the identification and monitoring of biological diversity, while ensuring at the same time that such collection activities do not threaten the diversity of such species in any way or its survival in the wild.
- iii) Be involved in the preparation of floras, field guides, taxonomic monographs, identification keys and manuals, handbooks, other reference works and publications that assist in the identification, monitoring and recovery of plant diversity.
- iv) Ensure that appropriate access to their collections is given to those seeking to use them for identification and monitoring purposes.
- v) Seek to monitor and identify plant species that are threatened, especially in the local area, including their distribution, current status, actual and potential threats and the recovery action needed. Work with local people to the extent possible in the collection of these data.
- vi) Collate all available information on the status of threatened plants to support Red Listing processes at national and international levels.
- vii) Seek to identify and monitor plant species that are showing potential to become invasive, especially in the local area.
- viii) Develop field-based monitoring programmes, focused on vulnerable areas, to enable long-term assessment of the impact of climate change on plant diversity.
- ix) Seek to develop more realistic plant diversity - climate change modelling approaches to detect potentially threatened species and potentially invasive species in a changing climate scenario.

3.2 Conservation action

Successful biodiversity conservation requires a multitude of skills, techniques and practices to be blended in a seamless fashion and often represents a complex mixture of biological, economic and sociological issues. Biodiversity conservation also needs to act at various levels of biological organisation, from genes and alleles, individuals, populations and species to whole ecosystems, preserving not only the components of biodiversity but also the interactions between them.

3.2.1 *In Situ* Conservation

In situ or on site conservation is defined as conservation of biodiversity within ecosystems and natural habitats. In the case of cultivated plants, *in situ* conservation is when conservation is carried out in the surroundings where the plants have been developed and utilised.

The aim of *in situ* conservation is to allow and enable biodiversity to maintain itself within the context of the ecosystem in which it is found. In the case of a plant population this will include its ability to sustain itself through self-replication and to have potential for continued evolution.

Many botanic gardens are active in *in situ* conservation, maintaining or managing nature reserves, areas of natural vegetation or working closely with managers of associated national parks and other protected areas. Over 400 botanic gardens worldwide have reported to BGCI that they manage areas of natural vegetation or have natural areas within their boundaries. Botanic gardens have special skills and resources to support *in situ* conservation, including the reference collections and libraries that support botanical research and the horticulture and nursery facilities that are important for habitat restoration, reintroductions and re-vegetation projects.

Activities in relation to *in situ* conservation relate to GSPC Targets 4, 5 and 7, which are:

- Target 4: *At least 15 per cent of ecological regions or vegetation types secured through effective management and/or restoration.*
- Target 5: *At least 75 per cent of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity.*
- Target 7: *At least 75 per cent of threatened plant species conserved in situ.*

Botanic gardens should:

- i) Collaborate with national and other land management agencies, public and private institutions and organisations, local communities and other relevant stakeholders involved in protected area and natural ecosystem conservation.
- ii) Undertake or participate in programmes aimed at conserving species diversity *in situ*, including species recovery programmes, habitat restoration, control of invasive plant species and the management of plant populations and ecosystems.
- iii) Seek to apply the international criteria to identify important areas for plant diversity in the areas in which they work, as the first step towards protecting these areas.
- iv) Develop appropriate research programmes that support *in situ* conservation, including conservation biology, restoration ecology, horticulture, population genetics, taxonomy, the control of invasive species, pests and diseases, floristic inventories and status surveys.
- v) Seek to include expertise in ecology, biodiversity inventorying and assessment and conservation genetics amongst their staff.

- vi) Develop and support appropriate strategies and programmes for the conservation of biodiversity in the human dominated landscapes in which many botanic gardens are situated.
- vii) Be involved in advising policy makers on the formulation and implementation of *in situ* conservation and land-use policies, plans and priorities for their own region or country.

3.2.2 *Ex situ* conservation

Ex situ conservation of wild plants is a central and unique role of botanic gardens. They have the appropriate facilities and staff expertise in botany and horticulture to provide an 'insurance policy' against plant extinction. *Ex situ* conservation can include the maintenance of samples of whole individuals, as well as seed, pollen, vegetative propagules and tissue or cell cultures. While recognised as one of the most important tools available to botanic gardens in biodiversity conservation, the use of *ex situ* conservation is justifiable only as part of an overall conservation strategy to ensure that species ultimately survive in the wild. It should be seen as a means to an end, not an end in itself.

Ex situ conservation has several purposes, including to:

- Rescue threatened germplasm.
- Produce material for reintroduction, reinforcement, ecological/habitat restoration and management.
- Produce material for conservation biology research.
- Bulk up germplasm for storage in various forms of *ex situ* facilities.
- Supply material for various purposes to remove or reduce pressure from wild collecting.
- Make available material for conservation education and display.

As a method of conservation, *ex situ* conservation is inherently deficient. Although a well-collected seed sample stored in a seed bank should adequately represent the genetic diversity of a species, it is not usually possible to maintain more than a limited sample of such diversity in cultivation. In addition, *ex situ* conservation may lead to unpredictable genetic change and can become in practice a form of domestication. It is often regarded as preservation rather than conservation. In contrast, *in situ* conservation, at least in theory, allows plant populations to develop and evolve in, and as part of, the ecosystem of their natural habitat. In practice both methods should be regarded as mutually reinforcing and complementary approaches.

Ex situ conservation in botanic gardens has several benefits:

- *Ex situ* conservation may be the only option available when a natural habitat has been destroyed.
- It can be very cost-effective.
- Seeds of many species especially lend themselves to compact storage (allowing bulk samples), they are economical and can undergo long term storage.
- Plant collections can give users ready access to a wide range of genetic variation within a species.
- Botanic gardens provide propagation and often research facilities, together with horticultural and other applied scientific skills needed in practical species conservation.
- *Ex situ* conservation provides back-up for populations of threatened plants in the wild, contributing material for reintroduction, restocking and restoration, as well as advice and data for field management.

Box 9: *Ex situ* conservation priorities in a climate changing world

Priority should be given to certain categories of plants for inclusion in *ex situ* conservation programmes.

- Taxa that are in immediate danger of extinction, either locally, nationally or globally.
- Taxa that have 'nowhere to go', such as those growing on mountain tops and low-lying islands, as well as high latitude and edge of continent species.
- Taxa that have poor dispersal capability and/or long generation times.
- Taxa with extreme habitat/niche specialisations, such as narrow tolerance to climate – sensitive variables.
- Taxa with co-evolved or synchronous relationships with other species.
- Taxa that are of special scientific interest, such as narrow endemics, those with unique phylogenetic lineages or geographical relics.
- Taxa, such as local ecotypes, that may be required for specific reintroduction or habitat restoration and management schemes.
- Taxa that are of local economic importance, such as minor food crops, medicinal plants and wild or cultivated plants providing the basis of local industries, agriculture, horticulture and crafts.
- Local 'flagship' species or subspecies that will stimulate conservation awareness and can be incorporated into education and fund raising programmes.

Targets 8 and 9 of the GSPC relate to *ex situ* conservation:

- Target 8: *At least 75 per cent of threatened plant species in ex-situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes.*

- Target 9: 70 per cent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, and associated indigenous and local knowledge respected and maintained.

Botanic gardens should:

- i) Formulate an institutional policy on their chosen, or designated, role in *ex situ* conservation and identify priority tasks, institutional responsibilities and resources that will be available to support such conservation programmes.
- ii) Develop and undertake planned programmes for the conservation of biodiversity *ex situ*, giving preference to plant species that are indigenous to their own region, especially ones that are threatened or are of actual or potential economic value (Box 9).
- iii) Develop and publish horticultural protocols for growing threatened species, especially those which are being cultivated for the first time.
- iv) Assess the current conservation value of their collections making sure they are, as far as possible, derived from documented wild sources, and manage these according to strict scientific and horticultural standards to maximise their value for conservation purposes.
- v) Adopt appropriate methodologies and procedures to capture and maintain maximum genetic diversity at population level of target species thus enhancing the value of such collections for biodiversity conservation and ecosystem restoration.
- vi) Collect baseline data on species distribution and threat assessment when collecting seeds and make relevant information available.
- vii) Never allow the development or maintenance of *ex situ* collections to damage or threaten *in situ* populations of such species, through over collection, inadvertent release of damaging pathogens and invasives or by other means.
- viii) Apply rigorous standards and procedures of cultivation and the storage of germplasm for effective *ex situ* conservation of threatened plants including careful husbandry, accurate labelling and meticulous record keeping.
- ix) Be aware of, and seek to minimise, the risks of hybridisation, inbreeding (leading to low seed set and homozygosity) and inappropriate out breeding (e.g. between populations within a species) amongst conservation collections.
- x) Seek to reduce losses and low survival rates of important conservation plants in cultivation, especially in artificial environments such as greenhouses, by implementing rigorous maintenance procedures and through the duplication and the maintenance of back-up collections.

- xi) Within the limit of available resources, seek to characterise their living plant collections and gather molecular data of value for conservation.
- xii) Maintain efficient information systems on their plant collections of importance for conservation and make this data available to the wider community through national databases and globally through BGCI's PlantSearch database.
- xiii) Provide expertise to support the implementation of species recovery programmes and *in situ* conservation and, where appropriate, provide material from *ex situ* holdings for reintroduction and other recovery projects.
- xiv) Develop field genebanks for plant species that cannot be stored in conventional seed storage systems.
- xv) Support and participate in the repatriation of plant material (following all necessary phytosanitary requirements) and information to the countries of origin of such material that may be of value for biodiversity conservation and sustainable use.
- xvi) Cooperate with partner botanic gardens in their own countries and other regions of the world to build collaborative programmes in *ex situ* conservation and to support capacity building in countries rich in biological diversity.

3.2.3 Integrated conservation

Biodiversity conservation cannot be accomplished effectively by one method, institution or sector working alone. The challenges facing biological survival require that every possible tool at hand is used, choosing the right combination to fit particular needs for each population, species, plant community and the natural habitats in which they grow. This multidisciplinary approach to plant conservation has been termed 'integrated conservation'.

The fundamental premise of integrated conservation strategies is that they must be collaborative and involve a wide range of relevant expertise and technical and scientific disciplines. Integrated conservation methodologies combine resources of land and habitat management, biological research, database and information management, and off-site (*ex situ*) propagation and cultivation.

Effective conservation practice needs the involvement of all those who have an impact on the species in order to be successful. Therefore one of the other fundamental premises of integrated conservation is the integration of all stakeholders such as government, industry, non-governmental agencies and the community.

The CBD highlights the importance of integrated conservation of biological diversity by stressing that conservation techniques used should be complementary. Integrated conservation strategies for wild plants have primarily involved the development and implementation of species recovery plans and programmes. These have often involved a combination of *in situ* assessment of natural plant

populations, monitoring of their status and the current or past causes of their decline, and the determination of future priorities, therefore enabling their recovery. Recovery measures include land protection, habitat management and/or restoration, *ex situ* cultivation and reintroduction and public education programmes.

Botanic gardens are well placed to undertake many activities in integrated conservation and already play major roles in botanical research, species recovery, ecosystem management and restoration, exploration and floristic surveys, reintroduction, development of sustainable use systems for wild plant resources, public education, conservation biology, management of living collections and other fields.

Botanic gardens should:

- i) Ensure that the conservation activities they undertake are carried out within the context of integrated conservation priorities and practices.
- ii) Support and seek to strengthen local, national and international networks of organisations and individuals involved in integrated conservation of biological diversity.
- iii) Seek to develop close cooperative partnerships with other institutions and organisations involved in plant conservation, including protected areas, biosphere reserves, other botanic gardens, local communities, government agencies including forestry, health, education, wildlife and agricultural departments, universities and other sectors.
- iv) Document and manage information effectively to support integrated conservation activities.
- v) Ensure that their activities in plant conservation are integrated fully with appropriate animal and ecosystem conservation activities.

3.3 Conservation research

A basic understanding of plant diversity is fundamental to ensuring its conservation and so the role of botanic gardens in research must be fully recognised and supported as a vital component in achieving biodiversity conservation.

Botanic gardens throughout the world are active in undertaking and promoting scientific research on plants and on biological diversity in general. Their collections and libraries provide important resources to support such research and many botanic gardens have excellent research facilities either within, or associated with, the institution. These include laboratories, herbaria, greenhouses, and growth chambers with controlled conditions, field experimental areas, climatic and weather stations, data management systems, and advanced equipment for molecular and genetic studies.

For traditional reasons and due to the major collections held by botanic gardens, they have a special role and responsibilities in plant taxonomy. Firstly through preparing and publishing the taxonomic works so essential in undertaking any biodiversity conservation. In addition, by training future taxonomists and

supporting the development of research in taxonomy in parts of the world where expertise and collections are poorly developed.

Some botanic gardens are active and directly involved in undertaking research in biotechnology, or facilitate biotechnological research by providing access to their plant collections. Major areas of activity in biotechnology in botanic gardens include *in vitro* propagation and multiplication, tissue and cell culture, recombinant DNA technology, molecular and genetic research, plant breeding and disease elimination. New methods in biotechnology present many possibilities and opportunities for the use of botanic garden collections and facilities as well as for biodiversity utilisation and conservation. However, the rapid advances in this field have presented uncertainties and may present risks that require careful consideration.

Botanic gardens are also well placed to undertake research on the impacts of climate change on plant diversity. This may range from phenotypic monitoring of plant behaviour over time to modeling plant responses to predicted future climate scenarios. Research on forest species diversity and carbon sequestration is also highly relevant to the climate change debate.

Although not all botanic gardens have the resources (staff, facilities and expertise) to enable them to play major roles in botanical research, all can contribute to such research by making their facilities and collections available to researchers. Many botanic gardens are closely associated with universities and therefore have special opportunities to undertake or develop research programmes that support plant conservation. Botanic gardens can also use their collections to engage the public in research activities and can develop and stimulate citizen science programmes.

Conservation research carried out by botanic gardens contributes to GSPC Target 3:

Target 3: Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared.

Botanic gardens should:

- i. Identify their current and future activities and priorities in botanical research, in particular highlighting those activities that can contribute to biodiversity conservation and its sustainable use.
- ii. Disseminate information derived from research programmes to support biodiversity conservation, including making it available to governments, decision makers, scientists, conservation practitioners, land managers, local communities and the general public, through a variety of ways including electronically and through publications.
- iii. Collaborate with others in the development and implementation of research programmes both nationally and internationally.
- iv. Seek to engage the general public in research activities through citizen science programmes.
- v. Give special attention to undertaking research on the plants, habitats and vegetation of their local region, including their socio-economic and cultural aspects and uses, based on local stakeholder prioritisation.

- vi. Undertake research, where appropriate, on the biological and physical processes that impact on biological diversity, especially in their local region, including research on reduced biodiversity due to invasive species, change in land use, climate change and pollution.
- vii. Include researchers in the botanic garden staff team where possible, and work to integrate their activities fully with the priorities and other activities of the institution.
- viii. Be aware, and follow the provisions, of relevant international agreements, instruments and national legislation relating to bio-safety and bio-ethics that seek to evaluate and control any possible risks related to GMOs, including their transfer, cultivation, propagation, handling and use.
- ix. Seek to provide current, informative and unbiased information to the general public on issues relating to biotechnology, bio-safety and bio-ethics.
- x. Share any benefits derived from the use of their plant collections for research, in accordance with the terms of the CBD.

3.3.1 Conservation in a climate changing world

Plants are of particular importance with regard to climate change as they are major regulators of the global climate and are the keystone of the carbon cycle. Plant diversity underpins all terrestrial ecosystems, providing the life-support systems upon which all life depends. Botanic gardens have a key role to play in ensuring the conservation of plants in the face of climate change.

Botanic gardens should:

- i. Develop clear and validated information and messages to be used for education purposes with a focus on linking climate change and plant extinction.
- ii. Document and share examples with relevant stakeholders of climate change impacts on plant diversity.
- iii. Compile and disseminate research findings regarding climate change and plants.
- iv. Develop field-based monitoring programmes for assessing the long-term impacts of climate change on plants.
- v. Maintain seed collections as an insurance policy for the future.
- vi. Work with local nurseries and the forestry sector to provide plant material of appropriate species for city greening schemes, afforestation, community planting etc.
- vii. Protect and promote the use of the wide range of adaptive traits present in wild plant species to enable human adaptation to climate change.

3.4 Ecological restoration

The science and practice of ecological restoration are developing rapidly to address the challenges presented by increasingly degraded landscapes. Many of the skills and resources available in botanic gardens, including plant taxonomy, horticulture and seed bank management are essential in providing support for restoration activities. Working in partnership with local government, communities and NGOs, botanic gardens are increasingly involved in developing, assisting and implementing ecological restoration programmes. The main areas where botanic gardens can contribute to ecological restoration are:

- Provision of seed bank facilities
- Production of plants
- Restoration research
- Outreach and education
- Application of horticultural techniques in the field
- Professional expertise and advice.

Ecological restoration work carried out by botanic gardens contributes to GSPC Targets 4 and 8:

- *Target 4: At least 15% of each ecological region or vegetation type secured effective management and/or restoration.*
- *Target 8: At least 75 per cent of threatened plant species in ex-situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes.*

In relation to ecological restoration, botanic gardens should:

- I. Consider restoration when collecting data on plants in the field (e.g. collect additional data on habitat, population, climate information etc.).
- II. Consider making existing research areas more relevant to restoration problems (e.g. environmental stress tolerance of seeds and seedlings, plant-animal interactions).
- III. Inform local restoration practitioners of their relevant skills, regional expertise and on-site resources and establish appropriate collaborative partnerships.
- IV. Make the horticultural skills of their staff available to restoration projects
- V. Make facilities such as glasshouses available for partners to produce plants and bulk up seeds for restoration.

- VI. Set up areas to trial and/or display techniques for restoration of local habitats.
- VII. Provide training programmes for local volunteers/staff in relevant areas.
- VIII. Join the Ecological Restoration Alliance of Botanic Gardens if they are actively participating in restoration efforts.
- IX. Act as a hub to facilitate the transfer of local skills, resources and equipment to be used in restoration.
- X. Contribute to relevant databases regarding available skills and expertise (BGCI's GardenSearch database).
- XI. Provide information on local restoration initiatives and encourage volunteer involvement.

Box 10: The Ecological Restoration Alliance of Botanic Gardens

In May 2012, a number of botanic gardens from around the world signed an agreement to restore the world's damaged ecosystems. Coordinated by BGCI, the Ecological Restoration Alliance aims to restore 100 damaged, degraded or destroyed ecosystems over the next 20 years. Restoration projects will be conducted on six continents, drawing on the proven restoration knowledge, capacity and experience of the allied botanic gardens, arboreta and seed banks. The places to be targeted include tropical forests, prairies, wild places within cities, wetlands and coastal sites – ecosystems that are under threat and are no longer able to provide essential services and resources for sustaining human livelihoods and biodiversity. Further information is available from BGCI.

3.5 Sustainability

Sustainability is the capacity to endure. In ecology the word describes how biological systems remain diverse and productive over time. For humans, sustainability is the potential for long-term maintenance of well being, and this has environmental, economic, and social dimensions. As we become increasingly aware that the earth's natural resources are finite and need to be used and managed with care and responsibility, achieving environmental sustainability has become a major concern and challenge for governments and institutions worldwide.

Traditional approaches to conservation often assumed that nature must be protected from use by humans. However, it is now generally recognized that for conservation to succeed it must be carried out in a way that allows the earth's natural resources to provide the goods and services that underpin the well-being of the world's population. Sustainability is therefore seen as a guiding principle for development, and this is inextricably linked to environmental integrity.

Sustainable development is defined as ‘...development that meets the needs of the present without compromising the ability of future generations to meet their own needs (The World Commission on Environment and Development 1987, p43)’. Achieving sustainable development requires the adoption and implementation of policies for changing resource consumption patterns, recycling, promoting energy efficiency and conserving, rehabilitating and carefully managing habitats, intact and damaged ecosystems, and landscapes.

Sustainable development requires policies and practices that create wealth, promote trade, combat poverty and promote human health, without damaging the capacity of countries to support their human population or the environment and biodiversity on which they depend.

Botanic gardens have a role to play in several aspects of sustainability. These broadly include:

- Sustainable use of plant diversity;
- Sustainable land use and local development;
- Sustainable practices in the botanic garden;
- Education for sustainable development.

3.5.1 Sustainable use of plant diversity

National economies of many countries rely on plant resources and millions of people rely directly on plants for their well-being and livelihoods. Sustainable use of plant species and diversity is a vital component of biodiversity conservation strategies. The sustainable use of biological diversity is a reoccurring theme in the CBD and one of its primary objectives (Articles 8 and 10).

“Sustainable use provides benefits to development by ensuring the long term supply of valuable resources to people and enabling the recovery of species and populations that have been depleted by over use” (Glowka 1994).

Botanic gardens have been, and remain, active in the sustainable use of plant diversity. Some botanic gardens were founded to introduce and cultivate economic plants, whether it was medicinal plants in Renaissance Europe, tropical crops in the colonial era or ornamental plants in this and the last century.

Many botanic gardens maintain extensive collections and undertake research on useful plants of actual or potential value for food, agriculture, medicine, forestry, horticulture, ecological purposes (such as habitat management, restoration and reintroduction, land reclamation, soil improvement and stabilisation), amenity (display, tourism, recreation), essential oils, fuel, forage and many other purposes. The role of botanic gardens in the sustainable use of plant genetic resources has also been acknowledged by organisations such as FAO.

Botanic gardens may also be active in monitoring domestic production and trade in plants and products, and international trade regulated by CITES.

Activities to ensure the sustainable use of plant diversity relate to GSPC Targets 11, 12 and 13:

Target 11: *No species of wild flora endangered by international trade.*

Target 12: *All wild-harvested plant based products sourced sustainably.*

Target 13: *Indigenous and local knowledge innovations and practices associated with plant resources, maintained or increased, as appropriate to support customary use, sustainable livelihoods, local food security and health care.*

Botanic gardens should:

- i) Work with local, national and international partners to develop or contribute to information systems documenting the diversity of plants used for economic purposes, including inventories and status surveys, and use these to identify and prioritise species whose conservation status is compromised by unsustainable levels of use.
- ii) Use their expertise in botany, horticulture, arboriculture and other fields to actively research and contribute to the development of sustainable use systems for plants that are of cultural, subsistence or economic value.
- iii) Develop species-specific baseline data on the status of populations in the wild and on what constitutes a sustainable harvest limit, both culturally and commercially.
- iv) Develop and maintain plant genetic resource collections especially of:
 - threatened plants of economic importance
 - wild plants of economic importance, including crop relatives
 - cultivars, primitive cultivars (land races) and semi domesticated plants.
 - plant groups that are not adequately covered by other institutions nationally or regionally.
- v) Be aware of the 'use' value of plants in their collections and provide interpretation for visitors that highlights issues around the sustainable use of these species.
- vi) Provide appropriate access to their collections of economic plants to those who would use them to support conservation and sustainable use systems.
- vii) Establish collaborations with local communities, development projects and agencies that work to integrate biodiversity conservation with sustainable use of plant genetic resources.

- viii) Support and contribute to the development of regional and international initiatives and organisations that promote the sustainable use and conservation of plant genetic resources.
- ix) Develop collaborative programmes to investigate and document indigenous or traditional uses of local domesticated and wild plant species in partnership with the people who rely on these resources.
- x) Work in partnership with appropriate bodies to identify, assess and communicate wild plant species that have economic importance or potential to urban and rural communities.
- xi) Assist in the introduction of plants to cultivation by providing expertise in the agronomic improvement of local varieties and horticultural techniques for cultivation initiatives by working in partnership with appropriate bodies.
- xii) Take an active role in extension services and outreach programmes in the community in such areas as poverty alleviation, healthcare, horticultural training and development and other fields that will help generate better living standards and sustainability for local communities.
- xiii) Work with communities to develop sustainable craft industries that are not detrimental to biodiversity and the environment, and which support conservation and sustainable development in priority regions.
- xiv) Develop partnership projects that facilitate the appropriate sharing of plant knowledge with local communities.

In relation to plant trade, botanic gardens should:

- xv) Develop and implement institutional policies in relation to CITES and plant trade and follow an agreed institutional Code of Conduct.
- xvi) Provide training to ensure that all staff are aware of, and follow, the institutional policy and code of conduct.
- xvii) Support national bodies in the implementation of CITES, through the development of a rescue centre for confiscated plants, training of customs officials and police, and by raising public awareness of CITES and its provisions.
- xviii) Contribute to long term programmes for the cultivation, propagation and distribution of plants endangered in the wild by trade, including those listed by CITES, in order to reduce or remove the market in illegally traded plants.
- xix) Gather and maintain information and undertake research on wild plants that are endangered by trade and use the data obtained to support the development and implementation of CITES nationally and internationally.

- xx) Support and promote certification schemes for wild harvested timber and other wild plant products (see Box 11)

Box 11: Certification

Various certification schemes are in place to verify the sustainable harvesting and trade in wild plant products. These include:

The Forest Stewardship Council (FSC)

The Forest Stewardship Council (FSC) was established in 1993 as an international non-governmental organisation. The mission of the FSC is *to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests*. More than 117 million ha forest worldwide are currently certified to FSC standards, distributed in over 82 countries and accounting for around 5 percent of the world's productive forests. FSC is generally considered to be the gold standard in forest certification being independent of particular national interests and incorporating a balance of environmental, social and economic criteria.

Various other forest certification schemes exist, an important alternative being the Programme for the Endorsement of Forest Certification schemes (PEFC) founded in 1999. This also promotes sustainably managed forests through independent third party certification and provides an assurance mechanism to purchasers of wood and paper products that they are promoting the sustainable management of forests. PEFC is a global umbrella organisation for the assessment of and mutual recognition of national forest certification schemes.

The FairWild Standard assesses the harvest and trade of wild plants against various ecological, social and economic requirements. FairWild certification is provided by the Institute for Marketecology, Switzerland. Use of the FairWild Standard helps support efforts to ensure plants are managed, harvested and traded in a way that maintains populations in the wild and benefits rural producers. The type of products collected from the wild that can be certified include medicinal and aromatic plants, berries, wild fruits, nuts and seeds, honey and raw materials for finished products (e.g. essential and fatty oils).

3.5.2 Sustainable land use, tourism and local development

Due to their diverse resources and considerable expertise and knowledge, botanic gardens are likely to get involved in local and regional development planning that influences, or has the potential to influence biodiversity e.g. tourism and rural development. Moreover, given that they are often situated close to urban areas, they can also influence urban development in a way that is favourable for biodiversity.

In some countries, tourism and the associated development generated is a major threat to the maintenance of biological diversity. Tourism is one of the world's fastest growing industries and some aspects have significant impacts on the physical and social environment. For tourism to be sustainable it

is dependent on some key principles including operating within the capacity of the environment so that biodiversity is not lost through the degradation of areas of natural and cultural significance. The CBD has produced international Guidelines on Biodiversity and Tourism Development (2004) to support responsible planning and sustainable management. The tool provides guidance on impact assessment and engaging the participation of a wide range of stakeholders, including indigenous and local communities, NGOs and the private sector. Botanic gardens should play a role within this framework.

Activities in this area relate to GSPC Targets 5 and 6:

Target 5: At least 75 per cent of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity.

Target 6: At least 75% production lands in each sector managed sustainably, consistent with the conservation of plant diversity.

Botanic gardens should:

- i. Seek to work in partnership with government at all levels and with other relevant bodies to plan the strategic development priorities in their state and region.
- ii. Be involved in local and regional development that influences, or has the potential to influence, biodiversity.
- iii. Work with relevant specialists (e.g. economists) to develop data and assess economic benefits of biodiversity and natural ecosystems.
- iv. Identify important areas of plant diversity in the local area, including in peri-urban and urban locations and work to ensure that these are protected from inappropriate development.
- v. Participate in research on the impact of local development and tourism on biodiversity.
- vi. Assist in the development of low impact tourism in areas with significant biodiversity value.
- vii. Develop education materials aimed at tourists to explain the importance of local plant diversity and measures needed to conserve it.
- viii. Offer training opportunities for local guides on the identification and importance of local plant diversity
- ix. As appropriate, supply information about biodiversity to support sustainable tourism developments that seek to raise resources for, or contribute to, biodiversity conservation.

- x. Work in partnership to build the capacity of communities to be involved in tourism that promotes the protection of biodiversity and creates employment opportunities.
- xi. Encourage the use of native plants in commercial forestry and ornamental horticulture and, as appropriate, provide access to their collections to support such usage.
- xii. Provide information (and research as appropriate) on suitable native alternatives to currently used non-native species, especially if these pose threats e.g. as invasive species.
- xiii. Assemble, research and maintain reference collections and data on plants important for sustainable agriculture, forestry and traditional land use.
- xiv. Monitor and research the impact of exotic plant and animal invasions and their effect on biodiversity and the sustainable use of plants and their habitats.

3.5.3 Sustainable practices in the botanic garden

As the world's natural resources – water, fossil fuels, plant resources etc. - are increasingly depleted, there is a growing recognition that sustainability has to become a matter of individual as well as institutional responsibility. Consideration of energy and water use is also critical at a time of global climate change. Botanic gardens, as leading environmental organisations, must face up to the challenge of improving their own environmental performance as well as developing as institutions that provide models of sustainability. Botanic gardens have the ability to demonstrate sustainable practices in a variety of ways and they should provide leadership and guidance for those who still remain to be convinced of the urgency of the environmental crisis we face.

Botanic gardens should:

- i) Develop and implement an institutional policy on sustainable practices that addresses:
 - horticulture (e.g. collection practices, composting, integrated pest management, use of fertilisers and chemicals).
 - low impact resource use (e.g. water quality, quantity and use, waste disposal, office administrative and catering outlets wastage, recycling).
 - equitable sourcing (e.g. equipment, food stuffs, shop merchandise produced from fair trade and sustainable sources).
 - design and construction (e.g. effluent, fuel requirements i.e. biomass usage and heating of glasshouses, fossil fuel use verses alternative energy sources).
 - transport and accessibility for staff and visitors.
- ii) Ensure staff are well informed about sustainability and the institutional policies in this area and are empowered to implement appropriate practices within their own work area.
- iii) Undertake regular 'green' audits to ascertain how they are addressing sustainability in their day-to-day operations.

- iv) Raise public awareness, especially amongst visitors, of the botanic garden's concern for environmental sustainability and policies in this area.

3.5.4. Education for Sustainable Development

Education for Sustainable Development (ESD) encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future. ESD attempts to represent the complex and dynamic relationships between the natural and social sciences. Botanic gardens clearly have a valuable role to play in ESD, informing and supporting the development of ESD programmes, implementing such programmes as part of their environmental education work (see Section 3.8) and sharing expertise with local practitioners.

In relation to Education for Sustainable Development, botanic gardens should:

- i) Endeavour to reflect the ethos of sustainability across the whole institution and involve all those working in the garden.
- ii) Focus on specific target audiences and tailor sustainability messages accordingly.
- iii) Build the capacity of staff to deliver ESD programmes and work with local partners to share this capacity.
- iv) Foster an experiential and participatory learning approach in delivering ESD programmes.
- v) Evaluate programmes during and after delivery and incorporate lessons learnt into future programmes.

3.6 Invasive alien species

The spread of invasive alien species is one of the major threats to global biodiversity. Botanic gardens hold large and diverse collections of plants, the majority of which may be exotic, and many of which may be new to cultivation. For gardens that are developing or maintaining collections from geographically diverse regions, the potential of introducing an invasive species is a major concern. This is exacerbated by changing global climatic conditions. It is vital that botanic gardens take steps to prevent future problem taxa from establishing through their collections

Activities on invasive species relate to GSPC Target 10:

Target 10: *Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded.*

Botanic gardens should:

- i. Ensure that all staff are made aware of the issues and problems posed by invasive alien plants.

- ii. Be aware of which species are known to be invasive in their country or region and of the risks that these species pose.
- iii. Be aware and act within local/national/ regional guidelines and polices on invasive species.
- iv. Develop and implement codes of conduct relating to the introduction and cultivation of exotic plant species.
- v. Conduct risk assessments of the plants in their collections.
- vi. Ensure that no invasive or potentially invasive plants are unintentionally introduced into the collections.
- vii. Carry out education and public awareness programmes for staff and visitors.
- viii. Continuously monitor the plants in their collections for signs of 'invasiveness' and take necessary action to control the spread of species if necessary.
- ix. Take care when disposing of unwanted stocks of plants and plant waste material from any part of the garden.
- x. Ensure potentially invasive species are not included on indices seminum.
- xi. Never offer for sale known or potentially invasive species in garden shops or nurseries
- xii. Control or remove invasive plants or other organisms from collections as soon as they are detected and confirmed.
- xiii. Share information on potentially invasive species with other botanic gardens.
- xiv. Work with the nursery trade to prevent the sale of invasive species through garden centres etc.
- xv. Promote an in-house strategy based on:
 - a. Prevention
 - b. Detection, surveillance and rapid response
 - c. Mitigation and control.

3.7. Training, capacity development and technology transfer

Botanic gardens have an important role to play in building capacity for the maintenance of biodiversity. Training is one of the most important tools for developing human resources and facilitating the transition to a more sustainable world. Training and capacity building can be done in formal and informal ways ranging from workshops and short courses to offering professional diploma and degree courses in horticulture and other disciplines. The target audiences for training and capacity building include botanic garden staff, students, teachers, the local and rural community and general public, and national and international clients.

The transfer of technology is also an important element of capacity building. Technology transfers can be conveniently divided into those involving the transfer of skills, know-how, knowledge and techniques, often known as 'soft technologies', and the transfer of tangible goods such as equipment, hardware or for example, computer programmes known as 'hard technologies'. The transfer of germplasm, such as a particular plant variety to be used for a specific purpose, can also be regarded as a technology transfer. Botanic gardens are extremely active in undertaking and supporting technology transfers both within and beyond the botanic garden community, nationally and internationally.

Activities in this area contribute to GSPC Target 15:

Target 15: *The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.*

Botanic gardens should:

- i. Build the capacity of botanic garden staff and provide ongoing support to promote a flexible and adaptable workforce in subject areas including conservation techniques, collection methodologies, propagation (in nursery and laboratories), habitat management and restoration, reintroduction, control and eradication of invasive plants, strategic and financial planning, international policies on conservation, plant identification and classification, horticulture, silviculture, education and marketing.
- ii. Identify priority areas for the strengthening of their human resources (e.g. team building, developing staff leadership skills, enhancing the skills of management staff in legal and political matters, providing opportunities for staff exchanges).
- iii. Network with other botanic gardens to share resources and knowledge.
- iv. Establish and/or strengthen vocational and professional training programmes that meet the needs of environment and development by working with universities and other learning institutions to establish and promote the botanic garden as a resource for higher education and training.
- v. Develop training opportunities, staff exchanges and close collaborations between institutions and organisations to facilitate capacity building and technology transfers both nationally and internationally.
- vi. Liaise with national/regional groups to coordinate capacity building and training and seek regional resources and support.
- vii. Use the skills within the botanic garden to provide courses that build the capacity of the local community for conservation and sustainability.
- viii. Develop relationships with expert support teams to assist in botanic garden development.

- ix. Develop the capacity of the botanic garden to maintain itself and its services and facilities and a secure financial status.
- x. Develop an institutional policy to identify and determine the scope, responsibilities and practice of technology transfer undertaken by the garden.
- xi. Promote the widest possible transfer of technology in support of biodiversity conservation and environmental sustainability, particularly concerning enhancing techniques and the practice of conservation in countries that are rich in biodiversity.

3.8 Education and public awareness

Reducing the threats to biodiversity is dependent on changing behavior. The importance of informing and educating people about the fundamental importance of biodiversity and how it can be more effectively managed and conserved is critical in the implementation of all international biodiversity policy. The CBD highlights the important role that public education and awareness raising plays in promoting conservation and sustainable development, and improving the capacity of people to address environmental and development issues. This role becomes ever more crucial as climate change impacts become more evident and both mitigation and adaptation responses require significant public behavioral change. As more of the population move into urban environments, botanic gardens will play an ever increasing and crucial role in public education. They may represent one of the only opportunities for urban inhabitants to visit a natural or semi natural setting in their region. As the population becomes isolated from the natural environment there is a risk that people will become unaware of how their daily lives impact on the environment. Therefore, there is a need to increase public sensitivity to environmental and development problems, and foster a greater sense of personal environmental responsibility, motivation and commitment towards sustainability.

Through their education programmes, botanic gardens can promote a vision for a more socially and environmentally sustainable future. Education programmes and activities can address topics including biodiversity threats and extinction risks, climate change, development issues, invasive species, genetically modified foods, the relationship between people and plants, the role of science in plant conservation, sustainable living, and the value of biodiversity. A variety of techniques and media can be used to convey these messages from guided tours, children's activities, cultural events and exhibitions to interpretive signs and messaging using the internet, radio, television and newspapers.

Education activities address GSPC Target 14:

Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.

Botanic gardens should:

- i. Develop themselves as centres for environmental education and sustainability by having well planned environmental education programmes with appropriate resources allocated.

- ii. Employ appropriately qualified professional education staff and establish education sections or departments within their organisational framework.
- iii. Develop an environmental education strategy stating what they want to achieve, how they aim to achieve it, identify the attitudes, behaviour and social change to be encouraged, and identify and prioritise the target groups, conservation messages, sustainability and development issues to be addressed and facilities and resources needed.
- iv. Ensure that their programme is flexible, taking into consideration different cultural and community values.
- v. Develop and promote botanic gardens as centres for environmental education to schools and:
 - work with national and regional education authorities to promote the inclusion of conservation, sustainability and development goals in school curricula;
 - collaborate and support teachers to bring their classes to the garden;
 - develop child-friendly policies and train staff in these policies;
 - conduct regular audits to ensure that the gardens is 'child friendly' e.g. access points, eating areas, storage areas, activity/play areas;
 - in collaboration with regional education authorities, develop and deliver curriculum based programmes in environmental education within the botanic garden.
- vi. Establish strong marketing and communication skills within the botanic garden to support effective communication with the community about their mission, and to seek to influence a broad target audience, including decision makers, politicians, teachers, technicians, practitioners, students, children, professionals, consumers, and communities.
- vii. Develop and implement a range of activities, using a variety of techniques which target a broad audience and convey messages that not only reach those who visit the garden, but the whole community, including non-traditional botanic garden users.
- viii. Identify themes for their programmes and activities that are relevant to their local and regional environment and conservation issues.
- ix. Use their programmes to raise awareness of their role in providing a sanctuary/refuge in urban areas and support local communities to 'green' their neighbourhoods.
- x. Offer a variety of informal education opportunities that complement the garden's mission and target a broad audience with diverse interests using holistic and experientially based techniques that aim to achieve practical outcomes.
- xi. Monitor and evaluate the techniques used in the visitor, interpretive and educational services to ensure that they are effective in achieving their objective.

3.9 Growing the Social Role of Botanic Gardens

While biodiversity loss will hit everyone, it is likely to most adversely impact on the marginalised in our societies – the poor, the weak and the excluded – in key indices such as poverty, food security and wellbeing. Environmental issues are social challenges and botanic gardens must therefore be prepared to engage across the entire social and demographic spectrum of their communities in order to tackle them. In growing their social role to address these 21st Century challenges, gardens will have to embed this role within a modern framework of values.

With this in mind, gardens should:

- i. Re-assess their values, mission statements and vision in relation to biodiversity loss in a process involving the whole organisation.
- ii. Conduct surveys to identify gaps in their garden's visitor demographics.
- iii. Improve their visibility to other organisations and potential partners who may be able to support them in the development of their social role.
- iv. By means of training and the introduction of new skills, build the capacity of their staff to work with diverse communities.
- v. Work with selected communities to identify their social needs and address a relevant environmental issue.

3.10 Partnerships, networking and community development

Botanic gardens hold valuable information relating to plant diversity, including its distribution in the wild, conservation status and trends, and its use and preservation. Their programmes include research on plant systematics and general plant biology; the interactions with social, cultural, and economic factors that impact biodiversity; the genetics and ecology of plants, both in the wild and in the context of human activities; all of which yield information vital to support biodiversity conservation.

However, despite their often wide ranging programmes, botanic gardens cannot achieve their targets in plant conservation and sustainable development alone. They need to form an alliance at all levels, international, national and local, and develop and implement wide ranging cooperative programmes. Furthermore, the current distribution of botanic gardens worldwide does not match the demands for biodiversity conservation and so botanic gardens should work together to share information and resources and integrate their conservation activities with other stakeholders. Besides the relationships between botanic gardens, there are also many different partnerships and linkages that botanic gardens

can form on a community, national or international level that can have significant effects on maintaining plant diversity and ensuring sustainable living.

Botanic gardens currently undertake, facilitate and support the exchange of such information by means of their publications, on the internet and by providing access to their databases. Free and open exchange of information on their plant collections and scientific activities has been a hallmark of the botanic garden community.

Activities related to partnerships, networking and information exchange support GSPC Target 16:

Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.

3.10.1. Information exchange

Botanic gardens should:

1. Develop an institutional policy to identify and determine the scope, responsibilities and practice of information exchange undertaken by the garden.
2. Manage information efficiently within the garden, and through their electronic data systems, in such a way as to facilitate the effective exchange of information with those seeking to use such information to support biodiversity conservation.
3. Undertake, facilitate and support the exchange of information relevant to, and valuable for, biodiversity conservation and environmental sustainability, particularly taking into account the special needs of countries rich in biodiversity.
4. Develop, participate in, and support initiatives to develop information exchange programmes on biodiversity and its conservation at national and international levels.
5. Develop partnerships for information exchange with other botanic gardens to assist in the promotion of work on biodiversity conservation.

3.10.2. Networking at national and international levels

Botanic gardens should:

- i. Become active members of global, regional and national network organisations for botanic gardens and biodiversity conservation.
- ii. Strengthen linkages and develop or support multi-tasked diverse networks to implement shared programmes for plant conservation and environmental education. Such networks could involve other botanic gardens, protected areas, universities, botanical institutions, a wide range of national and international governmental and non-

governmental organisations, the corporate and business sectors and development agencies.

- iii. Work with relevant bodies to coordinate and implement international and national policies on the conservation of biological diversity and highlight the role of botanic gardens in plant conservation.
- iv. Work together to present themselves globally as a well coordinated community able to perform effectively and efficiently.
- v. Work with BGCI and other bodies to stimulate and support the development of national and regional botanic garden networks.
- vi. Provide and support twinning opportunities to strengthen northern/southern hemisphere relationships, which should be characterised by sensitivity to each other's requirements and conditions.

3.10.3. Networking at a community level

Botanic gardens should:

- ii. Develop or support community based networks for conservation organisations to ensure a coordinated approach to the local conservation of plants.
- iii. Support and empower the local community to value and conserve plants and appreciate the role they play in everyday lives.
- iv. Develop partnerships with schools and universities to ensure a collaborative approach to environmental and science education in the region.
- v. Develop appropriate mechanisms to acknowledge and safeguard the indigenous knowledge and intellectual property rights of local and/or indigenous communities, and support their use of such knowledge for conservation and the sustainable use of plants.

3.11 Access to genetic resources and benefit sharing

Equitable access to genetic resources and benefit sharing is one of the three objectives of the CBD. The CBD recognises the sovereign rights of States over their natural resources and their authority to determine access to such genetic resources. However, the Convention also states that each Contracting Party shall endeavour to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and that they are not to impose restrictions that run counter to the objectives of the Convention. Access should be granted only with the prior informed consent of providers and requires mutually agreed terms between provider and user.

In 2010, the Parties to the CBD adopted the *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization*. The Nagoya Protocol is an international agreement which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way. By helping to ensure benefit-sharing, the Nagoya Protocol creates incentives to conserve and sustainably use genetic resources, and therefore enhances the contribution of biodiversity to development and human well-being. The Nagoya Protocol also covers traditional knowledge (TK) associated with genetic resources and the sharing of benefits arising from its use.

Botanic gardens hold in cultivation representatives of up to one-third of the vascular plant species of the world, much of it obtained before the provisions of the CBD came into effect. Accordingly, botanic gardens have very special responsibilities and obligations to ensure that they facilitate access to their collections for those seeking to use such material for the benefit of biodiversity conservation. Furthermore, it is important that botanic gardens follow fair and ethical policies relating to access to their collections and benefit sharing that are fully in accordance with the terms of the CBD, the Nagoya Protocol and relevant national legislation.

The types of benefits shared by botanic gardens with stakeholders are many and varied and can include access to collections and information sources, training and technology transfers, in-kind benefits, joint programmes, projects and publications, technical assistance and advice and other activities in support of capacity building and monetary benefits (such as royalties) derived from the use of plant collections for commercial purposes.

Under the CBD, botanic gardens have an obligation to obtain the prior informed consent of stakeholders in the country of origin of genetic resources they wish to obtain, not only relating to their collection of such material but also the proposed uses to which such material will be put. In practice, such prior informed consent takes the form of collecting permits and material acquisition agreements, which define the uses to which plant material covered by the agreement can be put. Such agreements may also cover obligations for the exchange of information derived or resulting from research on, or from, other uses of the material concerned.

Although many plant collections held by botanic gardens were obtained prior to the CBD (and so are not covered by its provisions), many botanic gardens agree that, as far as is practical and reasonable and within the scope of their available resources, they will treat all the genetic resources in their care in a similar manner, implementing ethical policies, facilitating access, identifying stakeholders, and sharing benefits to support biodiversity conservation.

Botanic gardens should:

- i) Develop, adopt and implement an institutional policy relating to access to their collections, material transfers and benefit sharing that is fully in accordance with the provisions of the CBD, CITES and any relevant national legislation.

- ii) Develop and implement a Code of Conduct relating to the implementation of institutional policies concerning access and benefit sharing and ensure that all staff follow this Code of Conduct.
- iii) Consider becoming a member of the International Plant Exchange network (IPEN) and following the IPEN Code of Conduct for all exchanges of plant material for non-commercial use.
- iv) Facilitate and provide access to their collections for bona fide users, particularly to support biodiversity conservation, research, education, display and other activities of public benefit.
- v) Make sincere and genuine efforts to identify stakeholders related to plant material they wish to source or use, particularly when obtaining material from wild sources; obtain prior informed consent for such collecting activities, and agreement on future uses and the sharing of benefits, if any, derived from such material.
- vi) Determine institutional obligations to share benefits with stakeholders nationally and internationally, including the type and extent of benefits to be shared.
- vii) Ensure that Material Transfer Agreements are recognised and accepted at a national level and agreed with all stakeholders.
- viii) Promote the fair and equitable sharing of the benefits arising from the use of the genetic resources in their collections (including their progeny and derivatives) with the country of origin of the material and other relevant stakeholders.
- ix) Develop appropriate procedures and mechanisms within the garden to:
 - record and maintain data on access and benefit sharing related to their plant accessions
 - track the movement and use of genetic resources within the institution and between different institutions
 - identify and share benefits derived from the use of genetic resources to ensure that such use is in accordance with the provisions of the CBD and any agreements entered into by the garden governing their use of such material.
- x) Communicate their policies and practices on access and benefit sharing to other relevant sectors such as government, private industry, the scientific community and non-government organisations.
- xi) Seek to influence national policy makers developing regulations relating to access to genetic resources about the importance of noting the distinctions between the use of genetic resources for scientific research, and for commercial purposes.

- xii) Support, encourage and assist other institutions with which they work to develop, adopt and implement policies relating to access and benefit sharing.
- xiii) Seek to harmonise their policies on access and benefit sharing with other institutions with which they work and in line with their relevant national legislation.
- xiv) Raise public awareness about the importance and need to share benefits derived from the use of genetic resources as a means to generate and apply new resources to biodiversity conservation.

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SECTION 4: IMPLEMENTING THE INTERNATIONAL AGENDA

Since its publication in 2000, the *International Agenda for Botanic Gardens in Conservation* has proved to be an important document for the botanic garden community guiding individual and collective conservation actions and influencing the broader policy arena through the CBD. Successful implementation of the Strategy has been achieved in a variety of ways at global, regional, national and local levels.

The need for botanic gardens to implement the objectives of the *International Agenda* has become increasingly important as the threats to plant diversity intensify. Registration to the International Agenda indicates a commitment to take action and work with the botanic gardens worldwide to secure plant diversity for the well being of people and the planet.

Measuring success

The *International Agenda* suggested four broad measures of success for the botanic garden community (see Table 2). Progress in these four broad areas has been good over the past ten years but the work is far from over. Over 400 botanic gardens around the world have registered and adopted the *International Agenda*, but progress in the other three areas included in Table 2 has been more difficult to measure globally. However the development of BGCI's on-line Garden and PlantSearch databases, means that systems are now in place to more accurately monitor progress. Inclusion of information by botanic gardens in these online databases provides a unique opportunity for global monitoring and sharing of data on the work of botanic gardens.

Table 2

Success measure	Indicator of progress (as recorded in BGCI's databases)
Global adoption of the International Agenda.	Proportion of botanic gardens who have registered their adoption.
Increased number of threatened plants & ecosystems included in botanic garden conservation programmes.	Number of threatened species in botanic garden collections. No of ecosystem conservation /restoration programmes ongoing.
Increased capacity of botanic gardens to carry out biodiversity conservation particularly in regions of high diversity.	Number of botanic gardens that have research, conservation and education programmes. Number of capacity building activities carried out by botanic gardens
Information available on the activities, collections & facilities of botanic gardens worldwide to support biodiversity conservation.	Proportion of botanic gardens providing regularly updated and complete information to BGCI's databases

Using the *International Agenda*

The *International Agenda* provides an agreed framework for botanic garden action in conservation that embraces and goes beyond the GSPC. Individual botanic gardens are encouraged to declare their intent to work for the implementation of the *International Agenda* by adopting it as the policy (or a part of the policy) for their institution.

Botanic gardens are encouraged to:

- i) Adopt the *International Agenda* if they have not already done so.
- ii) Use the *International Agenda* to inform their conservation actions, linking to the GSPC.
- iii) Publicise their adoption of the *International Agenda* to raise awareness of the importance and significance of global conservation action by botanic gardens acting collectively and to help secure resources to support their conservation programmes.

Monitoring and coordination

BGCI provides a secretariat and administrative support services to assist in monitoring and coordinating the implementation of the *International Agenda*.

A key role is to maintain information on the actions of botanic gardens that implement the *International Agenda*, so that coordination and cooperation can be fostered and awareness raised about the important work of these botanic gardens.

BGCI has:

- Developed an international registration scheme for botanic gardens that contribute to the implementation of the *International Agenda*.
- Developed a computer-based information system on the botanic gardens of the world, including information on their collections, facilities and activities (GardenSearch and PlantSearch)
- Developed a series of publications for the dissemination of information in support of the aims of the *International Agenda*.

And will continue to:

- Encourage botanic gardens globally to adopt the *International Agenda*.
- Maintain a list of institutions that have adopted the *International Agenda* and make this available electronically.
- Publish information, articles and protocols relevant to the implementation of the *International Agenda* and disseminate such information to the botanic garden community.
- Facilitate discussion fora and exchange of best practice on issues covered by the *International Agenda*.

Botanic gardens are encouraged to:

- i) Monitor and evaluate the activities they undertake that contribute to the general implementation of the *International Agenda* and the targets of the GSPC.
- ii) Communicate these activities to national and regional agencies and to share information with BGCI to enhance monitoring and coordination of global targets.
- iii) Provide data to the GardenSearch and PlantSearch databases maintained by BGCI on a regular basis.

Procedures for debate, review and revision

Regular meetings of representatives of botanic gardens in different parts of the world are an effective way of monitoring the implementation of the *International Agenda*. The BGCI Global Botanic Gardens Congress, held every three years, is recognised as the opportunity and venue for changes and updates to the *International Agenda* to be proposed and adopted. BGCI will convene these congresses and the venue and date of such meetings will be notified to all botanic gardens no later than six months before such meetings are held. Resolutions of the congress will be by consensus. However, should a vote be necessary, resolutions may be passed by a simple majority of delegates registered at the congress.

Specific and detailed policies and protocols may be necessary or desirable from time to time to define or redefine particular aspects of the *International Agenda*. Individual botanic gardens, groups of botanic gardens, other relevant bodies, or their networking organisations may develop such protocols and policies. While in draft, such policies shall be made widely available for comment, revision and agreement amongst the botanic garden community.

BGCI shall play a role in ensuring that such documents are widely available for review by botanic gardens throughout the world. Subsequent to this review process, such policies and protocols shall be presented to the Global Botanic Gardens Congress for finalisation and ratification. Ratification shall be achieved if agreed to by a two-thirds majority of all registered delegates attending the Congress.

Amendments and revisions of the *International Agenda* shall be undertaken from time to time. The purpose being to update its provisions, clarify particular clauses and their meanings, and make corrections and alterations in the light of developments, changes and advances in the fields of botany, conservation, the environment and in the operation of Conventions and policies that may impact on the *Agenda*. Such amendments may be prepared and proposed by individual botanic gardens, other relevant bodies, groups of botanic gardens, or their networking organisations.

BGCI shall play a role in ensuring that such changes are widely available for review by botanic gardens throughout the world. Subsequent to this review process, such amendments and revisions shall be presented to the Global Botanic Gardens Congress for finalisation and ratification. Ratification shall be achieved if agreed to by a two-thirds majority of registered delegates attending the Congress.

The preparation of a complete revision or redrafting of the International Agenda may be undertaken if proposed and subsequently agreed to by two-thirds of registered delegates attending a Global Botanic Gardens Congress.

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Annex 1

The Aichi Biodiversity Targets of the CBD's Strategic Plan for Biodiversity 2011-2020

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1

By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2

By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3

By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4

By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Target 5

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6

By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7

By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10

By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12

By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13

By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14

By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16

By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17

By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18

By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19

By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20

By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

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Annex 2: A CBD checklist for botanic gardens

The following checklist may help to define an individual botanic garden's policy and procedures and enable more active contribution to national CBD implementation.

National context

Contact your CBD National Focal Point, find out about your country's National Biodiversity Strategy and Action Plan and consider how your garden can actively contribute to national CBD implementation.

- Offer information on your garden's activities on conservation, sustainable use, access and benefitsharing to the NFP for inclusion in National Reports.
- Urge your garden's overseas partners to inform their CBD National Focal Points about collaborative contributions to national CBD implementation.
- Consider ways to improve communication with government and other CBD stakeholders, for example by hosting visits and participating in stakeholder meetings.
- Take opportunities to participate in the national delegation to CBD meetings (such as SBSTTA).
- Does your country have a GSPC National Focal Point? If not, and your garden is very active in plant conservation measures at a national level, consider offering to become the GSPC NFP.
- Does your country have a GTI National Focal Point? If not, and your garden has a strong taxonomic research programme, consider offering to become the GTI NFP. Consider how to contribute information and skills to national and international taxonomic initiatives.

Garden engagement

- Find out about and participate in regional and national botanic garden network initiatives for GSPC implementation.
- Use the 2010 Botanic Gardens targets to focus garden activities, and report progress to GSPC National Focal Points, BGCI and national botanic garden networks.
- Publicise the value and obligations of CBD and your role in its implementation through plant conservation and sustainable use displays, exhibits, educational materials and leaflets, and press releases.
- Distribute information about CBD and related institutional policies to all your staff, volunteers and members of your governing board (e.g. Board of Directors) and ensure they understand what is required of them. Consider a staff training programme.

Access and benefit sharing

- For plants and specimens collected post-CBD (Dec 1993): always obtain the appropriate documents showing prior informed consent and mutually agreed terms (e.g. collecting permits, export permits, letters of permission from landholders and/or material transfer agreements) – in addition to any necessary CITES and/or plant health documentation.

- Ensure that no illegally collected or acquired plants come into your collections ‘through the back door’.
- Assess the range of your garden’s collections (living and preserved; from *in situ* and/or *ex situ* sources), activities and research interests, and the principal users of the collections, as a first step towards developing an institutional policy on access and benefit-sharing.
- Develop and implement a policy that addresses how your garden will acquire, use and supply plants, how benefits will be shared, how your garden will treat pre- and post-CBD material, and your garden’s position on commercialisation.
- Adapt existing procedures or develop new procedures so that information on prior informed consent and terms of use (from permits and agreements) is kept linked with plants and specimens as they are used and transferred between users. Assign clear staff responsibility for curation and tracking issues.
- Check terms on plants from your collections before you supply or sell them to others outside the garden, to ensure that you are legally able to do so.
- Use an institutional Material Transfer Agreement (MTA) when supplying plants from your collections to research/commercial users outside the garden, to set out terms for use and benefit-sharing.
- Ensure that public plant sales only include plants whose terms allow for sale and that any restrictions (e.g. non-commercialisation) are communicated to buyers, for example on seed packet labels.
- Consider buying in plants from commercial sources to sell in public plant sales.
- If your garden contains collections in the public domain that are covered by the International Treaty on Plant Genetic Resources for Food and Agriculture, use the ITPGRFA Standard MTA for supplying specimens when appropriate. Consider what benefits your garden generates from its use of plants, and how these can be shared with countries of origin, for example through sharing information, skills, protocols and tools. Consider endorsing the Principles on Access to Genetic Resources and Benefit Sharing (the Principles) and joining the International Plant Exchange Network (IPEN).

Traditional knowledge

- If your institution collects and works with traditional knowledge, ensure that researchers are aware of and comply with relevant codes of practice and national and customary laws, and that research is carried out with the approval and involvement of local communities. Agree on whether and how information can be disseminated and what benefits can be shared.
- When working with traditional knowledge in the public domain, consider opportunities for acknowledgement of the original knowledge-holders, and benefit-sharing.

Invasive species

- Find out about relevant international and national laws and policies in your area and establish precautionary measures to avoid introducing invasive species.

- Develop a policy towards invasive species that addresses display, supply, plant disposal and plant sales.
- Consider risk-assessment procedures when accepting new plants; consult relevant international and national invasive species databases or lists.
- Avoid planting known invasive species except for public awareness or scientific purposes (e.g. for research on control measures).
- If known invasive species are planted for such purposes, take suitable measures to avoid their spread.
- Look out for signs of potentially invasive behaviour in established plants, and share your experiences, e.g. by informing other botanic gardens and your national authorities.
- Build public awareness of invasive species, for example through interpretation, exhibits and education modules, and consider how your garden can work with stakeholders such as local nurseries and landscapers to promote non-invasive alternatives for public use.

Sustainable use

- Ensure that all plant-based products used in the garden come from sustainable sources.
- Consider using the retail outlets (café, restaurant, shops etc.) to market sustainably-produced products (including fair-trade products) that support local livelihoods.
- Develop programmes with local communities that make use of the garden's horticultural expertise to support the sustainable use of local plant diversity.

Communication, education and public awareness

- Develop interpretation materials that provide information about the importance of biodiversity for all visitors.
- Develop linkages with local schools and provide opportunities for children to experience nature first-hand.
- Try to influence national education departments to include biodiversity education in national curricula – and develop supporting materials for such courses.
- Consider celebrating International Biodiversity Day (May 22nd) at your garden.

Annex 3: A REDD checklist for botanic gardens:

The following checklist may help to define an individual botanic garden's response to REDD-plus:

- Increase institutional awareness of the REDD-plus mechanism and begin monitoring the developments. Information is available at <http://unfccc.int/>.
- Review existing activities within institutions to identify those that are relevant to REDD-plus.
- Establish an institutional policy on REDD-plus. A consultation report by Kew scientists for the Elisach Review on 'Climate Change: Financing Global Forests' provides an example of how an institution has reviewed its practices (Moat, 2008).
- Establish institutional REDD-plus research programmes, building on existing REDD-plus related strengths.
- Develop in-house departmental REDD-plus networks and communication platforms to ensure a harmonized approach.
- Tailor existing programmes to REDD-plus and develop REDD-plus pilot projects to determine the extent of botanic garden's strengths.
- Observe and where achievable, contribute to existing pilot projects, for example in UN-REDD nations: More information at www.un-redd.org/.
- Begin institutional and partner discussions with forest agencies, NGOs and other stakeholders to establish how strengths could be drawn together, shared and applied to REDD-plus. Specifically in partner nations where REDD-plus is being developed.
- Publicise the potential role which botanic gardens can play in lending their expertise to the REDD-plus process and explain these roles to the wider public.
- Promote the potential for biodiversity and livelihood benefits to be achieved by REDD-plus at all relevant fora.
- Initiate REDD-plus discussions with higher level networks, including for example national and international government departments.
- Build more diverse networks and partnerships with organisations and stakeholders working in line with co-benefits other than those addressing biodiversity.
- Share experiences through national and regional networks and globally through BGCI.

Annex 4: A CITES checklist for botanic gardens

The following checklist may help to define an individual botanic garden's policy and procedures.

- Contact and find out about your national CITES Authorities.
- If your country is not a party to CITES, encourage it to accede to the treaty as soon as possible.
- Find out if your country's field botanists or botanic gardens staff have knowledge of particular threatened plants?
- Develop an institutional policy towards CITES.
- Consider registering your institution with the national Management Authority of CITES.
- Check your collections for plants on the CITES Appendices and maintain complete documentation for these species.
- Distribute information about CITES to all your staff and ensure they understand what is required of them.
- Assign clear staff responsibility for CITES matters with a designated person where appropriate.
- Agree and implement an institutional Code of Conduct for the accession of rare or threatened wild plants, whether or not they are listed by CITES.
- Always obtain export and, if necessary, import permits and CITES labels.
- Ensure that no illegally collected plants come into your collections 'through the back door'.
- Compile procedures for obtaining the necessary licences for the import or export of CITES-listed plants with your collaborating institutions.
- Publicise the value and requirements of CITES and your role in its implementation through plant displays, exhibits, educational materials and leaflets, and press releases.
- Consider ways in which you can become more closely involved in plant trade issues nationally and internationally, working collaboratively for example with national CITES Authorities, the CITES Plants Committee, BGCI, TRAFFIC and IUCN/SSC.
- Be willing and able to advise local and national authorities on matters relating to plants in trade, especially those that may be endangered by commercial exploitation. You may also be able to assist in warning the trade with respect to the introduction of alien invasive species and plant pests
- Establish a long-term programme for the cultivation, propagation and distribution of plants endangered in the wild by trade, including those listed by CITES, in order to reduce or even remove the market in illegally traded plants.
- Distribute propagated plant material, as appropriate, to:

- - the nursery trade, selected private growers and collectors;
 - conservation organisations and other bodies, for use in habitat restoration or species recovery programmes;
 - - other botanic gardens for conservation and research, both nationally and internationally.
- Assess the extent to which you can assist national CITES Authorities as a national rescue centre for plants seized or confiscated, and devise a programme for maintaining and utilising such material.

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Annex 5: Species included on Annex 1 of the International Treaty on Plant Genetic Resources for Food and Agriculture

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) came into effect in 2004 and has been ratified by more than 120 countries. Through the Treaty, countries agreed to establish a Multilateral System to facilitate access to genetic resources of 64 of our most important crops and forages and to share the benefits in a fair and equitable way. The list of species covered by the ITPGRFA is provided below:

Food crops

Crop	Genus	Observations
Breadfruit	<i>Artocarpus</i>	
Asparagus	<i>Asparagus</i>	
Oat	<i>Avena</i>	
Beet	<i>Beta</i>	
Brassica complex	<i>Brassica et al.</i>	Genera included are: <i>Brassica</i> , <i>Armoracia</i> , <i>Barbarea</i> , <i>Camelina</i> , <i>Crambe</i> , <i>Diplotaxis</i> , <i>Eruca</i> , <i>Isatis</i> , <i>Lepidium</i> , <i>Raphanobrassica</i> , <i>Raphanus</i> , <i>Rorippa</i> , and <i>Sinapis</i> . This comprises oilseed and vegetable crops such as cabbage, rapeseed, mustard, cress, rocket, radish, and turnip. The species <i>Lepidium meyenii</i> (maca) is excluded.
Pigeon Pea	<i>Cajanus</i>	
Chickpea	<i>Cicer</i>	
Citrus	<i>Citrus</i>	Genera <i>Poncirus</i> and <i>Fortunella</i> are included as rootstock.
Coconut	<i>Cocos</i>	
Major aroids	<i>Colocasia</i> , <i>Xanthosoma</i>	Major aroids include taro, cocoyam, dasheen and tannia
Carrot	<i>Daucus</i>	
Yams	<i>Dioscorea</i>	
Finger Millet	<i>Eleusine</i>	
Strawberry	<i>Fragaria</i>	
Sunflower	<i>Helianthus</i>	
Barley	<i>Hordeum</i>	
Sweet Potato	<i>Ipomoea</i>	
Grass pea	<i>Lathyrus</i>	
Lentil	<i>Lens</i>	
Apple	<i>Malus</i>	
Cassava	<i>Manihot</i>	<i>Manihot esculenta</i> only.
Banana / Plantain	<i>Musa</i>	Except <i>Musa textilis</i> .
Rice	<i>Oryza</i>	
Pearl Millet	<i>Pennisetum</i>	
Beans	<i>Phaseolus</i>	Except <i>Phaseolus polyanthus</i> .
Pea	<i>Pisum</i>	

Rye	<i>Secale</i>	
Potato	<i>Solanum</i>	Section <i>tuberosa</i> included, except <i>Solanum phureja</i> .
Eggplant	<i>Solanum</i>	Section <i>melongena</i> included.
Sorghum	<i>Sorghum</i>	
Triticale	<i>Triticosecale</i>	
Wheat	<i>Triticum et al.</i>	Including <i>Agropyron</i> , <i>Elymus</i> , and <i>Secale</i> .
Faba Bean / Vetch	<i>Vicia</i>	
Cowpea <i>et al.</i>	<i>Vigna</i>	
Maize	<i>Zea</i>	Excluding <i>Zea perennis</i> , <i>Zea diploperennis</i> , and <i>Zea luxurians</i> .

Legume forages

<i>Astragalus</i>	<i>chinensis, cicer, arenarius</i>
<i>Canavalia</i>	<i>ensifformis</i>
<i>Coronilla</i>	<i>varia</i>
<i>Hedysarum</i>	<i>coronarium</i>
<i>Lathyrus</i>	<i>cicera, ciliolatus, hirsutus, ochrus, odoratus, sativus</i>
<i>Lespedeza</i>	<i>cuneata, striata, stipulacea</i>
<i>Lotus</i>	<i>corniculatus, subbiflorus, uliginosus</i>
<i>Lupinus</i>	<i>albus, angustifolius, luteus</i>
<i>Medicago</i>	<i>arborea, falcata, sativa, scutellata, rigidula, truncatula</i>
<i>Melilotus</i>	<i>albus, officinalis</i>
<i>Onobrychis</i>	<i>viciifolia</i>
<i>Ornithopus</i>	<i>sativus</i>
<i>Prosopis</i>	<i>affinis, alba, chilensis, nigra, pallida</i>
<i>Pueraria</i>	<i>phaseoloides</i>
<i>Trifolium</i>	<i>alexandrinum, alpestre, ambiguum, angustifolium, arvense, agrocicerum, hybridum, incarnatum, pratense, repens, resupinatum, rueppellianum, semipilosum, subterraneum, vesiculosum</i>

Grass forages

<i>Andropogon</i>	<i>gayanus</i>
<i>Agropyron</i>	<i>cristatum, desertorum</i>
<i>Agrostis</i>	<i>stolonifera, tenuis</i>
<i>Alopecurus</i>	<i>pratensis</i>
<i>Arrhenatherum</i>	<i>elatius</i>
<i>Dactylis</i>	<i>glomerata</i>
<i>Festuca</i>	<i>arundinacea, gigantea, heterophylla, ovina, pratensis, rubra</i>
<i>Lolium</i>	<i>hybridum, multiflorum, perenne, rigidum, temulentum</i>
<i>Phalaris</i>	<i>aquatica, arundinacea</i>
<i>Phleum</i>	<i>pratense</i>
<i>Poa</i>	<i>alpina, annua, pratensis</i>
<i>Tripsacum</i>	<i>laxum</i>

Other forages

<i>Atriplex</i>	<i>halimus, nummularia</i>
<i>Salsola</i>	<i>vermiculata</i>