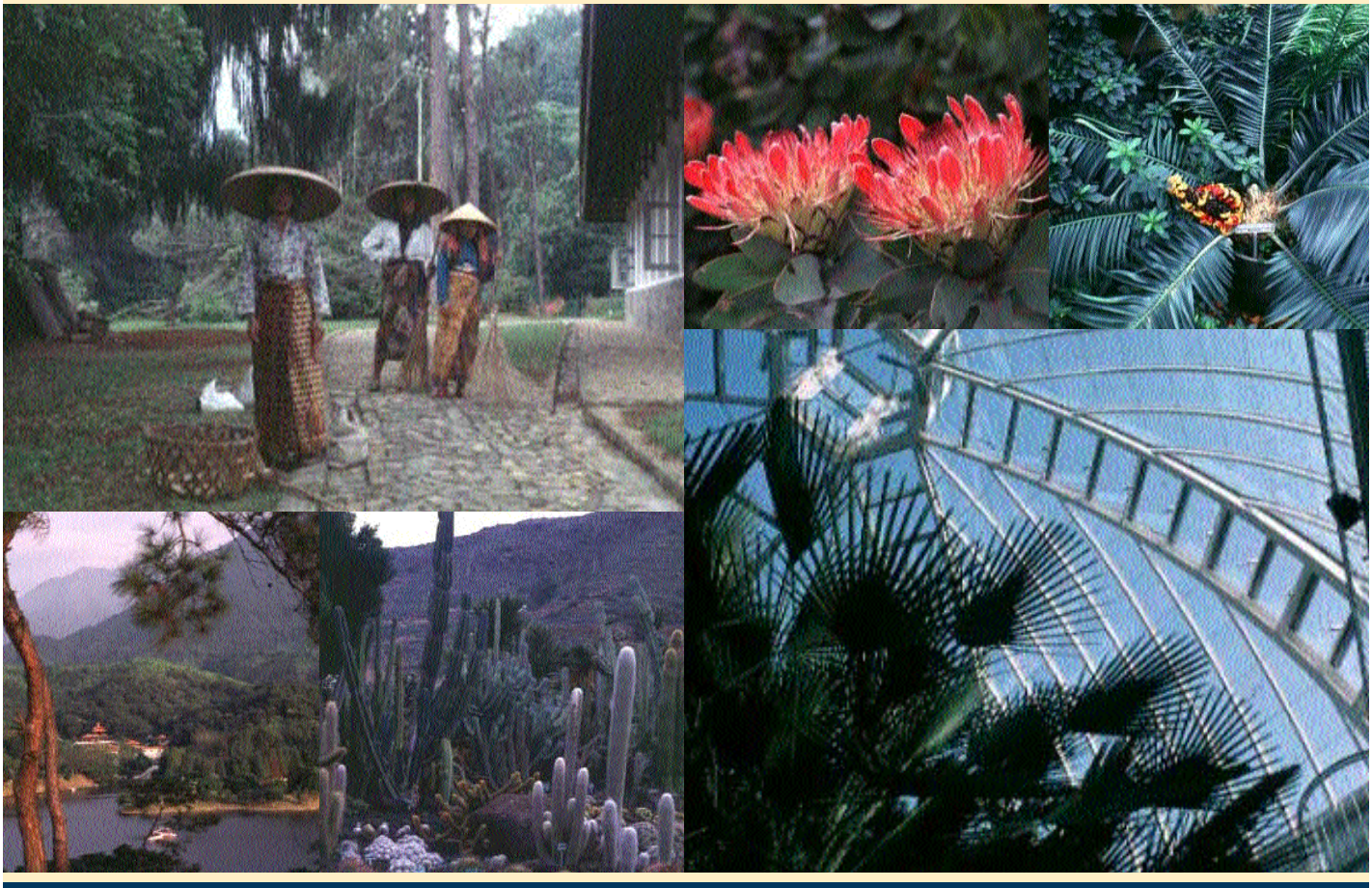
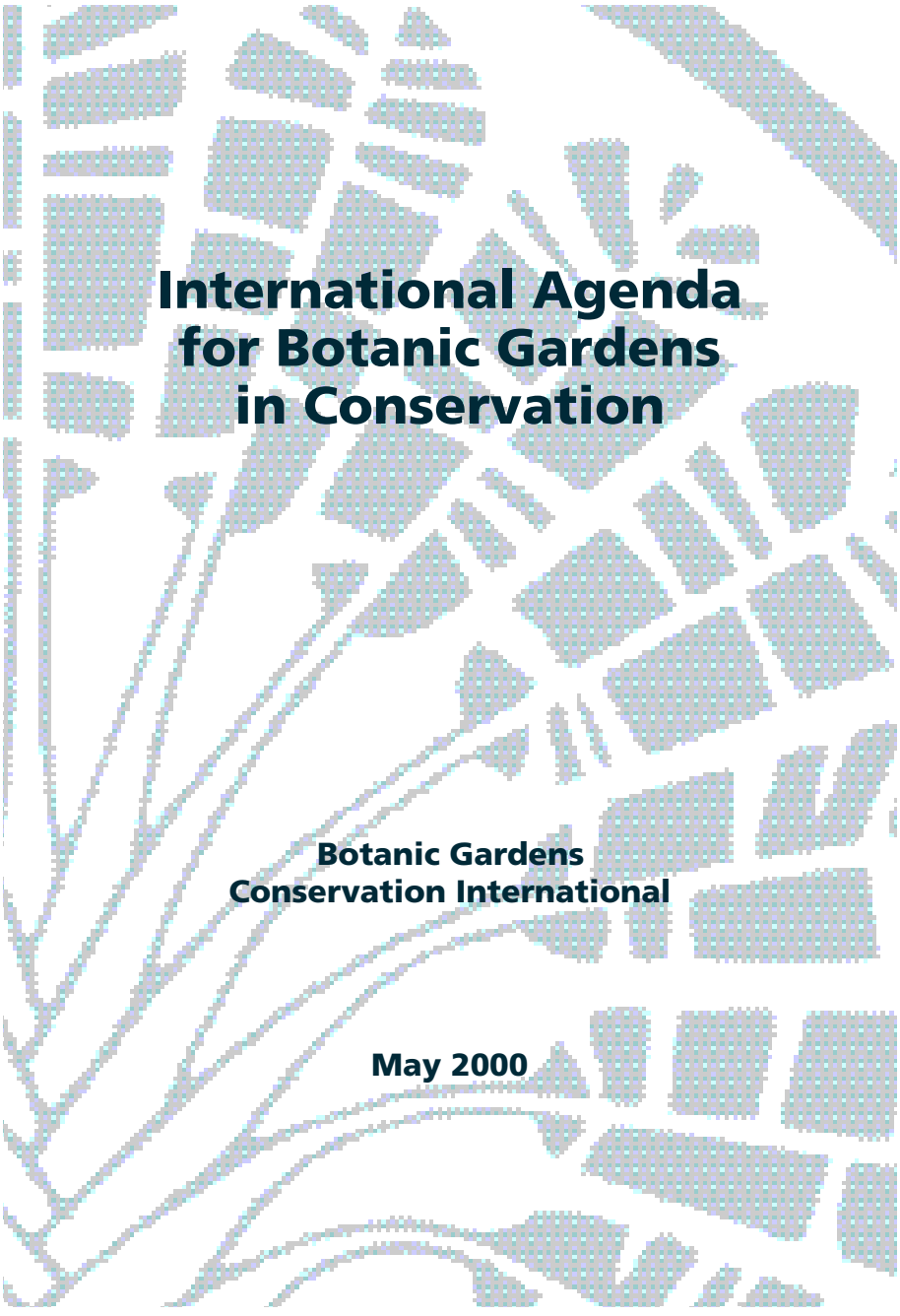
International Agenda for Botanic Gardens in Conservation





International Agenda for Botanic Gardens in Conservation

Botanic Gardens
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BGCI CPC AABGA The North Carolina Arboretum. World Botanic Gardens Congress

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Botanic Gardens Conservation International

Following its establishment in 1987,the IUCN Botanic Gardens Conservation Secretariat (BGCS) began to build its membership of botanic gardens worldwide and develop a programme of activities in support of botanic gardens. In 1989,The Botanic Gardens Conservation Strategy was published and the following year BGCS became independent from IUCN, and subsequently known as Botanic Gardens Conservation International (BGCI). BGCI registered as a U.K.charity and received the support of HRH The Prince of Wales as its Royal Patron. Independence helped it to gain a greater measure of self-determination and made it possible for the organisation to receive charitable donations in the U.K. BGCI also receives support from the Royal Botanic Gardens of Kew and Edinburgh as Patron Garden members. In addition to its head office in the U.K.at Kew, BGCI now has national foundations in the U.S.A.and Russia and regional offices in China, Colombia,Indonesia,the Netherlands and Spain.

A primary concern of BGCI has been to provide a means for botanic gardens in all parts of the globe to share information and news about their activities, programmes and any new advances made that benefit conservation and education. Networking and capacity building for botanic gardens has been assisted through BGCI's magazines and the publication of a series of resource books,manuals and policy handbooks on the development of botanic gardens and their roles, on such subjects as plant reintroductions,ex situ conservation,environmental education,education for sustainability, computer software, regional action plans, the Convention of Trade in Endangered Species of Fauna and Flora (CITES) and the Convention on Biological Diversity (CBD).

Although publications provide a valuable means to link botanic gardens,they are no substitute for ensuring that people from botanic gardens can meet regularly to share ideas,agree on common priorities and to plan the implementation of collaborative programmes. For this reason,BGCI organises an international botanic gardens conservation congress ever three years. Following the first such congress in Las Palmas de Gran Canaria, Spain in 1985,this congress has been held in Réunion Island;Rio de Janeiro, Brazil; Perth, Western Australia;Cape Town,South Africa; and Asheville, U.S.A.

BGCI also holds regular international congresses for botanic gardens on education. Four of these congresses have been held to date, in Utrecht,The Netherlands;Las Palmas de Gran Canaria, Spain; Brooklyn,New York, U.S.A.;and Thiruvananthapuram, India.

The last decade has also seen the establishment or growth of a wide range of national and regional organisations in all parts of the world for, or including, botanic gardens. BGCI has worked to support this development and to provide such organisations with assistance and support and in addition to collaborate closely with these sister networks.

Developing efficient information management systems to document botanic garden collections continues to be a priority. The BGCI databases list over 10 000 rare and endangered species in cultivation in botanic gardens. In 1987, BGCI published the International Transfer Format for Botanic Garden Plant Records (ITF) to facilitate the exchange of data on botanic garden plant collections in electronic form. The ITF quickly became a recognised international standard for botanic garden record systems. A second version of the ITF (ITF2) was completed and launched in 1998.

BGCI has developed a unique computer database on the botanic gardens of the world,which lists every known botanic garden, arboretum and many more similar institutions maintaining living plant collections in cultivation,with details of the facilities,collections and work of over 1800 botanic gardens.

Contents

Foreword

The publication of The Botanic Gardens Conservation Strategy in 1989 provided an extremely valuable shared rationale and framework for botanic gardens worldwide. Not only did it assist the development of many conservation programmes but it also stimulated the creation of new botanic gardens,or supported the redevelopment of older botanic gardens, throughout the world. However, much has changed for conservation in the intervening years, with the development of new conservation techniques and practices, the identification of changing priorities and with the enactment of important global instruments such as the Convention on Biological Diversity and Agenda 21 and new national laws and strategies to protect biological diversity.

In 1998 Botanic Gardens Conservation International began to give thought to how the Strategy should be renewed and updated. We considered that it would be a mistake simply to rewrite or redraft the existing text but that a fundamental revision involving input from many partners throughout the world should be undertaken to produce an action-based document, outlining priorities and targets for botanic gardens in the implementation of specific tasks,as well as to define general principles. We believed that the document should also address the need for botanic gardens to be active participants in the implementation of, for example, the Convention on Biological Diversity at national and international levels and to contribute to national sustainable development and environmental sustainability.

At BGCI's 5th International Botanic Gardens Conservation Congress,held in Cape Town,South Africa in September 1998 the delegates endorsed the need for this revision and an international consultation process was launched. Since then numerous contributions from individuals,institutions and organisations have helped to define the content and terms of the International Agenda, providing detailed submissions and many specific suggestions and commenting on and correcting the draft text. We hope that in this way the International Agenda will reflect a shared view on our global concern for biological diversity and agreement about the important roles that botanic gardens can play, individually and collectively, in its conservation. To all of those who have contributed to the International Agenda in so many different ways we offer our sincere thanks.

As we can see from this International Agenda,the tasks for botanic gardens in biodiversity conservation are extremely diverse, often complex and sometimes very demanding. Nevertheless, working individually and collectively, I have no doubt that we can achieve the ambitious targets we set ourselves,not only for plant conservation but to raise awareness of the need to build a sustainable future for the planet. Plant conservation must become a fundamental global priority if we are to ensure that our biological resources survive to support this fragile world.

Peter S. Wyse Jackson
Secretary General
Botanic Gardens Conservation International

May 2000

Executive Summary

There is a growing recognition that biological diversity is a global asset of vital importance and value to present and future generations. Nevertheless the threat to species and ecosystems has never been as great as it is today, with human beings living far beyond the carrying capacity of Earth. This has major implications for future economic and social development and so urgent measures must be initiated in all parts of the world to safeguard the global biological heritage. A fundamental requirement for sustainable living is to integrate conservation and development.

Botanic gardens worldwide play major roles in science, horticulture and education. In the last few decades,they have also become importance centres for biodiversity conservation,playing a role in integrating conservation and development.

The first global strategy for botanic gardens in conservation was The Botanic Gardens Conservation Strategy, published in 1989. However with many changes over the last decade in the context in which botanic gardens operate, it was essential to develop a new agenda for botanic gardens.

This *International Agenda for Botanic Gardens in Conservation* provides a global framework for the development of botanic garden policies and programmes for the effective implementation of international treaties and national laws,policies and strategies relevant to biodiversity conservation. Within the document, the role of botanic gardens in the development of global partnerships and alliances for biodiversity conservation are defined and a means to monitor the work of botanic gardens in plant conservation has been presented. The International Agenda aims to motivate botanic gardens to evaluate their conservation policies and practices to enhance their effectiveness and efficiency in plant conservation.

It is recognised that there is great diversity amongst the botanic gardens of the world. Some are old established institutions with vast collections of living and preserved plants from many parts of the globe, which provide vital resources to support science, conservation,horticulture and education. Other botanic gardens are more recent establishments often working with plants native to their own region. Nevertheless,the International Agenda provides a grass roots common agenda for every botanic garden, regardless of its size, history and collections. It gives guidance on how each botanic garden can develop its own role in conservation that is appropriate to its resources and to the relevant local and regional context and important environmental issues.

How to Use the International Agenda

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 to guide its planning and develop its own role in conservation that is appropriate to its region and resources. To implement a global mission for plant conservation, botanic gardens need to undertake a broad but closely coordinated strategy in conservation, research and education, working in cooperation and in collaboration with the widest possible range of other bodies.

Some initial priorities for botanic gardens are:

- Undertake an institutional 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 to genetic resources and benefit sharing
    - biotechnology
    - cultural heritage
    - ex situ conservation
    - identification and monitoring
    - impact assessment and mitigation
    - in situ conservation
    - information exchange
    - integrated conservation
    - national strategies on the conservation of biodiversity
    - networking/relationships with other sectors and/or organisations
    - public education and awareness
    - research
    - sustainable development
    - sustainable use of biodiversity
    - technical and scientific cooperation
    - technology transfer
    - training and capacity building
- Develop partnerships and alliances to ensure a united and best practice approach to plant conservation.

The successful implementation of the International Agenda will be dependent on each botanic garden carefully considering and formulating their own response to the Agenda. A series of measurable targets have been developed to help monitor the success of its implementation. In addition,an international registration system will be developed and maintained by BGCI to record the actions of botanic gardens implementing the Agenda. Regular meetings and publication of the results are also an important part of the monitoring and implementation process.

By providing a global framework for botanic gardens in conservation 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; therefore enhancing the legacy of the world's biological resources handed on to future generations.

Section 1

Introduction

1.1 Objectives

The objectives of the **International Agenda for Botanic Gardens in Conservation** are to:

i) Provide a common global framework for botanic garden policies, programmes and priorities in biodiversity conservation.
ii) Define the role of botanic gardens in the development of global partnerships and alliances for biodiversity conservation.
iii) Stimulate the evaluation and development of conservation policies and practices in botanic gardens to enhance their effectiveness and efficiency.
iv) Develop a means to monitor and record the actions undertaken by botanic gardens in conservation.
v) Promote the roles of botanic gardens in conservation.
vi) Provide guidance for botanic gardens on contemporary issues in conservation.

1.2 Background

In 1985, The World Conservation Union (IUCN) and the World Wide Fund for Nature (WWF) convened a conference on 'Botanic Gardens and the World Conservation Strategy' with the aim of exploring the multiple roles of botanic gardens worldwide in plant conservation. Their aim was to facilitate the preparation of an international botanic gardens conservation strategy and to work towards its implementation. Following the 1985 conference, held in Las Palmas de Gran Canaria Spain, the IUCN Botanic Gardens Conservation Secretariat (IUCN-BGCS) was created. BGCS began its work in early 1987 with the aim of implementing the new strategy and drawing together the botanic gardens of the world as a global force for plant conservation.

The Botanic Gardens Conservation Strategy was published in 1989 with the following aims:

1. Outline why the involvement of botanic gardens is an essential element in living resource conservation for sustainable development.
2. Identify the priority tasks that botanic gardens need to undertake as their part in implementing the World Conservation Strategy.
3. Propose effective ways in which the botanic gardens of the world can work together to achieve these priorities.
4. Provide a coherent set of principles and procedures that will allow botanic gardens to plan their part, alongside other institutions, in achieving the maximum amount of long term conservation of plant species and populations and focus public attention on the issues of conservation through appropriate educational displays and programmes (IUCN-BGCS and WWF, pvii).

This Strategy played an important part in guiding the developing role of botanic gardens in conservation throughout the 1990s. It was published in several languages (Bahasa Indonesia, Chinese, English, Italian, Portuguese, Russian and Spanish) and sent to over 3000 institutions and organisations worldwide.

1.3 The Current Status

There are over 1800 botanic gardens and arboreta in 148 countries worldwide and they maintain more than 4 million living plant accessions (individual plant

collections). Amongst their collections are representatives of more than 80 000 species, almost one third of the known vascular plant species of the world (Wyse Jackson 1999). These collections contain a wide diversity of plants. They are particularly rich in such groups as orchids, cacti and other succulents, palms, bulbs, conifers, temperate trees and shrubs and wild species, especially those that are threatened, as well as tens of thousands of cultivars of economic importance and their wild relatives, such as fruit trees and medicinal plants. In addition, botanic gardens have a wealth of other collections such as herbaria (preserved specimens) and seed banks.

There are now few countries without at least one botanic garden. New botanic gardens are being established throughout the world mainly to become botanical resource centres supporting native plant conservation. In addition, many older existing botanic gardens are being redeveloped to take on new roles in botanical resource management. 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.

The developing roles of botanic gardens in biodiversity conservation, environmental education and sustainable development provide great opportunities and responsibilities for institutions throughout the world. There has never been a better time for botanic gardens, when their importance and multiple roles are being increasingly recognised by governments and international agencies. Strengthening the global network of botanic gardens and linking it closely to others working to safeguard the biodiversity of our planet must be the most important and urgent task for botanic gardens.

In 1998, BGCI launched an international consultation process to review and update *The Botanic Gardens Conservation Strategy* (IUCN-BGCS and WWF 1989). In the decade since the Strategy was published much has changed in the world, for botanic gardens and for plant conservation. New international and national policies and frameworks now exist, such as the Convention on Biological Diversity, in the context in which botanic gardens operate. New conservation techniques have also been developed, especially enhancing the role of botanic gardens in conservation biology, molecular studies, and ecological research and in practices such as reintroduction, wild plant population management and habitat restoration.

Environmental education has become a primary concern to botanic gardens, which now receive over 150 million visitors each year. Not only concerned with education about plants, many botanic gardens are promoting environmental sustainability by working with their visitors and local community to understand the vital links between human survival and sustainable development.

Traditional aspects of botanic gardens research in plant taxonomy and biosystematics continue to underpin much work in biodiversity and in horticulture and they remain major botanic garden priorities. All these aspects of their work needed to be reviewed and evaluated to identify future priorities and tasks so that botanic gardens could recognise their obligations and responsibilities in conservation. The aim was to complete and launch the new strategy in 2000 under its new name, the *International Agenda for Botanic Gardens in Conservation*, so that the way forward for botanic gardens into the next millennium can be determined.

1.4 The Global Mission of Botanic Gardens in Conservation

During the last few decades, botanic gardens throughout the world have acknowledged the need to accept the challenge of undertaking a global mission for conservation. This mission was expressed collectively for the first time in *The Botanic Gardens Conservation Strategy* (IUCN-BGCS and WWF 1989), which was widely contributed to, reviewed and welcomed by botanic gardens throughout the world. In this *International Agenda for Botanic Gardens in Conservation* the mission is further refined and updated in the light of new developments in conservation and the botanic gardens community.

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

- Stem the loss of plant species and their genetic diversity worldwide.
- Focus on preventing further degradation of the world's natural environment.
- Raise public understanding of the value of plant diversity and the threats it faces.
- Implement practical action for the benefit and improvement of the world's natural environment.
- Promote and ensure 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 must work in partnership with a wide range of bodies to achieve their targets including governments, organisations,institutions,corporations,communities and individuals.

1.4.1 The main elements of the global mission

The mission will require botanic gardens to undertake a broad but closely coordinated cooperative strategy in conservation, research and education,of which there are several main elements.

i) Conservation

- Work within international and national policies and frameworks for the conservation of biological diversity.
- Set agreed levels and standards in plant diversity conservation, integrating techniques in ex situ and in situ conservation.
- Support the development of global capacity for conservation through collaborative partnerships at all levels.
- Fully integrate conservation of plant diversity at the ecosystems, species,population and molecular levels.
- Develop, implement and participate in plans and actions aimed at the recovery of species and the restoration of ecosystems and their diversity.
- Maintain genetically diverse and accessible samples of the world's plant species in their collections throughout the world.
- Pay special attention to the conservation of plant species that are threatened and/or of direct economic importance to human societies.
- Develop and implement control measures for invasive alien plants that pose great threats to biodiversity.
- Develop and implement best practices in plant conservation for botanic gardens.
- Ensure the fullest community and institutional participation in botanic garden programmes.

ii) Research,monitoring,and information management

- Stimulate and undertake research on plant biology and interactions with social,cultural, and economic factors that impact on biodiversity, and utilise the results of this research to support conservation action.
- 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.
- Contribute to integrated,distributed, interactive information systems to manage and make accessible information on plant diversity.
- Work in partnership to develop best practice techniques for research,monitoring and information management.
- Promote botanic gardens as centres of information on plant diversity and conservation.

iii) Education and public awareness

- Undertake public awareness programmes within the botanic gardens, and in the community, to raise public awareness of the value of plant diversity and the human impacts that threaten its maintenance.

- 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.

1.4.2 Role review of botanic gardens

Botanic gardens perform a multitude of diverse but interconnecting roles in conservation. In some countries, they are the primary institution involved nationally in the research,collection, maintenance and conservation of wild plant species. Many are involved in the conservation of plants of importance for food and agriculture, as well as those used for many other economic purposes. In addition,botanic gardens incorporate information on plants, the environment, ecological systems and sustainability into their programmes and activities. In addition,botanic gardens are important for demonstrating the relationship and interdependence of society and nature, and helping communities to live sustainably.

Some of the major activities of botanic gardens around the world are listed in Box 1. Not all botanic gardens currently undertake all or even most of these activities and they cannot be expected to. However, the list demonstrates the unique potential resources, experience and skills of botanic gardens for conservation in a way that no other institution can.

Box 1

Major activities of botanic gardens

- arboriculture
- city and town planning, resource allocation and land use
- conservation biology
- cultivar conservation and maintenance
- dendrology
- empowering and building the capacity of local and rural communities for conservation
- environmental education programmes
- environmental impact assessment
- ethnobiological research
- field genebanks
- herbarium studies and plant taxonomy
- horticultural research
- horticultural training
- integrated pest control management
- laboratory research, including in vitro (tissue culture) plant cultivation
- library services and information centres
- new crop genetic resource introduction and assessment
- ornamental horticulture and floriculture
- plant reintroductions and research in habitat restoration
- pollution abatement and monitoring programmes
- public recreation
- remedial training and therapy
- seed store and tissue banking
- conservation networks and community groups
- systematics
- teacher training
- tourism
- wild plant species research,conservation and management ex situ and in situ

1.5 Botanic Garden Background: Strength in Diversity

Each botanic garden has a different purpose, organisational structure and location and therefore the emphasis of its work may vary. The different emphasis placed on each function is what gives each botanic garden its distinctive character and its special role.

1.5.1 The characteristics (and definition) of a botanic garden

In 1987,an extensive survey of institutions maintaining living collections was undertaken and with the results a computer database was established listing every known botanic garden in the world,as well as details of their resources,staff and activities. The aim of the database was to support the development and subsequently the implementation of *The Botanic Gardens Conservation Strategy* (IUCN-BGCS and WWF 1989).

Shortly after in 1990,BGCI prepared an international directory of botanic gardens,where 1400 institutions were recorded. This was a considerable increase from the 708 institutions that had been included in the previous edition in 1983. Today the total of institutions maintaining living collections listed by BGCI has risen to 1846 worldwide, in 148 countries.

The lack of a very clear definition as to what constitutes a 'botanic garden' has blurred the edges between what are public parks or private collections and what are true scientifically based botanic gardens. Some institutions have been accepted into the list even though they might only be marginally described as a botanic garden.

An early definition of a botanic garden given by the International Association of Botanic Gardens (IABG) was '...a botanic garden or arboretum is one open to the public and in which the plants are labelled'. However *The Botanic Gardens Conservation Strategy* (IUCN-BGCS and WWF 1989) contains a more comprehensive list of characteristics defining a botanic garden (Box 2) that incorporate the diversity of roles that these institutions now undertake.

Box 2

Defining characteristics of a botanic garden

- adequate labelling of the plants
- an underlying scientific basis for the collections
- communication of information to other gardens, institutions,organisations and the public
- exchange of seeds or other materials with other botanic gardens,arboreta or research stations (within the guidelines of international conventions and national laws and customs regulations)
- long term commitment to, and responsibility for, the maintenance of plant collections
- maintenance of research programmes in plant taxonomy in associated herbaria
- monitoring of the plants in the collection
- open to the public
- promoting conservation through extension and environmental education activities
- proper documentation of the collections, including wild origin
- undertaking scientific or technical research on plants in the collections

This list does not,however, constitute a comprehensive summary of the activities undertaken by botanic gardens.

(IUCN-BGCS and WWF 1989, p5)

It should be recognised that there are many institutions that are clearly botanic gardens but are only able to meet some of these criteria. BGCI's most recent definition of a botanic garden is one that it hopes encompasses the spirit of a true 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, p27)*

In some instances a garden has retained the name 'botanic' for historic reasons. Some or even most of the plant collection may survive but all scientific activities have ceased and documentation has been lost. One might argue for the removal of these from

the global list of botanic gardens. However, experience has shown that it is precisely these institutions in many parts of the world that are currently being revived, redeveloped and re-established to become potentially important botanical centres.

Within the context of this International Agenda for Botanic Gardens in Conservation, the use of the term 'botanic gardens' should be interpreted to include arboreta and other specialised forms of plant collection.

1.5.2 Distribution of botanic gardens

About 60% of the world's botanic gardens are situated in temperate regions, in North America, Europe and the countries of the former Soviet Union. In areas where there are exceptional concentrations of species with high levels of endemism such as South America, Southeast Asia and Africa, there are still relatively few botanic gardens (Box 3).

However there is cause for optimism as a large number of new botanic gardens are being created in these high biodiversity regions. Most have relatively few resources but nevertheless their aim is to contribute to the conservation and sustainable use of native plants.

Box 3

Distribution and number of botanic gardens

Region	Number of botanic gardens
Africa and the Indian Ocean	98
Asia	265
Australasia	153
Caribbean Islands	43
Central America	56
Europe	621
Former Soviet Union	155
Middle East	10
North America	297
South America	107
Southeast Asia	41
Total	**1846**

Source: BGCI database, 2000

1.5.3 The types of botanic gardens

Within the definition of a botanic garden given on page 12, there may be included a great diversity of institutions ranging from large gardens with several hundred staff and a diverse range of activities to small institutions with limited resources and activities. Nevertheless, as suggested by the International Agenda, all can play a role in botanical resource management, botany, horticulture, conservation and education.

The fastest growing sector in the botanic garden world is the creation of community botanic gardens. These gardens are designed to serve specific needs in their local communities and are often managed by those same communities. In some tropical countries, botanic gardens have been created alongside national parks and have been designed to play roles in integrated conservation, sustainable development and public education.

A diverse range of organisations and administrations manage botanic gardens. Many are state administered or managed by regional or local authorities and receive public funding. More than 30% of the world's botanic gardens belong to universities and other research institutes for higher education, and a relatively small proportion are private. In recent years the trend has been for botanic gardens to gain greater financial and administrative independence, often becoming trust-administered and operating partly with funds gained through their independent fund raising efforts.

The major types of botanic gardens in the world are outlined in Box 4, although many have multi-purpose roles and so do not fit neatly into any well-defined category.

Box 4

The types of botanic gardens

1. **'Classic' multi-purpose gardens** - are often institutions with a broad range of activities in horticulture and horticultural training; research, particularly in taxonomy with associated herbaria and laboratories and public education and amenity. They are generally state supported.
2. **Ornamental gardens** - are often very beautiful establishments with diverse plant collections that are documented; they may or may not currently have research, education or conservation roles. Some ornamental gardens are privately owned and many municipal gardens fall into this category.
3. **Historical gardens** - include the earliest gardens developed for the teaching of medicine; some were established for religious purposes. A number of these gardens are still active in medicinal plant conservation and research, and today are primarily concerned with the collection and cultivation of medicinal plants and increasing public awareness about them.
4. **Conservation gardens** - most have recently been developed in response to local needs for plant conservation. Some contain, or have associated areas of, natural vegetation in addition to their cultivated collections. Included in this category are native plant gardens, which only cultivate plants from their surrounding region or national flora. Most conservation gardens play a role in public education.
5. **University gardens** - many universities maintain botanic gardens for teaching and research. Many are open to the public.
6. **Combined botanical and zoological gardens** - are currently reassessing the roles of their botanical collections. Plants collections are being researched and developed that provide habitats for the displayed fauna, and interpretation of these habitats to the general public is an important element.
7. **Agro-botanical and germplasm gardens** - function as an ex situ collection of plants of economic value or potential for conservation, research, plant breeding and agriculture. Several are experimental stations associated with agricultural or forestry institutes and contain associated laboratory, plant breeding and seed testing facilities but many are not open to the public.
8. **Alpine or mountain gardens** - are most frequently in mountain regions of Europe and some tropical countries. They are specifically designed for the cultivation of mountain and alpine flora, or in the case of tropical countries, for the cultivation of subtropical or temperate flora. Some alpine and mountain gardens are satellite gardens of larger lowland botanic gardens.
9. **Natural or wild gardens** - contain an area or natural or semi-natural vegetation, which is protected and managed. Most are established to play conservation and public education roles and include areas where native plants are grown.
10. **Horticultural gardens** - are often owned and maintained by horticultural societies and open to the public. They exist primarily to foster the development of horticulture through the training of professional gardeners, plant breeding, registration and conservation of garden plant varieties.
11. **Thematic gardens** - these specialise in growing a limited range of related or morphologically similar plants or plants grown to illustrate a particular theme generally in support of education, science, conservation and public display. These include orchid, rose, *Rhododendron*, bamboo and succulent gardens or gardens established on such themes as ethnobotany, medicine, bonsai, topiary, butterfly gardens, carnivorous plants and aquatics.
12. **Community gardens** - are generally small gardens with limited resources, developed for, and by, a local community to fulfil its particular needs, such as recreation, education, conservation, horticultural training, and the growth of medicinal and other economic plants.

(adapted from Wyse Jackson 2000, p9)

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

1.6.1 Convention on Biological Diversity (CBD)

The world community has recognised,through the United Nations Convention on Biological Diversity (CBD), the negative effects of the loss of biodiversity on quality of life and on the survival of humankind and life in general on this planet. This Convention entered into force in December 1993, 18 months after it opened for signature at the United Nations Convention on Education and Development (UNCED) in Rio de Janeiro, Brazil in 1992.

The Convention aims to:

- Conserve the world's biological diversity.
- Promote the sustainable use of the components of biological diversity.
- Provide for the equitable sharing of benefits from the use of biodiversity, including providing assess to genetic resources and the transfer of relevant technologies.

Botanic gardens are playing an important role in achieving these aims. Botanic gardens' collections and the application of their skills in areas such as taxonomy, botanical research, conservation, propagation and cultivation 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 biodiversity strategies. Their work in other sectors, from the development of new crops for agriculture and the discovery of new plant-based medicines, to education, illustrates the important role they can play in implementing the Convention.

Botanic gardens implement the CBD in several ways.

General Measures for Conservation and Sustainable Use
Contributing to national biodiversity strategies and sustainable development (Article 6).

Identification and Monitoring
Undertaking work in plant taxonomy systematics, floristics,inventories, monitoring, and surveys (Article 7).

***In situ* Conservation**
Contributing through the development, designation,care and management of protected areas, habitat restoration or re-creation and wild plant population research, recovery or management (Article 8).

***Ex situ* Conservation**
Developing and maintaining germplasm collections including seed banks, field genebanks, tissue collections in culture, individual species recovery programmes, and databanks (Article 9).

Sustainable Use of the Components of Biological Diversity
Identifying and developing economically important species in commercial horticulture, forestry and agriculture, and in bioprospecting (Article 10).

Research and Training
Undertaking research in many relevant fields, such as taxonomy, ecology, biochemistry, ethnobotany, education,horticulture, plant anatomy,

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biogeography and providing training opportunities and courses in conservation and related disciplines, often available to national and international trainees (Article 12).

Public Education and Awareness
Providing public education and developing environmental awareness,including programmes to promote public understanding of biodiversity, its importance and loss. Many botanic gardens play important roles in school and university teaching (Article 13).

Access to Genetic Resources (and benefit sharing)
Developing the capacity of partner institutions for biodiversity conservation through collecting fees, research support,equipment, information,training, shared specimens. As well as providing access to their vast conservation resource of stored and managed biodiversity (Article 15).

Exchange of Information
Making information on their collections and the results of their research widely available through published and unpublished literature and accessible databases. Many botanic gardens share data on their collections (Article 17).

Technical and Scientific Co-operation
Cooperating in technical and scientific areas, including joint research and staff exchanges (Article 18).

The CBD is a binding international regulation for the countries that are parties to it. Their obligations are constantly evolving as parties negotiate further decisions and legislation and policies are adopted and implemented at national level. The CBD has a major impact on the way botanic gardens operate in all parts of the world (refer to Box 5 to see how botanic gardens can respond to the CBD).

Box 5
Ways botanic gardens can respond to the Convention on Biological Diversity

- Develop an institutional policy on the CBD and a strategy for its implementation in the garden. This will ensure that the best possible use is made of the present and future resources and all the actions of the botanic garden are in line with the spirit and letter of the Convention.
- Seek to publicise the CBD and its objectives to their constituency to increase its understanding of the value of biodiversity and the importance of plant conservation.
- Work to implement the CBD at a national and international level through practical action and by working with other bodies, governments and the Secretariat of the CBD.

Refer to Annex 1 for a detailed checklist

1.6.2 CITES - The Convention on International Trade in Endangered Species of Wild Fauna and Flora

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was set up to control international trade of endangered species of fauna and flora and came into force in 1975. CITES allows trade in species (including plants) that can withstand current rates of exploitation, but prevents trade in those that face extinction. The Convention operates through the issue and control of export and import permits for species listed in three Appendices (Box 6).

Box 6

CITES APPENDICES

Appendix I	lists species which are threatened with extinction; international trade in these species is prohibited.
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.

Each member nation who has adopted the Convention is responsible for its implementation, including the appointment of Management and Scientific Authorities. It is a duty of the Management Authority to establish a strategy for the control and utilisation of all confiscated plants.

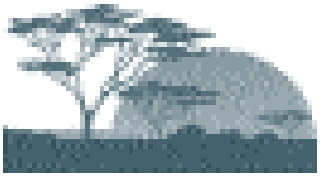
Botanic gardens have a central role in improving the implementation and awareness of CITES. They can actively protect taxa threatened with extinction through illegal or unsustainable commercial exploitation in several differing but complementary ways.

Botanic gardens can:

- Register as a scientific institution with their CITES Management Authority
- 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.

Refer to Annex 2 for a detailed checklist

1.6.3 The United Nations Convention to Combat Desertification



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 such as in parts of China,India,the Arabian Peninsula, Israel,South Africa and the U.S.A.,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 (Article 16).
- Conserving germplasm of dryland plants in their collections.
- Providing training in plant conservation techniques appropriate for the management of dryland plant resources and ecosystems.

1.6.4 The United Nations Framework Convention on Climate Change

The 1992 United Nations Framework Convention on Climate Change is an international agreement developed in response to the concern that human activities are changing the basic conditions that allowed life on earth to exist and are risking altering the global climate. Among the expected consequences are an increase in the average temperature of the earth's surface and shifts in worldwide weather patterns. This climate change will affect forests,agriculture and food security, biological diversity, and most ecosystems.

The ultimate objective of the Convention is to stabilise greenhouse gas concentrations in the atmosphere and prevent further human induced interference in the climate system. The level should allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. The Convention sets out detailed Commitments (Article 4) for Contracting Parties to the Convention and there is a role for botanic gardens in helping their countries to fulfil these commitments.

Botanic gardens are well placed to:

- Cooperate and work with other institutions to monitor and assess the impact of climate change on biodiversity.
- 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 or to the high levels of carbon dioxide in the Earth's atmosphere.

1.6.5 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.

Botanic gardens can support this Convention in several ways.

- Apply 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'.

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1.6.6 The Convention on Wetlands

The Convention on Wetlands (popularly known as the Ramsar Convention) is an international treaty that provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Signed in 1971 and entered into force in 1975,originally the Convention was set up to protect wetland habitats for the conservation of waterfowl. It now has broadened its scope to cover all aspects of wetland conservation, their wise use and importance for biodiversity conservation. The Convention also recognises the well being of human communities supported by wetland ecosystems.

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.

1.6.7 Agenda 21: Programme of Action for Sustainable Development

Agenda 21 forms a blue print for a 'global partnership' to encourage cooperation among nations as they support a transition to sustainable living on earth. The central belief is that all countries can protect the environment while simultaneously experiencing growth.

The Agenda is a non-binding programme of action, which was adopted by more than 178 Governments at the 'Earth Summit' in 1992. Although the Agenda lacks the force of international law, the adoption of the text carries with it a strong moral obligation to ensure implementation of its strategies. The implementation of the Agenda is primarily the responsibility of governments at all levels,through national strategies,plans, policies and procedures. International and regional organisations are also called upon to contribute to this effort and the broadest public participation and the active involvement of non-governmental organisations and other groups are encouraged.

Critical to the effective implementation of the objectives and policies agreed by the governments in all areas of Agenda 21 will be the commitment and genuine involvement of all institutes and social groups, including botanic gardens.

Botanic gardens can address the four major areas outlined in Agenda 21 in several ways.

Section I Social and Economic Dimensions

- Provide and promote opportunities for small scale enterprises and support local business and services to improve the standard of living of people in their community (Chapters 2 and 30).
- Incorporate development issues into botanic garden education programmes (Chapters 2 and 4).
- Provide training for community members,teachers and botanic garden staff to increase their understanding of local and global development issues (Chapters 3-5).
- Develop and implement community outreach programmes that empower the community to combat poverty and achieve sustainable livelihoods (Chapters 3 and 6).

Section II Conservation and Management of Resources for Development

- Develop partnerships with other bodies and the local community to manage local resources sustainably and to restore degraded areas (Chapters 11 and 12).
- Promote sustainable or alternative livelihood systems in fragile areas (Chapter 12)
- Provide support for nature based tourism that operates in a sustainable manner (Chapter 13).
- Evaluate and identify the potential economic and social implications,and benefits of the conservation and sustainable use of local biological resources (Chapter 15).

III Strengthening the Role of Major Groups

- Work with government,business and industry, the scientific and technological community, non-government organisations,the general public and local communities to strengthen their participation in sustainable development (Chapters 23-32).
- Improve communication and cooperation between the scientific community, decision makers and the general public (Chapters 23-32).

IV Means and Implementations

- Provide and promote education, public awareness and training as a means of implementing Agenda 21 (Chapter 36).
- Incorporate education for sustainability into programmes and activities to teach about local, national and global issues and develop values, attitudes and skills to motivate and empower people to live sustainably in the natural and social environment.

Refer to Annex 3 for a detailed checklist

1.6.8 The Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture

The Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture was adopted in 1996 at an International Technical Conference on Plant Genetic Resources in Leipzig, Germany and developed by the Food and Agriculture Organization of the United Nations (FAO).

The main objectives of the FAO Global Plan of Action are to:

- Ensure the conservation of plant genetic resources for food and agriculture as a basis for food security.
- Promote sustainable use of plant genetic resources for food and agriculture, foster development and reduce hunger and poverty.
- Promote the fair and equitable sharing of the benefits arising from the use of plant genetic resources.
- Assist countries and institutions in identifying priorities for action.
- Strengthen existing programmes and enhance institutional capacity (FAO 1996, pp13-14).

This Plan is a framework document and catalyst for action to provide sufficient food to feed the world's people for the current century. In 1983, the FAO Conference established the Intergovernmental Commission on Plant Genetic Resources and adopted a non-binding International Undertaking on Plant Genetic Resources to promote international efforts for their conservation. In the light of the CBD, the International Undertaking is now being revised because it originally recognised genetic resources as the common heritage of all people and subscribed to the concept of free exchange. Negotiations are continuing to bring the Undertaking into harmony with the CBD, which recognises national sovereignty over genetic resources and states that authority to determine access to genetic resources rests with national governments.

Botanic gardens are recognised as having a major part to play in implementing the Global Plan of Action. The Plan notes that botanic gardens are important for genetic resource conservation through the maintenance of living collections, seedbanks and in-vitro collections (FAO 1996). Furthermore, it points out that species of importance for medicinal and ornamental purposes, as well as plant genetic resources for food and agriculture (PGRFA) of essentially local significance are often more fully represented in botanic garden collections than in traditional collections of PGRFA. The importance of including botanic gardens and arboreta in regional programmes for ex situ conservation of PGRFA has also been highlighted.

1.6.9 National legislation on conservation,environmental protection, protected areas and sustainable use

Many countries have developed national legislation and/or national strategies and action plans on biodiversity conservation and environmental protection. Numerous nations have also enacted legislation to safeguard biodiversity, including for example, protection of specific taxa or populations of plants and animals that may be endangered.

One major way that countries are safeguarding biodiversity for the future is by the establishment of protected area networks.Through these networks significant sites of natural importance and the diversity they contain,are safeguarded for the future, as national parks,nature reserves and as other forms of protected areas.

The CBD (Article 6A) requires each Contracting Party to 'Develop national strategies,plans or programmes for the conservation and sustainable use of biological diversity, or adapt for this purpose existing strategies,plans or programmes which shall reflect, *inter alia*, the measures set out in this Convention relevant to the Contracting Party concerned (UNEP 1994 p7)'.

Botanic gardens have a major role to play in supporting the enactment of such national legislation for biodiversity and environmental protection as well as to help in defining and implementing national biodiversity action plans.

Botanic gardens can contribute to national biodiversity action plans and specific national laws to protect wildlife and the environment by:

- Advocating the legal protection of national biodiversity and the environment in general.
- Advising on the specific terms and scope of such legal instruments.
- Assisting in the development of legislation and national biodiversity action plans.
- Promoting the adoption of measures to ensure the sustainable use of biodiversity.
- Ensuring botanic gardens and their roles are integrated into existing policies.
- Encouraging and assisting others to follow the laws and following the laws themselves.
- Providing services as scientific authorities for international conventions such as CITES.
- Developing methodologies for putting conservation into practice on a national scale.
- Providing leadership in the development of international policies and conventions on the environment,sustainability and plant conservation.
- Training relevant government authorities e.g. customs officials on CITES issues.
- Raising public awareness about their role in implementing national biodiversity and environmental legislation.

1.7 Defining the Mission of the Individual Botanic Garden

Botanic gardens are urged to develop their own individual responses to this International Agenda. No botanic garden will be able to implement more than a fraction of the priorities and actions outlined in the document. However, that should not prevent any botanic garden from seeking to maximise and enhance their individual roles in conservation and identifying their priorities and the scale of their tasks and responsibilities. If they have not already done so, botanic gardens are encouraged to incorporate a long term commitment to a conservation role into the mission and governance of the garden,and seek or designate whatever resources are necessary to achieve this mission within a carefully planned and considered implementation framework.

One of the main targets for an individual botanic garden may be to achieve the conservation of the flora of their own region. Significant actions in this regard range from scientific research to collaborating with local community groups in habitat protection and restoration. They must generally adopt a scale that is local and appropriate for local needs. Different botanic gardens need to adopt different priorities and geographical focus, related to their size, resources, scale of operations,mission and brief and the priority tasks or responsibilities available to them. Their mission may also extend to supporting and collaborating with botanic gardens and other bodies elsewhere in the world,especially in regions where resources for plant conservation are few and in countries that are rich in biological diversity.

The accessions policy of the institution should closely reflect its defined role so that the plant collections maintained are clearly in support of the achievement of the garden's mission. This policy may also be defined in relation to the work of other bodies, for example, to ensure that roles and responsibilities are distributed and shared between a number of botanic gardens and other similar institutions in a region to prevent duplication and identify gaps in coverage. Collaboration and coordination are key words in this context.

1.8 Building and Sustaining the Institution

One of the threats to botanic gardens is the sustainability of the institution. Public sector funding for the operation of botanic gardens and other public organisations is being reduced and there is increasing competition for private support and endowments in many countries. As a consequence of this,support for the key roles of botanic gardens may be reduced and some institutions are finding it increasingly difficult to function as effective scientific, educational and conservation orientated institutions.

Building and sustaining the institution is vital and in order to address contemporary issues,many botanic gardens are remodelling themselves and their operations to reflect the time we live in and ensure their relevance in the future. It is not only older established botanic gardens that are facing these ongoing challenges but also the new botanic gardens being developed worldwide.

Botanic gardens should seek to prove their relevance to the conservation of natural and cultural heritage and their importance as national institutions for science, culture, education, recreation and tourism. To promote the institution and ensure understanding of its relevance in contemporary society, botanic gardens should:

- Be part of a appropriate national or regional network organisation.
- Search for new ways to broaden their financial base.
- Work with new partners outside the institution.
- Undertake work that has an ecological and socio-economic context.
- Identify strengths and benefits and communicate these to stakeholders.

Planning provides the foundation for botanic gardens management and future success. It helps botanic gardens prepare for, and anticipate, future trends that might be beyond their control. In addition, documentation of plans provides a valuable instrument for promoting the botanic gardens both within and outside the institution. Botanic gardens should work with their staff to develop strategic plans,institutional policies and business plans to ensure that the garden has a clear vision,mission and realistic targets. As part of this process,priorities need to be defined, resources identified and weaknesses addressed so as to assist in achieving the garden's mission.

The value of staff in building and sustaining an institution should never be underestimated. Botanic gardens staff are being confronted with new challenges and roles and it is essential that botanic gardens have good communication practices within the institution and support and empower staff through training, skills and knowledge development,ensuring their involvement in all levels of planning and decision making.

Section 2

The Practice of Conservation

2.1 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 the 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.

2.2 National Strategies on the Conservation of Biodiversity

Botanic gardens can play important roles in assisting in the development and implementation of national strategies,plans and programmes for the conservation of biological diversity and its sustainable use. They can provide expert advice, data, information,practical assistance and collaboration in the creation of such national plans. After their completion,botanic gardens can be amongst leading institutions involved in their implementation,and in any processes that evolve to revise and update such strategies and to monitor progress made in their implementation.

Botanic gardens should:

i) Identify their particular roles in assisting the preparation of national strategies for biodiversity conservation and for the sustainable use of plant resources.
ii) Seek to participate in national processes and consultations undertaken as part of the preparation of national biodiversity conservation strategies.
iii) Provide data,advice and other forms of assistance to authorities seeking to develop national strategies.
iv) Ensure that staff throughout the institution are aware of, and involved in,contributing to submissions made for inclusion in any local, regional or national strategies to which the botanic garden contributes.
v) Encourage those with whom they work to be involved in such strategic planning for biodiversity conservation.
vi) Seek to participate in the development of conservation strategies at a local level, focused on the conservation and sustainable use of biodiversity in their own regions with partner organisations and/or community groups.
vii) Integrate their activities and future plans with such strategies to ensure that the work of their institution is involved in their implementation at all appropriate levels.
viii) Support,assist and encourage, as far as possible, collaborating institutions and partners,nationally and in other countries,to enable them to be as effective as possible in contributing to the development of biodiversity conservation strategies.

2.3 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 all information is accessible and usable for conserving biodiversity. Botanic gardens, along with national parks, museums, universities and herbaria,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.

Botanic gardens should:

i) Seek to ensure that their collections,data and expertise are made available and utilised to the fullest extent possible to support the identification and monitoring of biological diversity throughout the world.
ii) Ensure that appropriate access to their collections is given to those seeking to use them for identification and monitoring purposes.
iii) Maintain and organise data derived from identification and monitoring activities undertaken by the botanic garden to ensure that such data are safeguarded and made available to potential users.
iv) Work where possible to help identify the components of biological diversity important for conservation and sustainable use.
v) Seek to monitor and identify plant diversity that is threatened, especially in their local regions, including its distribution,current status,actual and potential threats and the recovery action needed.
vi) 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.
vii) Be involved in the preparation of Floras, taxonomic monographs, identification keys and manuals,handbooks, other reference works and publications that assist in the identification, monitoring and recovery of plant diversity.
viii) Be involved in the identification and monitoring of plant diversity at all levels, including species, habitats and the interactions and processes involved in the maintenance of biological diversity.

2.4 Integrated Conservation

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.

Biodiversity conservation cannot be accomplished effectively by one 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 Convention on Biological Diversity (CBD) highlights the importance of integrated conservation of biological diversity by stressing that conservation techniques used should be complementary (refer to Annex 4 for a list of integrated conservation techniques). 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. Integrated conservation development programmes have been primarily based on innovative land use strategies,including biosphere reserves, multiple-use conservation areas, buffer zones on protected area boundaries and a variety of other approaches.

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) Undertake, or assist in undertaking or evaluating, model and demonstration projects in integrated conservation to help establish and develop tools and methodologies and identify potential problems and risks.
iii) Provide up-to-date information for the prioritisation, selection,establishment and management of integrated conservation projects involving threatened plants,especially those that are of economic importance.
iv) Support and seek to strengthen national and international networks of organisations and individuals involved in integrated conservation of biological diversity.
v) Provide advice and guidance as relevant to the CBD Secretariat and other bodies on the aims, methods, feasibility and practice of integrated conservation of plants.
vi) 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.
vii) Document and manage information effectively to support integrated conservation activities.
viii) Ensure that their activities in plant conservation are integrated fully with appropriate animal and ecosystem conservation activities.

2.5 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 they are conserved in the surroundings where they have been developed and utilised (Refer to Section 2.8).

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 revegetation projects.

Botanic gardens should:

i) Support the implementation of procedures for the protection and management of natural ecosystems.
ii) 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.
iii) Integrate their ex situ conservation activities in support of in situ conservation, with the aim of achieving viable populations of species in natural habitats.
iv) Seek to include expertise in ecology and conservation genetics amongst their staff.
v) 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.
vi) 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.
vii) Promote public awareness on the importance of in situ conservation.
viii) Develop and support appropriate strategies and programmes for the conservation of biodiversity in the human dominated landscapes in which many botanic gardens are situated.
ix) 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.
x) Support and provide advice to local enterprises that use wild plant resources in a sustainable way, particularly where botanic garden expertise can be used to develop methods to reduce pressure on plant resources in situ, through cultivation and other means.

2.6 Ex situ conservation

Ex situ conservation is recognised as one of the most important tools available to botanic gardens in biodiversity conservation. *The Botanic Gardens Conservation Strategy* states that 'The purpose of ex situ conservation is to provide protective custody. It is justifiable only as part of an overall conservation strategy to ensure that species ultimately survive in the wild. Its role should be seen as a means to an end,not an end in itself:as a source of material for reintroduction into damaged habitats and to enhance populations as part of ecosystem management, for research and education, for selecting material for introduction into the nursery trade, local agriculture, amenity planting and local forestry, etc. Another role is to take the pressure off wild populations for plants that are likely to be the subject of interest by scientists, commercial horticulturists, hobbyists or local gatherers. Above all,ex situ conservation makes plants available for use by [humankind] (IUCN-BGCS and WWF 1989,p21)'.

Ex situ conservation has several purposes:

- Rescue threatened germplasm.
- Produce material for reintroduction, reinforcement,habitat restoration and management.
- Produce material for conservation biology research.
- Bulk up germplasm for storage in various forms of ex situ facility.
- Supply material for various purposes to remove or reduce pressure from wild collecting.
- Grow those species with recalcitrant seeds that cannot be maintained in a seed store.
- Make available material for conservation education and display.

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 be 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.

As a method of conservation, ex situ is inherently deficient in that it is not usually possible to maintain more than a limited sample of the genetic diversity in cultivation or in storage. In addition, it 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 (refer to Annex 5 for information on Seed banks).
- 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 7

Ex situ conservation priorities

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

- Species or taxa that are in immediate danger of extinction,either locally, nationally or globally.
- Species or 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.
- Species or taxa,such as local ecotypes,that may be required for specific reintroduction or habitat restoration and management schemes.
- Local 'flagship' species or subspecies that will stimulate conservation awareness and can be incorporated into education and fund raising programmes.
- Species or taxa that are of special scientific interest, such as narrow endemics or geographical relics.

Despite various approaches taken by different botanic gardens,there is an across the board need for more botanic gardens to focus and consider their ex situ conservation roles by:

- Assessing the current conservation value of their collections.
- Assigning new priorities and identifying important species requiring conservation action (Box 7).
- Enhancing their documentation systems.
- Managing their collections according to stricter scientific and horticultural standards to maximise their value for conservation purposes.
- Implementing agreed and well planned actions so that they can reach the conservation targets they set themselves.

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 7).
iii) Develop their infrastructures and facilities to enable them to undertake effective ex situ conservation of important plant species in their region.
iv) Support the implementation of species recovery programmes and in situ conservation through the use of their ex situ holdings for appropriate reintroduction and other recovery projects (Annex 6).
v) 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.
vi) Ensure that they adopt appropriate methodologies and procedures to capture and maintain adequate samples of the genetic diversity of plants conserved in their collections, thus enhancing the value of such collections for biodiversity conservation.
vii) Within the limit of available resources, seek to characterise their living plant collections and gather molecular data of value for conservation.
viii) Maintain efficient information systems on their plant collections of importance for conservation and, as appropriate, provide access to such data for those undertaking bona fide conservation actions for these species.
ix) 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.
x) Check the availability of suitable germplasm from other sources before considering wild collection.
xi) Develop field genebanks for plant species that cannot be stored in conventional seed storage systems.
xii) Seek to ensure the genetic integrity of their plant collections by making sure they are, as far as possible, derived from documented wild sources, thereby increasing their value for ex situ conservation.
xiii) Support and participate in the repatriation of plant material and information to the countries of origin of such material that may be of value for biodiversity conservation and sustainable use.
xiv) 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.
xv) Cooperate with partner institutions to undertake research of value for the development of ex situ conservation techniques and practices.
xvi) Develop educational displays of rare and endangered plant species, to highlight the plight of threatened plants and the conservation roles of botanic gardens.
xvii) Give particular focus to the conservation of genepools, rather than miscellaneous individuals of particular species, by ensuring adequate initial sampling.
xviii) 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.
xix) 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.

Networking organisations should:

i) Develop, assist and/or support regional programmes for ex situ conservation, identifying priorities and assigning responsibilities to particular gardens and monitoring the implementation of actions, with the aim of coordinating actions and avoiding duplication of efforts.
ii) Assist botanic gardens to build accessible information systems on their plant collections.
iii) Disseminate information on effective ex situ conservation techniques, procedures and priorities to help build capacity and standards of ex situ conservation in their region.
iv) Undertake regular assessments and disseminate information and reports on ex situ conservation activities of the botanic gardens within their region.

2.7 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 in 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.

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.

Many botanic gardens are currently active in research in some of the following areas:

- biotechnology
- conservation biology
- conservation genetics
- data management systems and information technology
- ecology
- ecosystem conservation
- education
- ethnobotany
- exploration
- floristics
- horticulture
- invasive species biology and control
- molecular genetics
- plant breeding
- pollination biology
- propagation
- restoration ecology
- seed and spore biology
- systematics and taxonomy
- urban environments.

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, other users and the general public to support conservation and sustainable use programmes through a variety of ways including publications.

iii) Collaborate with others in the development and implementation of research programmes both nationally and internationally.

iv) Seek to raise awareness amongst the general public of the importance of research undertaken on plants.

v) Give special attention to undertaking research on the plants, habitats and vegetation of their local region and their socio-economic and cultural aspects and uses.

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 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) Help to ensure that the results of scientific and other forms of research undertaken by and within botanic gardens are used to develop or support methods for conservation and sustainable use of biological diversity.

2.8 Sustainable Use of Biodiversity

Sustainability is seen as a guiding principle for development. Development and environmental integrity must be inextricably linked. Economies of most countries rely on plants so the conservation of biological diversity and the sustainable use of its components must be ensured. 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 is difficult to define but includes two fundamental ideas. Firstly that the sustainable use of wild species provides benefits to conservation not only to conserve particular species but also their associated ecosystem/s. Secondly 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 biodiversity. 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, forestry, horticulture, ecological purposes (such as habitat management, restoration and reintroduction, land reclamation, soil improvement and stabilisation), amenity (display, tourism, recreation), essential oils, fuel, medicinals (Annex 7), forage and many other purposes (Box 8). Their role in the sustainable use of plant genetic resources has also been acknowledged by organisations such as the Food and Agriculture Organization of the United Nations (FAO 1998).

Botanic gardens are also active in monitoring domestic and international damaging or potentially unsustainable trade in plants and produces, regulated by the Convention on International Trade in Endangered Species of Fauna and Flora (CITES).

Box 8

The economic uses of plants

Botanic gardens maintain many plant collections of actual or potential importance for economic use. The main priority for botanic gardens are plants with the following uses:

aromatics
bee foods
beverages
dyes and tannins
environmental management
fibres and canes
food crops (including vegetables, root crops, cereals,fruits and seeds)
forage and pasture
fuels and fuel wood
intoxicants
invertebrate food
medicinals
oils
ornamentals
poisons
religious and ceremonial
spices
timbers
waxes, latex and resins
wild crop relatives
wild crops

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 Conference of the Parties to the CBD has been called upon to help develop and implement an action oriented programme of work on sustainable tourism development and within this programme botanic gardens should play a role.

Many countries regard their botanic gardens as important tourist assets and the income to the botanic gardens from visitors and tourism is relied upon. Larger institutions have public relations and marketing sections employing professional staff, however in smaller gardens such promotion is carried out by staff who are required to be multi-skilled in several areas and may not have specific training in this work. The challenge for all botanic gardens is to attract people and then use innovative education programmes that engage the public and raise their awareness of the issues involved with the maintenance of biological diversity and living sustainably and the cultural,conservation and scientific purposes of the plant collection.

2.8.1 Sustainable use of plant genetic resources

Botanic gardens should:

i) Promote the sustainable use of biodiversity through the assessment, conservation and utilisation of plant genetic resources.
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, particularly relating to the economic use of wild plant resources.
iii) Develop and maintain plant genetic resource collections especially:
   - threatened plants of economic importance
   - wild plants of economic importance, including crop relatives
   - cultivars,primitive cultivars (land races) and semi domesticated plants.
iv) Seek to obtain national recognition as genetic resources conservation centres for the economic plant collections maintained.
v) Provide appropriate access to their collections of economic plants to those who would use them to support conservation and sustainable use systems.
vi) Give particular attention to the conservation of plant groups that are not adequately covered by other institutions nationally or regionally.

vii) Develop their genebank collections (seed, spore and tissue collections) to include plants of economic importance.
viii) Establish collaborations with development projects and agencies that work to integrate biodiversity conservation with sustainable use of plant genetic resources.
ix) Develop methodologies to help to control the unsustainable collection of wild plants.
x) Develop or contribute to information systems documenting the diversity of plants used for economic purposes, including inventories and status surveys.
xi) Develop programmes to investigate and document indigenous or traditional uses of local domesticated and wild plant species.
xii) Support and contribute to the development of regional and international initiatives and organisations that promote the sustainable use and conservation of plant genetic resources.

2.8.2 Sustainable forestry, agriculture and land use

Botanic gardens should:

i) Participate in the development and evaluation of sustainable agriculture, forestry and other land use practices, particularly focused on the impact that they may have on biodiversity, habitats and traditional land-use systems.
ii) Assist as appropriate in measures taken to protect watersheds, soils and the vegetation they support.
iii) Encourage the use of native plants in commercial forestry and ornamental horticulture and, as appropriate, provide access to their collections to support such usage.
iv) Support and participate in efforts made to conserve economically important plants in situ, through their continued use in traditional systems.
v) Assemble, research and maintain reference collections and data on plants important for sustainable agriculture, forestry and traditional land use.
vi) 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.

2.8.3 Sustainable tourism

Botanic gardens should:

i) Participate in research on the impact of tourism on biodiversity.
ii) Involve themselves in the development of national and/or regional strategies to integrate biodiversity considerations into their tourism plans.
iii) Develop education programmes aimed at tourists to explain the importance of local plant diversity and measures needed to conserve it.
iv) Assist in the development of low impact tourism in areas with significant biodiversity value.
v) As appropriate, supply information about biodiversity to support sustainable tourism developments that seek to raise resources for, or contribute to, biodiversity conservation.
vi) Work in partnership to build the capacity of communities to be involved in tourism that promotes the protection of biodiversity and creates employment opportunities.
vii) Work with local, national and international tourist authorities to seek their advice and assistance in publicising the gardens.
viii) Provide visitors with programmes that focus on the historic and cultural heritage of the gardens, the plant collections, research in progress and conservation.

2.8.4 Sustainable plant trade

Botanic gardens should:

i) Develop and implement institutional policies in relation to CITES and plant trade and follow an agreed institutional Code of Conduct (Annex 8).
ii) Ensure that all staff are aware of, and follow, the institutional policy and code of conduct.
iii) 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.
iv) 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.

v) 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.

2.9 Training and Capacity Building

Botanic gardens have an important role to play in building capacity for the maintenance of biodiversity, and as part of this 'training' provides a crucial role. 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.

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 botanic gardens (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 and build a global botanic garden community.

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 collaborative capacity building/training programmes with wider conservation/ environmental organisations.

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.

2.10 Public Education and Awareness

The CBD and Agenda 21, resulting from the Earth Summit held in Rio de Janeiro in 1992,highlighted the importance that public education and awareness raising play in promoting sustainable development,and improving the capacity of people to address environment and development issues. As more of the population move into urban environments,botanic gardens will play an ever increasing and crucial role in public education and awareness raising. 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 environment and development problems,and foster a greater sense of personal environmental responsibility, motivation and commitment towards sustainability.

The role of botanic gardens is as an advocate for the maintenance of biodiversity and therefore botanic gardens need to reorient their education programmes and incorporate a vision for a more socially and environmentally sustainable future. These programmes and activities can address topics including development

issues, invasive threats,genetically modified foods, the relationship between people and plants, the role of science in plant conservation, sustainable living, and the value of biodiversity for example.

Botanic gardens can use a variety of techniques to convey these messages from guided tours,cultural activities and exhibitions to interpretive signs and media such as the internet, radio, television and newspapers.

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,that 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) Evaluate the techniques used in the visitor, interpretive and educational services to ensure that they are effective in achieving their objective.

2.11 Impact Assessment and Mitigation

Environmental impact assessments are procedures undertaken to identify potential threats to the environment. These threats can include invasive plants,climate change, pollution and development projects.

Botanic gardens can be involved in helping to undertake such assessments by making available their facilities (laboratories etc.) and staff expertise. In addition,botanic gardens have a responsibility to regulate their own environmental impacts by undertaking appropriate prior assessments.

Projects that can damage biological diversity are occasionally mitigated by safeguarding an equivalent area or habitat,or through conservation measures undertaken by other means. In such mitigation measures, botanic gardens are occasionally requested to assist, for example by conserving plant resources ex situ that are being destroyed in situ.

Botanic gardens should:

i) Undertake impact assessments for any major developments that they undertake both within and beyond the garden, to ensure that no adverse effect on biodiversity is caused by such actions.
ii) Not allow their expertise and facilities in ex situ conservation to be used as a justification to allow the destruction of biological diversity in situ.
iii) Assist in the implementation of environmental impact assessments when they have appropriate staff skills and other resources available for such purposes,particularly if their involvement can help to conserve important plant resources or natural habitats.
iv) Work in partnership to integrate all responsible authorities and regulations so there is a united position on managing threats.

2.12 Access to Genetic Resources and Benefit Sharing

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.

Botanic gardens hold in cultivation representatives of up to one-third of the vascular plant species of the world, much of it collected, received or otherwise obtained before the Convention on Biological Diversity 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 and relevant national legislation.

The importance of botanic gardens developing mechanisms and sharing benefits derived from the use of their plant collections with relevant stakeholders has also been highlighted under the terms of the Convention on Biological Diversity. In the context of access and benefit-sharing, a stakeholder have been defined as '...an individual, organisation or group whether formal or informal,affected by, or with an interest in,the activities relating to the acquisition,use or supply of genetic resources,their progeny or derivatives (Royal Botanic Gardens Kew 1999)'. Stakeholders may include national, regional and local governments,local communities and indigenous groups,organisations and institutions,land-owners and farmers and private individuals.

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 and 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) 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.
iv) 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.
v) Determine institutional obligations to share benefits with stakeholders nationally and internationally, including the type and extent of benefits to be shared.
vi) Ensure that Material Transfer Agreements are recognised and accepted at a national level and agreed with all stakeholders.
vii) 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.
viii) 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.
ix) 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.
x) 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.
xi) Support, encourage and assist other institutions with which they work to develop, adopt and implement policies relating to access and benefit sharing.
xii) 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.
xiii) 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.

2.13 Technology Transfer

The transfer of technology has been defined as the '...transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service (United Nations Conference on Trade and Development - UNCTAD 1990)'. 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 programs 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.

Botanic gardens should:

i) Develop an institutional policy to identify and determine the scope, responsibilities and practice of technology transfer undertaken by the garden.
ii) 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.
iii) Develop training opportunities,staff exchanges and close collaborations between institutions and organisations to facilitate technology transfers both nationally and internationally.

2.14 Information Exchange

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. 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. In the 1980s botanic gardens pioneered the exchange of information on their living collections in electronic format by means of the International Transfer Format for Botanic Garden Plant Records (ITF) (IUCN-BGCS 1987),and by recognising the need for compatibility between electronic data systems and incorporating such compatibility into their databases.

Botanic gardens should:

i) Develop an institutional policy to identify and determine the scope, responsibilities and practice of information exchange undertaken by the garden.
ii) 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.
iii) 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.
iv) Develop, participate in, and support initiatives to develop information exchange programmes on biodiversity and its conservation at national and international levels.
v) Develop partnerships for information exchange with other botanic gardens to assist in the promotion of work on biodiversity conservation.

2.15 Technical and Scientific Cooperation

Close technical and scientific cooperation exists at many levels within the botanic gardens community. Such cooperation has been promoted, fostered and supported by many individual botanic gardens as well as networking bodies such as Botanic Gardens Conservation International and national or regional botanic garden associations. The need to broaden, enhance and build on existing cooperation between botanic gardens and the wider botanical, environmental and conservation communities has also been identified as a future priority. This is not only to build capacity for biodiversity conservation amongst various sectors but also to help implement integrated conservation programmes.

Existing technical and scientific cooperation already undertaken by botanic gardens includes:

- Joint or collaborative research and conservation projects and programmes at national and international levels.
- International institutional 'twinning' initiatives.
- Cooperative capacity building and human resource development initiatives,especially in support of developing country institutions.
- Joint initiatives to develop policies,technologies and techniques of importance for biodiversity conservation and environmental protection.

Botanic gardens should:

i) Seek to develop and enhance new and existing technical and scientific cooperation and collaboration with other organisations and institutions,both nationally and internationally, in support of the conservation and sustainable use of biodiversity.
ii) Identify priorities for future technical and scientific cooperation especially with, and to support, institutions and organisations in countries that are rich in biodiversity.
iii) Promote cooperation with partner bodies at all levels within the garden.
iv) Encourage and support their staff to develop technical and scientific collaboration and cooperative links with staff in related institutions.
v) Participate actively in networking initiatives at national and international levels to foster closer technical and scientific cooperation.

2.16 Biotechnology

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 should:

i) Participate in policy formulation and contribute to the assessment/approval process for national regulatory systems for genetically modified organisms (GMOs).
ii) 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.
iii) Seek to provide current,informative and unbiased information to the general public on issues relating to biotechnology, bio-safety and bio-ethics.
iv) Share any benefits derived from the use of their plant collections for biotechnology, in accordance with the terms of the CBD.

2.17 Cultural Heritage

Plants form the foundation of all civilisations,they have been,and still do, play a vital role in providing humans with food,medicine, and clothing as well as playing a role in religion, cultural events and celebrations. For more than 450 years,botanic gardens have been showcasing the world's biodiversity and many have had a significant role in the early development of botany and have provided innumerable opportunities for people to research and learn about plants,their uses and values. Many of the world's botanic gardens are a rich heritage with an endowment of historic plant collections,period gardens, libraries,herbaria, historic buildings and architectural features.

Botanic gardens have a responsibility to safeguard their heritage and provide and pass on a legacy for future generations.

Botanic gardens should:

i) Seek recognition and promote the heritage values of botanic gardens.
ii) Endeavour to preserve, safeguard and manage the cultural heritage (including religious,sacred and architectural values) of the botanic garden site and the local community.
iii) Use visitor, interpretive and educational services and facilities to communicate the links between people, nature and plants and raise awareness of the roles of botanic gardens in history and the development of botany, science and plant introduction.
iv) Work in partnership with museums,national and international heritage associations and other such bodies to increase awareness and understanding of the values and uses of plants.
v) Provide support to, and work in partnership with, indigenous people to protect and maintain their knowledge of plant values and uses and conserve cultural heritage.
vi) Endeavour to ensure that new buildings constructed in the botanic garden are of the highest possible quality and design that provide a legacy for future generations.

2.18 Sustainable Development

Humanity is part of nature and is utterly dependent upon it. Over the last four decades concern has mounted over the impact of human activities and lifestyles on plant diversity. 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 will require the adoption and implementation of policies for changing resource consumption patterns, recycling, promoting energy efficiency, conserving, rehabilitating and carefully managing habitats, intact and damaged ecosystems,and landscapes.

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

An alternative approach to sustainable development is looking at a preferred future (looking from the future to the present). Although it is difficult to predict the specific needs of future generations, the basic needs will be to combat poverty and protect and promote human health and the natural environment. The appropriate actions will need to encompass a change in all areas such as economic, social,political, cultural, technological, environmental,ecological, biotechnological,and spiritual.

Due to their diverse resources, considerable expertise and knowledge and situation often close to urban areas, botanic gardens are well placed to have a major role in promoting social change for a sustainable future (Willison 1997). If however botanic gardens are to be effective in influencing the public to live sustainably, they need to not only preach sustainability they need to establish themselves as models of sustainability.

2.18.1 Planning and policy development

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) Develop and promote codes of conduct relating to wild and sustainable harvesting of wild plants.
iii) Be involved in local and regional development that influences,or has the potential to influence, biodiversity e.g.tourism and rural development.
iv) Review their own institutional policies and practices to see how they impact on sustainable development.

2.18.2 Research and economics

Botanic gardens should:

i) Work in partnership with other relevant bodies to develop data that helps to set levels of sustainable exploitation of plant species.

ii) Work with relevant specialists (e.g.economists) to develop data and assess economic benefits of biodiversity and natural ecosystems through cooperation.
iii) Work in partnership with appropriate bodies to identify, assess and communicate wild plant species that have economic importance (Box 8) or potential to urban and rural communities.
iv) 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.
v) Liaise with, and support,commercial plant trade organisations to introduce appropriate plants into the commercial nursery trade (i.e. rare, unusual and native).
vi) Promote the development of integrated pest management in relevant areas of horticulture, agriculture and related disciplines,as well as in their own operations.

2.18.3 Raising public awareness and empowering the community

Botanic gardens should:

i) 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.
ii) Use visitor, interpretive and educational services within the botanic garden to promote corporate citizenship and the sustainable use of natural resources, to raise awareness of consumer lifestyles, and show the link between environmental protection and healthy economics for sustainable development and ways people can live sustainably.
iii) 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.
iv) Develop partnership projects that facilitate the appropriate sharing of plant knowledge with local communities.

2.18.4 Sustainable practices within the botanic garden

Botanic gardens should:

i) Develop and implement an institutional policy on sustainable development 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 sources (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.

2.19 Networking/Relationships with Other Sectors and/or Organisations

Botanic gardens cannot achieve their targets in sustainable living and the maintenance of plant diversity alone. They must form an alliance at all levels,international,national and local,and develop and implement wide ranging cooperative programmes. The current distribution of botanic gardens worldwide does not match the demands for biodiversity conservation and so botanic gardens need to work together to share resources and integrate their conservation activities with other stakeholders

(IUCN-BGCS and WWF 1989). 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.

2.19.1 Networking on an international and national level

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 with 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 to develop and implement a shared programme for plant and environmental conservation.
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) Use electronic networking as a resource for future development.
vi) Form partnerships with other botanic gardens to provide support to the establishment and development of new and existing botanic gardens.
vii) Work with BGCI and other bodies to stimulate and support the development of national and regional botanic garden networks.
viii) Provide and support twinning opportunities to strengthen northern/southern hemisphere relationships,which should be characterised by sensitivity to each other's requirements and conditions.

2.19.2 Networking at a community level

Botanic gardens should:

i) Develop or support community based networks for conservation organisations to ensure a coordinated approach to the local conservation of plants.
ii) Support and empower the local community to value and conserve plants and appreciate the role they play in everyday lives.
iii) Develop partnerships with schools and universities to ensure a collaborative approach to environmental and science education in the region.
iv) 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.

Annexes

Annex 1

A checklist for botanic gardens to implement the Convention on Biological Diversity

1. Obtain and read a copy of the text of the Convention on Biological Diversity.
2. Develop an official policy on the CBD and a strategy for its implementation in your garden to ensure that that all the actions of your botanic garden are in line with the spirit and letter of the Convention. It will include:

- How the mission of your garden is relevant to the CBD;consider reviewing your mission to become more involved with the aims of the CBD.
- A 'CBD-audit' or strategic review of your garden and its collections in relation to the CBD.
- An institutional Code of Conduct on collecting and acquiring plant material.
- Material Transfer Agreements and Material Acquisition Agreements to help ensure that benefits arising from distributed plant material are fairly and equitably shared.
- An awareness programme so that all staff are aware of,and follow, the garden's policies, procedures and practices relating to the implementation of the CBD.

3. Seek to publicise the CBD and its objectives to your constituency.
4. Work to implement the CBD at a national and international level:

- Become involved in the development and implementation of national biodiversity conservation strategies and action plans and offer advice on plant diversity matters to national policy-makers.
- Seek to be included,or represented, in official delegations sent by your government to the Conference of the Parties of the CBD or to SBSTTA (Subsidiary Body on Scientific and Technological Advice), or seek accreditation and attend meetings in your own right as a non-governmental organisation.
- Ask your government for support and official recognition of your garden's role in implementing the CBD.
- Become involved in processes and working groups established by organisations such as BGCI, to develop appropriate international policies for botanic gardens.
- Develop and strengthen partnerships with institutions in other countries,particularly those that are rich in biodiversity but poor in resources, and assist them in all ways possible to meet their challenges and obligations in implementing the Convention.

(Wyse Jackson 1997,p16)

Annex 2

A CITES checklist for botanic gardens

- Contact and find out about your national CITES Authorities, Management Authority and Scientific Authority.
- Find out if your country is a party to CITES. Who are the experts in your country on plant trade?
- Do your country's field botanists or botanic garden 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 assemble complete documentation for these species.
- Distribute information about CITES to all your staff and ensure they understand what is required of them.
- Designate one member of staff to be your CITES Officer.
- Agree and implement an institutional Code of Conduct for the collection 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 your role, locally and nationally, in the implementation of CITES 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.
- Follow your own guidelines and Code of Conduct!

(Akeroyd et al 1994) Refer to Annex 8 for a code of practice on plant trade for botanic gardens

Annex 3

Are checklist for botanic gardens to promote and implement Agenda 21

National and international

- Contact your national authorities which negotiate International conventions:
  - Has your country approved Agenda 21?
  - If it has not,why not?
  - If your country has not approved Agenda 21, encourage it to do so.
  - Has your country prepared a national strategy to implement Agenda 21?
  - Has your national authority produced leaflets on Agenda 21 that you could use with your educational materials?
- Contact groups at a national and international level to share materials and expertise in the implementation of Agenda 21.
- Cooperate with national governments to support the implementation of national policies in sustainable development.
- Participate in,support and/or develop relevant national and international programmes and partnerships.

Internally

- Review your development and operations policies and practices and develop an institutional policy on sustainable development.
- Allocate a staff member to be your Agenda 21 Liaison Officer.
- Decide on the level of involvement that is possible in each area e.g. exemplify in operations, incorporate sustainability and development issues into education and interpretation programmes,or actively promote through outreach programmes.

- Distribute information and organise workshops about Agenda 21 for all your staff so they can provide leadership and an example in the community.

Locally

- Explore and support the needs and interests of visitors and the local community in sustainable development.
- Undertake a consultative process with your local community, businesses,non-government organisations and botanic garden staff to identify and prioritise local concerns and opportunities.
- Using the outcomes from the consultative process, determine what issues your garden could address relevant to plant conservation and sustainable living at a local level. These issues might include threats to local plants and habitats, water shortage during drought, the disappearance of traditional knowledge or invasive plants and animals for example.
- Examine the strengths of the botanic garden to identify how you can contribute to resolving local issues.
- Assess the facilities and resources needed and/or available for undertaking the implementation of Agenda 21.
- Contact all local groups with a view to collaborating on projects and providing mutual support.

(BGCI 1999, pp53-54)

Annex 4

The CBD and integrated conservation

The Convention on Biological Diversity (CBD) highlights the importance of integrated conservation of biological diversity by stressing that conservation techniques used should be complementary. Integrated conservation techniques may be interpreted to include:

- The identification and monitoring of the components of biological diversity (Article 7).
- In situ conservation of biological diversity through the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings,as well as through the establishment of a system of protected areas. In situ conservation also includes a number of restitution techniques to restore plant populations in the wild and their habitats,through active management, reintroductions,translocations, reinforcement and efforts made to recreate whole or restore damaged ecosystems (Article 8).
- Ex situ conservation of the components of biological diversity in genebanks, botanic gardens and other institutions (Article 9).
- Programmes of research on biological diversity to contribute to the development of techniques for the conservation and sustainable use of the components of biological diversity (Article 12).
- Programmes for public education and awareness that promote public understanding of the importance of and measures required for the conservation of biological diversity (Article 13).
- The promotion of technical and scientific cooperation and national and international levels (Article 18).

Furthermore the CBD refers to the need to integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies (Article 6b).

Annex 5

Seed banks

The storage of material in the form of seeds is one of the most widespread and valuable ex situ approaches to conservation. Extensive expertise has been developed in this field by agencies and institutions involved with plant genetic resources over the past 30 years. Seed banking has considerable advantages over other methods of ex situ conservation such as ease of storage, economy of space, relatively low labour demands and consequently, the capacity to maintain large samples at an economically viable cost.

Seeds are a convenient means of long term storage of genetic diversity, as the samples are small in size, are easily handled, require low maintenance and frequently remain viable for long periods. In general, conditions of low temperature and desiccation allow seeds to maintain viability, in many cases indefinitely. Seed banks take up little space, but can be expensive to run, both because of the need to maintain low temperatures and the necessity for germination tests, growth trials and regeneration. They are not suitable for species with recalcitrant seeds.

Botanic gardens in many countries have developed seed banks for the storage of seeds, mainly of wild species. BGCI figures (1998) indicate that there are currently almost 200 botanic gardens that have seed banks maintaining seeds in long term and medium-term storage.

Several botanic gardens have developed the capacity to store isolated embryos,minute seeds and tissues under conditions of cryopreservation,maintaining samples in liquid nitrogen at temperatures of -196°C. Such techniques offer great potential for the maintenance and conservation of biodiversity, particularly plant species that cannot be stored by conventional means.

Botanic gardens should be aware of the vulnerability of stored material to external factors such as power cuts, civil disturbance, adverse weather conditions and natural disasters.

(Laliberté 1997)

Annex 6

Sample contents of a species recovery programme

- description of the species or taxon
- taxonomy, morphology and where possible, the genetic variation of the species
- present known and past distribution,as far as is known
- current status (is it endangered and to what degree?)
- population and reproductive biology/life history
- habitat description and ecology
- limiting factors (e.g. available suitable habitat)
- identification of relevant stakeholders and collaborators in the species recovery programme
- actual and potential threats
- conservation measures and actions required
- recovery objectives
- recovery criteria (measurements of how to judge whether objectives have been met)
- implementation schedule
- resources required and available (including personnel)
- aftercare and monitoring
- work plan
- budget and costs

(Akeroyd and Wyse Jackson 1995)

Annex 7

Botanic gardens and medicinal plants

The importance of plants for healthcare has often been underestimated. As stated by a recent World Bank paper 'Despite all the progress in synthetic chemistry and biotechnology, plants from the wild floras of developing countries are still an indispensable source of medicinal preparations both preventative and curative. Indeed,it is thought that more than 80% of the world's population rely primarily on plants for health care... [and] medicinal plants are a possible 'bridge' between sustainable economic development, affordable health care and the conservation of biodiversity in many countries (Srivastava et al. 1995)'.

Many botanic gardens play an active role in medicinal plant study and research,cultivation and conservation. Their extensive collections are easily accessed and available, for example, to support local initiatives in primary health care using medicinal plants and their sustainable use, particularly in developing countries. They are also available as a resource for screening programmes for pharmaceutical companies and to provide material for those assessing the value and safety of particular herbal medicines. Botanic gardens can provide the expertise to improve the agronomy of cultivated medicinal plants and bring into cultivation those species needed in medicine that have not been previously cultivated. Most medicinal plants are at present grown as unimproved wild plants, and so tend to be very variable. Effective plant breeding requires access to a wide range of genetic variation as a starting material. Botanic gardens have an important role in the development of a gene pool of wild stock plants,which can contribute to breeding programmes.

Annex 8

A code of practice on plant trade for botanic gardens

- Judge whether any plant trade operations that you influence or in which you participate are detrimental to the survival of plant species or vulnerable populations.
- Be aware, and try to obtain and read copies,of all relevant legislation relating to the protection of wild plants and regulation of the trade in wild plants at local, national and international levels.
- Never break any of these laws intentionally, and take all measures possible to ensure that you do not break them unintentionally.
- Include in your institution's curation or accessions' policy guidelines to be followed on plant trade issues.
- Always check sources,provenance and documentation of new accessions and the credentials of those with whom you exchange plants.
- Do not purchase, collect,accept as unauthorised gifts,or otherwise receive plants that are known to be in breach of national or international regulations or that have inadequate, incorrect or incomplete legal documentation.
- Designate a member of staff whose duties will include the checking of legislation on plant trade and ensuring that the institution's activities and policies comply fully with such legislation.Ensure that this person is in regular contact with the CITES Management and Scientific Authorities of your country.
- Lobby for the conservation of your country's flora and the protection of its most vulnerable species from illegal or unsustainable trade.
- Make available, where possible and appropriate, any spare seed or propagated material of threatened plants from the collections of your institution, if the distribution of such material can have the effect of reducing trade pressure on threatened wild populations,and if such material may be released in accordance with the terms of the CBD.

(Akeroyd et al.1994) Refer to Annex 2 for a CITES checklist for botanic gardens

Section 3

Implementing the International Agenda

3.1 Global Mechanisms for Monitoring Implementation of the International Agenda and Reporting

The implementation of the *International Agenda for Botanic Gardens in Conservation* represents a considerable challenge and responsibility for the botanic garden community, both individually and collectively. Successful implementation will only be achieved if botanic gardens develop carefully formulated and well considered individual and collective responses to it. In this section, administrative procedures are outlined to provide a means to measure its implementation,to report on activities undertaken in its implementation and to register those institutions that are involved or seek to be involved in its implementation.

Also included is a set of step indicators and targets by which a measure of the success in achieving its objectives can be made.

3.1.1 Measurable targets

It is difficult to set measurable targets by which the success in implementing the International Agenda can be monitored. Local or institutional targets may be created so that institutions can assess their own success in achieving conservation. However, it is recognised that global targets for plant conservation must urgently be established which go beyond the work of botanic gardens. These targets should 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.

For the botanic garden community:

Target: Botanic gardens globally adopt and implement the International Agenda.

Success measure: Number of botanic gardens worldwide who have adopted the International Agenda.

Target: Each known threatened plant and ecosystem is included in a programme for conservation,with the ultimate aim of safeguarding them and their genetic diversity in the wild.

Success measure: Number of species recovery programmes and ecosystem conservation programmes and their success rate.

Target: The capacity of botanic gardens is developed for biodiversity conservation worldwide and in particular in regions of high diversity. Resources identified and

accessed to support their biodiversity conservation activities.

Success measure: Number of botanic gardens operating throughout the world; the percentage that have research, conservation and education programmes.

Target: Current information on the activities,collections and facilities of botanic gardens worldwide is available to support biodiversity conservation

Success measures: Number of botanic gardens linked to the Internet; number of botanic gardens with comprehensive and accessible electronic data systems on their collections.

For individual botanic gardens:

Target: Conservation programmes for any threatened plants species are established and implemented in their own regions,leading ultimately to the recovery of such species in the wild.

Success measures: Number of botanic gardens undertaking plant conservation programmes; number of individual species conservation programmes implemented.

Target: Public education programmes on conservation, sustainability and the environment are created and/or strengthened.

Success measures: Number of public education programmes operated by botanic gardens on a national, regional and international level;percentage of visitors to botanic gardens aware of environmental and conservation priorities and the role of botanic gardens; attitudes of the general public to plant conservation and environmental protection.

3.2 Adopting the International Agenda

The International Agenda has been published and made available to botanic gardens to provide an agreed framework for botanic garden action in conservation. 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 in conservation.

Botanic gardens should:

i) Agree to adopt the International Agenda by making a written undertaking to work for the implementation of its provisions.
ii) Seek to publicise their adoption of the International Agenda to those who work with,or visit,their botanic garden, so as to raise awareness of the importance and significance of a global policy for botanic gardens in conservation and to help raise new resources to support their conservation programmes.

3.3 Developing a Registration System

It is important to maintain information on the actions of botanic gardens that implement the International Agenda, so that gaps can be identified and addressed, coordination and cooperation fostered, and awareness raised about the important work of these botanic gardens.

Botanic Gardens Conservation International should:

i) Develop an international registration scheme for botanic gardens that have declared their intent to contribute to the implementation of the International Agenda.
ii) Encourage botanic gardens globally to adopt the International Agenda as their (or part of their) institutional policy on conservation.
iii) Maintain a list of institutions that have made such a declaration,and publish and make available this list regularly.

iv) Seek to gain endorsement for the principles and objectives of the International Agenda from other non-garden bodies, institutions and organisations, with the aim of strengthening and fostering cooperation for its implementation.

Botanic gardens should:

i) Consider the development of an international register of projects that contribute to the implementation of the International Agenda.
ii) Allow the names of their botanic garden to be added to the list of those institutions that have made a declaration of intent work for the implementation of the International Agenda.

3.4 Monitoring

Monitoring the implementation of the International Agenda will be an important future task to ensure that targets are being met and priorities achieved.

Botanic Gardens Conservation International should:

i) Undertake to monitor and evaluate the implementation of the International Agenda on a global scale.
ii) Support and cooperate with networking organisations and individual botanic gardens that are monitoring implementation at local, regional and national levels.
iii) Maintain a computer-based information system on the botanic gardens of the world,including up to date information on their collections, facilities and activities.
iv) Use the results of monitoring and evaluation to determine ways in which the International Agenda can be made more effective.

Network organisations should:

i) Establish appropriate coordinating,monitoring and evaluation systems to ensure that biodiversity conservation targets in their own regions are being met.
ii) Develop and implement electronic information systems to monitor biodiversity conservation activities that contribute to the International Agenda.
iii) Appoint or designate one or more people to be a regional coordinator for activities related to monitoring the implementation of the International Agenda.
iv) Undertake occasional surveys to document facilities,activities and institutional involvement in the implementation of the International Agenda.
v) Support international monitoring of the implementation of the International Agenda by providing data and information as appropriate.

Botanic gardens should:

i) Monitor and evaluate the activities they undertake that contribute to the implementation of the International Agenda so that assessments of the achievement of institutional goals can be made.
ii) Provide information of activities undertaken that are relevant to the implementation of the International Agenda to national, regional or international bodies and organisations that are monitoring and coordinating the achievement of global targets.

3.5 Administrative Structures

There is a need to establish institutional and network administrative structures to coordinate and monitor the implementation of the International Agenda.

Botanic Gardens Conservation International shall:

i) Provide a secretariat and administrative support services to assist in monitoring and coordinating the implementation of the International Agenda.
ii) Organise international expert consultation groups, as required, to prepare additional policy, technical and procedural papers to elaborate and consider matters relating to the implementation or operation of the International Agenda.

Network organisations should:

i) Assist in providing coordination at national and regional levels to monitor and support the implementation of the International Agenda by botanic gardens.
ii) Support individual botanic gardens to develop appropriate administrative structures to assist in developing responses to the International Agenda, implementing its provisions and monitoring activities undertaken.

Botanic gardens should:

i) Establish their individual institutional response to the International Agenda.
ii) Monitor their activities that contribute to the implementation of the International Agenda.
iii) Formulate individual targets that they seek to achieve in the implementation of the International Agenda.
iv) Create appropriate administrative structures to ensure that their implementation of the International Agenda is planned,coordinated and monitored within their individual institution.
v) Offer support to other institutions and organisations with which they work to promote the development of administrative structures for the International Agenda implementation.
vi) If appropriate, establish thematic or special interest groups within the botanic garden to consider their implementation of the International Agenda in different fields in which they are active.
vii)Establish processes and procedures to enable regular reports on their conservation activities to be made available to the Secretariat monitoring the International Agenda implementation.

3.6 Meetings

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 International Botanic Gardens Conservation Congress,held every three years, will be 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 included in the international directory of botanic gardens maintained by BGCI,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.

Botanic Gardens Conservation International shall:

i) Organise regular international congresses where the implementation of the International Agenda can be planned,considered and monitored.
ii) Inform the botanic gardens and networks of the world about these congresses and invite contributions for discussion and consideration.
i) Prior to the Congress,prepare a report outlining progress made since the previous Congress on the implementation of the International Agenda. Such a report will be presented to the Congress for approval and subsequently published.

Network organisations should:

i) Seek to organise regular meetings at a national or regional level to consider the implementation of the International Agenda in their own region.

Botanic gardens should:

i) Seek to be represented at such meetings and within the limits of their available resources, be active in contribution to their deliberations.

3.7 Publication of Results

There is a need to ensure that the results of work undertaken in implementing the International Agenda are published and widely disseminated (including printed form and by electronic means) to ensure that

botanic gardens worldwide have access to information on guidelines,codes of conduct and best practice, techniques and methodologies and the results of successful projects undertaken.

Botanic Gardens Conservation International should:

i) Publish information and articles relevant to the implementation of the International Agenda and disseminate such information to the botanic garden community.

ii) Encourage botanic gardens to publish and disseminate the results of their work through relevant national and international journals and other media.

Botanic gardens should:

i) Ensure that results of their work in conservation are published and disseminated widely.

3.8 Adoption of Protocols to the Agenda

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.

Botanic Gardens Conservation International 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 International Botanic Gardens Conservation Congress for finalisation and ratification. Ratification shall be achieved if agreed to by a two-thirds majority of all registered delegates attending the Congress.

3.9 Revision of the International Agenda

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.

Botanic Gardens Conservation International 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 International Botanic Gardens Conservation 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 an International Botanic Gardens Conservation Congress.

3.10 Financing and Resourcing Conservation

Although the majority of botanic gardens receive their main funding from single sources such as government, charitable trusts or university departments there is no guarantee that this situation will continue in all cases, or that there will be ongoing resources and finance for essential conservation work. Too often conservation project funding and implementation is dependent on the initiative of individuals within an institution rather than by the development of institutional programmes. There are a range of diverse ways that botanic gardens can raise funds to assist in financing and resourcing conservation, but they need to plan carefully to ensure

their efforts are successful (Leadlay and Greene 1998). Developing a secure financial basis for the institution should be one of the top priority tasks for each botanic garden.

Botanic Gardens Conservation International shall:

i) Assist botanic gardens in their fund raising efforts for conservation by providing advice, expertise and support as appropriate.

Network organisations should:

i) Provide support, advice and expertise to their members in fund raising efforts.
ii) Encourage the development of partnerships and cooperative conservation projects that enhance funding possibilities.

Botanic gardens should:

i) Develop a fund raising strategy for their activities undertaken in conservation as part of the overall strategic plan for the garden.
ii) Investigate ways to access further resources from parent bodies or institutions, government authorities,charitable donations and specific project funding for local conservation actions.
iii) Investigate ways to raise resources from earned revenue (e.g.sales of plants,gate and programme fees,cottage industries,and profits from shop and/or restaurant/café sales) to support conservation initiatives.
iv) Form partnerships with local communities to develop volunteer programmes that contribute to botanic garden development,management, maintenance and local conservation projects.
v) Form partnerships with bodies that have a complementary mission so as to attract support for conservation based partnership initiatives.
vi) Support networking organisations such as BGCI to access and develop resources to help implement the International Agenda.
vii)Raise awareness of the important conservation work they are undertaking amongst national and local authorities,potential donors and the general public to help attract new and sustained support for their programmes in biodiversity conservation.

Glossary of Terms

For the purposes of the *International Agenda for Botanic Gardens in Conservation* the following terms are defined:

Accession is a specimen or sample held in a collection (living or preserved).

Biodiversity (biological diversity) means '...the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (UNEP 1994, p4)'.

Biotechnology is any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use (CBD). It has also been defined elsewhere more narrowly to include new technologies that have a strong molecular basis.

Ex situ conservation is the conservation and maintenance of samples of organisms outside of their natural habitat, usually in the form of seed, pollen, vegetative propagules, tissue or cell cultures or individuals

Genebank is a collection of propagating materials that are stored under conditions that retain viability for long periods. It can include seed, pollen, tissue culture, vegetative propagating material, DNA and even whole plants grown as plantations.

Herbaria are the traditional way in which dried plant material is stored in the long term. Herbaria conserve the type specimen of each taxon described by botanists and they are a documentary fund as regards the distribution,phenology and variability of plant specimens.

In situ conservation is the conservation of biological diversity in nature.

Integrated conservation is the combination of the complementary approaches of in situ and ex situ conservation for the protection and management of biological diversity, by combining species level conservation with the management of communities and ecosystems. Integrated conservation also seeks to draw together organisations using different methods for conservation of diversity and draw together all stakeholders across government,industry and community who have an impact on the survival of species.

Introduction is the establishment of a plant in an area in which it has never been known to occur.

Reintroduction or ***Restitution*** involve the release and management of a plant into an area in which it formerly occurred, but in which it is now extinct or believed to be extinct - also called ***Reinstatement*** or ***Re-establishment***.

Restoration is defined by the Society for Ecological Restoration as:'The process of intentionally altering a site to produce a specified historic ecosystem. The intent of the work is to emulate the natural structure, function,diversity and dynamics of a defined, indigenous ecological system.'

Species Recovery Plan is a comprehensive practical plan of action to safeguard a species against further loss/deterioration of its remaining genepool.

Stakeholder is '...an individual, organisation or group whether formal or informal,affected by, or with an interest in, the activities relating to the acquisition, use or supply of genetic resources, their progeny or derivatives.' (Royal Botanic Gardens Kew 1999).

Sustainability '...involves an equation between environmental requirements and development needs. It can be balanced by acting either to reduce stresses or to increase 'carrying capacities' (UNESCO 1997 p12)'.

Sustainable development is '...development which meets the needs of the present without compromising the ability of the future generations to meet their own needs (The World Commission on Environment and Development 1987, p43)'.

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