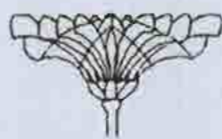
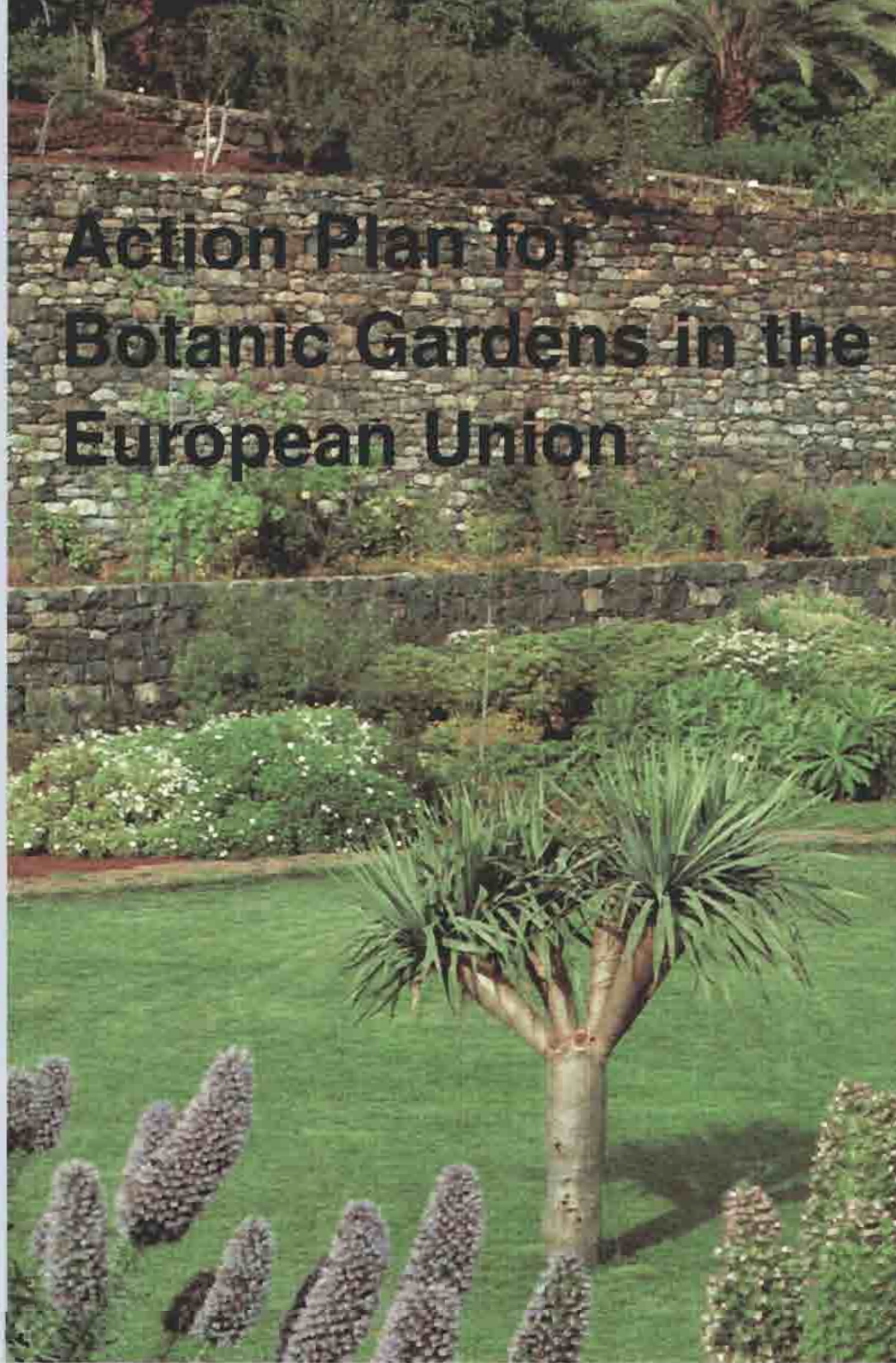




Action Plan for Botanic Gardens in the European Union



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Action Plan for Botanic Gardens in the European Union

**Edited and compiled by Judith Cheney, Joaquín
Navarrete Navarro and Peter Wyse Jackson for the
BGCI/IABG European Botanic Gardens Consortium**

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Back cover: *National Botanic Garden of Wales, UK* (top); *Jardín Botánico de Córdoba, Spain* (middle); *Orto Botanico, Pisa, Italy* (bottom).

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Peter Wyse Jackson
Secretary General
Botanic Gardens Conservation International

March 2000

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Summary

The Action Plan sets out for botanic gardens in the European Union more than 30 objectives on science and horticulture; heritage and culture; conservation of biodiversity; education, training and awareness; networking and co-operation; capacity building; and funding to implement the Action Plan. Ways of achieving each objective are suggested. Case studies give examples of current activities and innovative programmes being undertaken by botanic gardens in the European Union. Information is also included on the numbers and diversity of botanic gardens in the EU as well as on their network organisations.

This document has been drafted and widely considered and reviewed by staff from botanic gardens throughout the European Union. It seeks to provide a firm foundation for joint and individual actions that can be undertaken by botanic gardens in the region. It goes beyond providing just a framework for botanic gardens' involvement in plant and environmental resources management, research and conservation, but provides specific suggestions for programmes that can be implemented by botanic gardens in many fields.

It is designed to be accessible to anyone with an interest in plants and the environment. However, there are a number of very specific audiences we have kept in mind when preparing this Plan. These audiences are:

- governing bodies, administrators and staff of botanic gardens
- those working to create, develop or strengthen botanic gardens
- government departments and ministries, especially those responsible for the environment and education
- those involved in the development and implementation of national and regional conservation and environmental policies
- environmental education policy formers
- non-government organisations and other groups carrying out environmental and conservation work
- funders.

Its goals are to:

- provide an EU-wide regional framework and shared rationale and priorities for botanic gardens' actions for plants and the environment
- strengthen the capacity of EU botanic gardens
- help gardens to develop programmes to educate the public about the importance of plants for the planet
- provide guidance for individual botanic gardens in the formulation and implementation of programmes and to suggest priority actions for such gardens for the study of plants, for conservation and to promote the sustainable use of plant diversity
- foster development of the EU botanic garden network, to promote even closer regional collaboration and raise greater resources for their individual and joint priority actions.

Introduction

By Peter Wyse Jackson

There are more than 400 botanic gardens in the European Union (*see Box 1*), their staffs comprising some 1,500 scientists, and 5,000 other employees (technicians, gardeners, education staff, guides, office staff and guards). These botanic gardens receive more than 50 million visitors each year and are the major way in which the people of Europe can gain access to information on the diversity and importance of the world's plants. Many botanic gardens in the European Union are also leading institutions of world significance in botanical research, plant conservation, education and horticulture.

- They grow more than 50,000 species of higher plant in their living collections.
- Their herbaria hold over 40 million specimens from all over the world.
- Amongst them are over 100 germplasm banks, conserving important collections not only of wild flora, but also of species of agricultural interest and containing tens of thousands of seed accessions – one of the most important genetic reserves in the world.
- Their museum and library collections are some of the most important and extensive in the world – an important part of the Europe's heritage and culture and an essential resource for botanical studies.

Botanic gardens have played a significant role in many cultures and civilisations over the ages. Their contribution to cultural development, economic progress and commercial expansion has been of very great importance. Today, their roles are many and various, as outlined in Box 2, which lists some of the major activities currently undertaken by botanic gardens in the European Union.

They perform such diverse roles and functions that it is not easy to define what is a botanic garden. However, a convenient definition to use is that they are:

'institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education' (Botanic Gardens Conservation International 1999).

Within this definition, there may be included a great diversity of institutions ranging for large gardens with several hundred staff and a diverse range of activities to small institutions with limited resources and activities. Nevertheless, as suggested by this Action Plan, all can play a role in botanical resource management, in botany, horticulture, conservation or education.

Botanic gardens are managed by a wide range of organisations and administrations. 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. 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 with funds gained increasingly through independent fund-raising efforts.

BOX 1

Botanic gardens in the European Union

Area or Country	Number of botanic gardens
Austria	13
Belgium	25
Denmark	8
Finland	8
France	68
Germany	78
Greece	4
Ireland	11
Italy	54
Luxembourg	1
Netherlands	43
Portugal*	9
Spain*	16
Sweden	9
United Kingdom†	77
EU total	424

*Including botanic gardens in Macaronesia (Canary Islands, Madeira and the Azores)

†Including Gibraltar

BOX 2

Some current roles and activities for botanic gardens in the European Union

- Wild plant species research, conservation and management *ex situ* and *in situ*
- Plant reintroductions and habitat restoration research
- Arboriculture and dendrology
- Library services and information centres
- Environmental education programmes for children and adults
- Teacher training
- Tourism
- Public recreation
- Horticultural research
- Ornamental horticulture and floriculture
- Horticultural training
- Remedial training and therapy
- Introduction and assessment of new crop genetic resources
- Cultivar conservation and maintenance
- Seed and tissue banking
- Field genebanks
- Herbarium studies
- Laboratory research, including *in vitro* (tissue culture) plant cultivation
- Ethnobiological research
- City and town planning, resource allocation and land use

The major types of botanic garden in the European Union are outlined in Box 3, although many have multipurpose roles and so do not fit neatly into any well-defined category.

The plant groups best represented in living collections in botanic garden in the European Union include many important groups, including carnivorous plants, orchids, palms, cacti and other succulents, ferns, tropical ornamentals, cycads, bulbous plants, bromeliads and conifers. Many botanic gardens place particular emphasis on growing and maintaining thematic collections of such groups as medicinal and aromatic plants, economic plants, particularly fruit trees and their wild relatives, ornamentals, plants of ethnobotanical or historical interest, alpine and temperate trees.

Stimulated by increasing awareness of the need for plant conservation, many botanic gardens have given particular emphasis to replacing plant accessions whose origins are unknown with newer material of known wild origin and giving higher priority to maintaining genetically diverse collections of priority rare or endangered plant taxa. Furthermore, there is an increasing trend for botanic gardens to focus on and give priority to the cultivation of the native flora of their own region, particularly those that are threatened. It is hoped that this Action Plan will stimulate this work amongst many more gardens.

BOX 3**Types of botanic garden in the European Union****'Classic' multipurpose gardens**

These are often the largest with a broad range of activities in horticulture and horticultural training; research, particularly in taxonomy with associated herbaria and laboratories; public education; and amenity. They are generally State supported.

Ornamental gardens

These often very beautiful establishments with diverse plant collections, but currently with little or no research, education or conservation role. Their plants are often not labelled. Some are privately owned. Many municipal gardens fall into this category.

Historical gardens

These include many of the earliest botanic gardens established as physic gardens for the teaching of medicine. Some were developed for religious reasons and many were laid out in elaborate geometric patterns. Some of these are still active in medicinal plant conservation and research and are still today primarily concerned with collection and cultivation of medicinal plants and spreading of information about them to the public. Some have associated laboratory and research facilities.

Conservation gardens

Most of these are recently developed in response to local needs for plant conservation and 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 play roles in public education.

University gardens

Universities have traditionally maintained botanic gardens. Most have a multipurpose function in teaching and research. Many are open to the public.

Combined botanical and zoological gardens

Often the botanical element is secondary to the zoological collection, but the importance of botanical collections in many zoos is currently being reassessed.

Agro-botanical and germplasm collection gardens

These 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. Many are not open to the public. Many contain associated laboratory, plant breeding and seed testing facilities.

Alpine or mountain gardens

These gardens, most frequently in mountain regions of Europe, are specifically designed for the cultivation of mountain and alpine flora. Some are satellite gardens of larger lowland botanic gardens.

Natural or wild gardens

These gardens contain an area of 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.

Horticultural gardens

These gardens, often owned and maintained by horticultural societies, exist primarily to foster the development of horticulture through the training of professional gardeners, breeding, registration and conservation of garden plant varieties and to act as gardens for the use, pleasure and service of members. Most are also open to the general public. Several have broader aims in plant species conservation.

Thematic gardens

These specialise in growing a limited range of related or morphologically similar plants or plants grown to illustrate a particular theme. These include orchid, rose, rhododendron, bamboo and succulent gardens or gardens established on such themes as ethnobotany, medicine, bonsai, topiary, butterfly gardens, carnivorous plants, aquatics.

In the last 20–30 years there has been a renaissance in botanic gardens worldwide, largely as a result of the developing concern for the loss of biodiversity and the need for many more institutions to become active in plant resource conservation. There has also been a corresponding rise in botanic garden involvement in research and conservation of the floras of the regions or countries in which they are situated. Their traditional and widely accepted role in *ex situ* conservation has also been broadened considerably by many botanic gardens. Many botanic gardens are now taking a more integrated approach to biodiversity conservation, linking their work on the cultivation and conservation of plants in the garden and maintained in their seed banks with an enhanced role in *in situ* plant conservation. Such integrated conservation activities take many forms, including work in areas of conservation biology, including plant reintroductions, habitat and wild population management and restoration, the control of invasive plants, genetic and molecular studies, environmental advocacy, taxonomic research and exploration and environmental education.

An important feature of the botanic garden scene in Europe over the last decade has been the extent to which networks of closely co-operating botanic gardens have been developed. Since its establishment in 1987, Botanic Gardens Conservation International itself has developed to become a major networking organisation for botanic gardens in Europe and worldwide and includes most of the major European botanic gardens as members. Although all these networks have arisen from a great diversity of origins, there are now effective operational links and close co-operation amongst them. The development of this Action Plan is a tangible outcome of this close co-operation.

Need for an Action Plan for botanic gardens

We depend totally on plants for every aspect of our existence – food, clothing, housing, health and pleasure. Plants (all plants, not just the few thousand we use directly) are the basis of all life on earth; and, to survive, we need to treat plants as important partners in our lives. Nevertheless, throughout the world we are threatening this rich part of our natural heritage. Natural habitats are coming under increasing pressure and the erosion of the diversity of our native plants continues, despite growing awareness of the importance of biodiversity in Europe and our urgent need to protect and manage it for the future.

Botanic gardens in the European Union have become increasingly aware of their considerable responsibilities, not only for plant resource management, conservation and research, but also to safeguard the heritage collections of buildings, plants, landscapes and artefacts that are within their stewardship. In this new world climate of awareness about the environment, it has therefore become urgent for EU botanic gardens to unite their efforts and work together.

The aim of this Action Plan is therefore to:

- define the role that botanic gardens can play in measures that the world community has formulated to safeguard plants and the environment, including how botanic gardens relate to international and national instruments, legislation and conventions that focus on plants and the environment
- help to define botanic garden responsibilities and obligations in plant resource management and conservation;
- define a shared mission and work programme
- agree targets that define how EU botanic gardens can contribute to biodiversity conservation and environmental sustainability
- develop efficient systems to document plant diversity within and beyond the European Union
- ensure that EU botanic gardens are linked, co-ordinated, monitored and supported by network organisations
- promote greater co-operation between botanic gardens within Europe and elsewhere in the world
- ensure that the botanic garden community co-operates closely with non-garden institutions and organisations, including governments, NGOs, other bodies and individuals who are working to achieve similar aims
- strengthen efforts made by so many institutions to gain new resources for their work; to turn their plans into actions.

How to use the Action Plan

This Action Plan will be most effectively implemented at the level of the individual botanic garden. It may be valuable for individual gardens to undertake the preparation of an institutional response to the Plan, reviewing its current policies, management, practices, procedures, resources and facilities. The following fundamental questions might be addressed as part of such a review.

- What is the mission of the garden? Is it clearly defined and understood? Does it outline the garden's purpose, objectives, targets and future activities and is the mission fully understood by all those associated with the garden – governing bodies and other authorities, staff, funders and visitors?
- What are the garden's current and future projected roles in areas such as botanical research, conservation, education and horticulture? How do these relate to the Action Plan objectives and do they address priorities identified also by other groups, bodies and authorities?
- Can all staff be involved in the preparation of a response to the Action Plan so that their commitment to working to implement it is assured?

Clearly, no botanic garden can be active in implementing all, or even much, of the Action Plan. Nevertheless, it provides a shared agenda from which each individual institution can select its own priority activities for implementation, those for which it is best suited. It may also be used to support efforts made by botanic gardens to obtain new resources so that they can play increasingly effective and significant future roles.

The Action Plan is also designed to be used by networking organisations and other bodies associated with botanic gardens; to help define their programmes complementing, supporting, guiding and monitoring the botanic gardens with which they work.

So how do you begin to use this Plan?

We suggest that you first turn to the case studies that are provided at the end of each chapter (*see list on p.5*), to read about just some of the initiatives being undertaken in the region. They will give you a broad overview of just how diverse the activities are which can be undertaken by botanic gardens. Next, systematically begin reading the text from the beginning. Highlight anything that sounds as though it might be possible in your region or institution. Share the ideas with your colleagues and then begin putting together proposals for programmes, using some of the arguments from this Plan. If at all possible, make contact with one of the individuals or institutions mentioned in this Plan and discuss your thoughts. Make an estimate of what the programme might cost to start and what it will cost each year to sustain.

The next step may be a difficult one – getting support for implementing the programme you have identified. You probably know the best way to do this for your particular situation, but again there is a lot to be gained by calling others and asking how they did it. Alliances with existing organisations are a good idea and local NGO and governmental support are highly desirable if your plans necessitate the pursuit of major funding.

A Science and Horticulture

Chapter contributed by David Bramwell and Michael Kiehn

The scientific basis of botanic gardens is what sets them apart from pure amenity gardens, but they are not always perceived in this context. More could be done to raise awareness of current research carried out in botanic gardens in plant science and a wide range of other disciplines and their potential for future research.

The botanic gardens of Europe have a long-established tradition as centres of excellence in science and horticulture. This has not only benefited the European continent, but has also been the basis for the establishment and management of botanic gardens throughout the world.

Botanic gardens of the EU maintain a large sample of the world's plant diversity and have considerable potential as resource centres for research, conservation and education. The 'rivers of biodiversity' that flow through botanic gardens as a result of their accessions' policies provide a supply of scientific and horticultural research material not available from any other source. The gardens also maintain many of the oldest and most important botanical libraries so essential to scientific research and horticultural science.

In many EU countries, botanic gardens are currently the principal institutions for systematic botany, floristics and taxonomy, at a time when these essential subjects have been largely displaced in universities by molecular and biochemical research.

The EU botanic gardens are amongst those best prepared to assume the responsibility given by the Convention on Biological Diversity (CBD) as centres for study and conservation of plants and habitats. The recognition in recent years that 'integrated approaches to plant conservation are most productive when they combine different methodologies' (Wyse Jackson, 1998: Botanic gardens: a revolution in progress. *World Conservation* 2, 14–15) has enhanced the importance of botanic gardens and their plant collections. These institutions have generally responded well, with a wide range of conservation strategies and programmes, including the maintenance of off-site (*ex situ*) collections; gene banks, usually in the form of seed-storage; specialised nursery and horticultural facilities; micropropagation and tissue culture; species recovery, reintroduction and habitat-restoration programmes; the management of natural areas; research related to conservation, such as floristics and systematics; conservation, population and reproductive biology; molecular studies of systematic and genetic diversity, etc. In this context, EU botanic gardens need to be encouraged even more to fulfil one of their most important modern functions: acting as major centres of science and horticulture dealing with wild plant resources for the future. (See also *Objective E1*.)

OBJECTIVE A1 Promote botanic gardens as resource centres for scientific research

Much research is already carried out in EU botanic gardens, particularly those associated with universities, contributing to many disciplines, e.g. botany, horticulture, zoology, forestry, agriculture, conservation, biochemistry, engineering, food science. However, there is scope for much more, and there is a great deal yet to be discovered about the morphology, anatomy, physiology and reproduction of plants, particularly those from the tropics. Facilities and horticultural skills and, of course, plants are available in many EU botanic gardens for such research and for comparative studies of a range of plants under controlled conditions. There are opportunities for collaborative research with other agencies and institutions. Yet, this fundamental aspect of the work of botanic gardens, usually carried out in private parts of the garden, is sometimes little known and may be obscured by the beauty of the public parts of the garden. Much could be done to explain the relevance of research carried out 'behind the scenes' (see also *Objective A2*).

To achieve Objective A1, EU botanic gardens should:

- carry out research on morphology, physiology, ecology, reproduction, genetics and other aspects of plants
- make their research facilities and skills more widely known to other scientific bodies and seek to undertake collaborative projects
- disseminate the results of their scientific and horticultural research by publishing in scientific and horticultural journals, and reporting at conferences, in local and national media and in special exhibitions and open days.

OBJECTIVE A2 Facilitate access to scientific and horticultural information in botanic gardens

Information from scientific and horticultural research carried out in botanic gardens is relevant to such fields as applied biology, conservation, management and use of natural resources, plant breeding and crop development, amenity horticulture, the pharmaceutical industry (see Box 4); but many botanic gardens are not seen in these contexts.

The research providing this information should have a strong consumer/user-driven approach, to ensure that it helps to resolve current problems. The results should be made available to users rapidly and in a comprehensive and user-friendly form.

BOX 4

Some uses of floristic and systematic information

Horticulture

- Determination of environmental range – hardiness and tolerance
- Preselection of taxa for optimum use in specific locations
- Estimation of horticultural value and potential uses
- Foliage and floral characteristics – aesthetics
- Propagation characteristics

Crop development

- Determination of wild relatives of existing crop plants
- Determination of phenology of particular species
- Information on N₂ fixing in legumes
- Sources of information about genetic parameters, such as hybridisation etc.
- Identification of potentially new crop plants

Resource management

- Cataloguing and characterising species in a geographical area
- Floristic accounts of geographical areas
- Determination of potential weediness
- Prediction of potential pest and disease occurrence
- Tracking of the spread of weeds and aliens
- Determination of the natural habitats and environments of plant species
- Determination of areas of high endemism
- Determination of historic trends in vegetation change
- Identification of potential areas for resource conservation
- Determination of rarity

Modified from Morin, N. R. *et al.*, 1989: How Floristic Information is Used. *Floristics for the 21st Century* (eds: Morin, N. R., Whetstone, D. E., Wilken, D. & Tomlinson, K. L.), *Missouri Botanical Garden Monographs in Systematic Botany* **28**, 58–70.

Data from research in botanic gardens are often hidden in internal reports, files and databases inaccessible to potential users outside the institute; the information should be made more freely available. The general public is often unaware of the research carried out in botanic gardens, but many would be interested. European gardens have the potential to be an open window to the public, acting as an interface between science, horticulture, people and plants; stimulating an interest in plants; and generating public sympathy and support for conservation of nature and natural resources throughout the continent.

To achieve Objective A2, EU botanic gardens should:

- make available data generated from their scientific and horticultural programmes in a user-friendly form through traditional or electronic publication
- provide up-to-date information on rare and threatened species in their collections or in their science and horticulture programmes
- form links with national and international plant databases (using the International Transfer Format or other means)
- endeavour to make their science and horticultural programmes user or consumer orientated
- develop public displays on science and horticulture, particularly their role in conservation and related research.

OBJECTIVE A3 Consolidate botanic gardens as major centres of taxonomy

Research in plant systematics and taxonomy provides the basis for all applied and integrated approaches to plant sciences and for species and habitat protection or management programmes. The importance of taxonomic input in many activities aimed at the conservation and sustainable use of biological diversity has been emphasised in the Global Taxonomy Initiative (Decision IV/ID; fourth Conference of the Parties of the CBD, Bratislava 1998). In many universities, botanical research in systematics is mainly restricted to molecular and biochemical studies and botanic gardens are, therefore, not only the custodians of valuable resources for taxonomic research but frequently the most important institutions for the study and teaching of systematic botany, floristics and taxonomy. An estimated 2,500 scientists are employed in approximately 600 European botanic gardens and their associated institutions, some of which (e.g. Kew, Leiden, Geneva, Berlin) include major national herbaria. Most are actively involved in systematics and taxonomy, including horticultural taxonomy, floristics, biogeography, cataloguing of local floras, etc. This makes the botanic gardens of Europe the main source of trained taxonomists and horticulturists; and a principal one for the scientific data needed for floristic and ecogeographical surveys, and the identification of rare or threatened species and their management, propagation and cultivation. More taxonomists are needed and botanic gardens have a role to play in providing training and stimulating an interest in taxonomy in people of all ages in the hope that some may wish to study it further.

To achieve Objective A3, EU botanic gardens should

- promote their position as centres of excellence in taxonomic research and teaching and continue to provide the essential baseline data for plant science
- raise awareness of the importance and continuing relevance of taxonomic work carried out in botanic gardens and stimulate an interest in it
- exchange information with taxonomists working in other scientific institutions and museums, and with field botanists
- provide courses and advice on identification and taxonomy of plants, for students, professional people and the public (*see also Objective D3*).

OBJECTIVE A4 Consolidate botanic gardens as research centres for identification, biodiversity conservation and sustainable use

Many botanic gardens have a major commitment to research in particular areas of the world and they have little spare capacity for new fields of investigation. Others have the potential to participate in new programmes and develop modern techniques, and there are important areas of biodiversity study and conservation open to them.

Traditionally, botanic gardens have been involved in *ex situ* conservation, their main activity being to act as safe havens for the last surviving individuals of threatened species or as managers of seed-banks; this is still an important task. Until recently, however, they had not been direct participants in *in situ* habitat protection and species recovery. Initiatives taken, largely by the botanic garden community itself, have over the past few years increased awareness of the capacity of many of them to participate actively in species recovery and management programmes and in *in situ* conservation initiatives. Major deficiencies in the understanding of conservation biology (such as plant reproductive biology, pollination mechanisms, pollinator relationships, seed dispersal and establishment) and population dynamics (autecology) are amongst the principal handicaps to the establishment of successful reintroduction programmes and to the management of rare and threatened species and their habitats in general. Botanic gardens, with their traditional expertise in plant and plantings management and their modern capacity for research, can contribute significantly.

The conservation and sustainable use of biodiversity depends, through science and research, on the availability of accurate information on component species and their place in natural ecosystems. The CBD recognises this fact in several of its Articles (see Box 12, p.33), and sets amongst its targets the:

- identification of ecosystems, species and genomes important for conservation and sustainable use (Article 7)
- promotion of the protection of ecosystems, natural habitats, and the maintenance of viable populations of species in natural surroundings (Article 8)
- promotion of research that contributes to biodiversity conservation and sustainable use (Article 12).

The requirement of the Convention for the identification of the diversity of 'genomes important for conservation and sustainable use' and the 'maintenance of viable populations of species' offers a plethora of potential molecular and genetic research programmes at both population and genome levels for botanic gardens.

Botanic gardens already carry out research on storage, germination and establishment of seeds and seedlings and on the storage of recalcitrant seeds that cannot be preserved in cold conditions. They also, through micropropagation and *in vitro* culture, work on the reproduction of so-called difficult species, many of which show declining viability in normal conditions because of their natural situation as tiny last-refuge populations. Such studies are essential and provide basic information for species management. They are an important part of integrated conservation policy.

To achieve objective A4, EU botanic gardens should:

in *in situ* conservation

- develop science and research programmes using modern techniques to study the biodiversity, reproductive biology and conservation biology of Europe's threatened species to contribute to their *in situ* conservation
- participate in research on the identification of European Important Plant Areas (IPAs) in co-operation with other bodies, such as the Planta Europa project, and carry out research on the endemic and threatened plants in IPAs
- direct a considerable part of their research capacity towards the study of the endemic and threatened plants of the rich flora of the Mediterranean Basin, a major proportion of which lies within the political boundaries of Europe (see Case Study 10), and contribute to the implementation of the *Conservation of Mediterranean Island Plants, Strategy for Action* (Delanoë, O., Montmollin, B. & Olivier, L., 1996 IUCN/SSC)

- strengthen their traditional research links with botanic gardens and scientific workers in countries of the developing world and participate in the application of modern techniques to *in situ* conservation of the rich floras outside Europe

under the CBD

- participate in the production and evaluation of the scientific information required under the CBD for the conservation of European plant diversity

in *ex situ* conservation

- seek to enhance their positions as major centres for conservation of wild-plant germplasm, promoting their capacity to carry out research on seed biology and storage, micropropagation, and the propagation and cultivation of plants; and to contribute scientifically to integrated conservation policies and programmes in the EU.

OBJECTIVE A5 Promote and consolidate botanic gardens as major centres of specialised horticulture

Horticulture in botanic gardens is of a specialised nature and quite different from that carried out, for example, by local authorities or amenity gardens. The living collections maintained by European botanic gardens have been the basis for the development of much of modern scientific horticulture. The staff have particular skills and knowledge for growing, maintaining and propagating a very wide range of plants from diverse climates and habitats. Many of the species are rare, some are brought into cultivation for the first time in botanic gardens; their requirements are not fully understood and staff have to determine the requirements for their germination, healthy growth and reproduction. Glasshouse and field experiments carried out in the garden by botanists and other scientists are often dependent on the cultivation skills and advice of horticultural staff. However, this skill and expertise has not always been recognised, perhaps because there has been little encouragement for horticulturists to write up and publish their results, and so the knowledge remains with individual members of staff.

In botanic gardens, traditional horticultural skills, especially in plant propagation, are complemented by newer techniques, such as micropropagation, tissue culture, low-temperature seed storage and chemically or mechanically assisted germination. These techniques are particularly relevant for conservation, and tend to involve co-operation between scientific and horticultural staff in the management of living collections. The modern needs of integrated, scientifically based conservation require high quality collections to be grown in optimum conditions; the information from horticultural research and experimentation is essential for reintroduction and habitat restoration programmes, which often depend on botanic gardens for plant material and horticultural skills. Attention also has to be paid to the horticultural requirements of wild European plants of wider general interest, such as the wild relatives of crop species of European origin, medicinal plants, ornamentals and others of economic interest.

As well as the need for scientific horticulture, EU botanic gardens should recognise the need for their collections to be displayed in an attractive and pleasing way, as public appreciation of them is an important factor in environmental education. Horticultural staff may be called on to mount special displays and plantings that address various aspects of the garden's education, research or conservation programmes.

The high quality horticulture in botanic gardens should be promoted through research and training schemes including practical workshops and staff training and exchange schemes.

The number of people choosing horticulture as a career has declined in recent years, though there has been an increasing trend for mature students from other disciplines to undertake work and training in botanic gardens. It is not widely known that many botanic gardens run horticultural training schemes, in conjunction with educational institutions; more could be done to promote such schemes (*see also Objective D3*).

BOX 5

PlantNet: policy for horticulture

Horticulture is the one common activity linking all collections of living plants. Good horticultural practice is crucial to the maintenance, and therefore to the utilisation, of plant collections. All users rely on the horticultural skills of collection holders to acquire and maintain collections.

From *PlantNet Strategy Plan* (1999): PlantNet: The Plant Collections Network of Britain and Ireland.

BOX 6

Quality of horticulture for plant collections

'Whilst the scientific integrity of botanic collections has to be questioned, there need to be sound principles behind policies for accessions for plant collections and, perhaps more boldly, for de-accessions. The quality and craftsmanship of horticulture must not be allowed to diminish; otherwise, the consequences for plant collections, however sound the collections policy is, will be third-rate poorly grown plants, indifferent displays and public disapproval.'

Goodenough, S. (1996): *PlantNet Newsletter* 3, p.18.

To achieve Objective A5, EU botanic gardens should:

- promote the highest standards of scientific horticulture in the maintenance and use of their collections
- encourage and promote horticultural research programmes on rare and threatened species in Europe and on the wild relatives of useful and potentially useful taxa
- employ high standards of ornamental horticulture in displaying their collections, to enhance their value for botanical and environmental education
- encourage horticultural staff to report the results of their trials and research, through publication and talks
- stimulate more discussion and collaboration between botanical and horticultural staff and with staff at other scientific and horticultural institutions
- encourage horticultural staff to participate in conferences and workshops and to take part in expeditions to study plants growing in the wild
- publicise their horticultural training schemes and the appeal and importance of a career in scientific horticulture.



Nursery at the Jardín Botánico Canario 'Viera y Clavijo', Canary Islands, Spain (Jardín Canario)

CASE STUDY 1

Propagation of Italian wild orchids

Many members of the family Orchidaceae are included in the Red Lists of rare and threatened wild flora. Germination of seeds of terrestrial orchids is not possible using conventional techniques because infection by a mycorrhizal fungus is required for development of the seedlings. Work on *ex situ* propagation of Italian wild orchids by *in vitro* asymbiotic seed germination has been carried out at the Botanical Garden of University of Modena and Reggio Emilia since 1996. This is a collaborative venture which aims to re-establish and increase orchid populations in their original sites in the wild. Similar programmes on wild orchids have been developed by botanic gardens in other European countries.

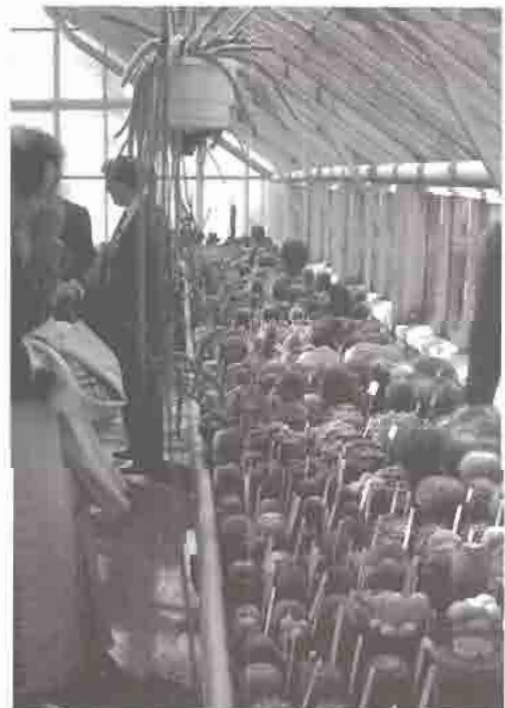
CASE STUDY 2

Research on bryophytes

Almost a quarter of the 1,687 species and subspecies of bryophyte in Europe (including Macaronesia) and nearly two-thirds of the 65 endemics are threatened; four species are thought to be extinct.

The Bryophyte Specialist Group of IUCN's Species Survival Commission recognises that further research is required into the *ex situ* storage, cultivation and transplanting of bryophytes as part of an integrated conservation programme.

A three-year pilot research project on bryophytes in the UK is being undertaken by the Royal Botanic Gardens, Kew. This initiative was launched in 1999 at an international workshop, which considered *in vitro* and *ex situ* cultivation, cryopreservation, re-establishment, reproductive biology, life-history strategies, phylogenetics, patterns of genetic diversity and sampling strategies.



Cactus display at the National Botanic Garden of Belgium

CASE STUDY 3

'Raised Bog' display at the University of Salzburg Botanic Garden: for teaching and research

When this Austrian Garden was planned, one of the focal points was to be a presentation and scientific study of the 'natural treeless plant communities' of Austria, which are significant up to the subalpine and alpine regions around Salzburg. Raised bogs (Hochmoore) form an important part of these treeless plant communities and today face many threats.

The Garden was established in 1987. Today, in an area of 180 m², the raised bog displays about 70 species typical of this plant community, including seven of *Sphagnum* and several of *Utricularia*, all of which are endangered in Austria. The display makes a part of the natural heritage of the region that is found only in remote areas readily accessible, and it raises public awareness of the need to preserve this type of vegetation *in situ*. It also gives scientists and interested amateurs opportunities to observe and study the dynamics and elements of this plant community *ex situ* and under controlled conditions.

CASE STUDY 4

Pannonian display at the University of Vienna Botanic Garden: for education and *ex situ* conservation

An outdoor display of plants in the Garden shows plants of the dry-area grasslands (Trockenrasen) in north-east Austria and gives an impression of these habitats. Often mistaken as wasteland, such grasslands are valuable and diverse ecosystems; as a result of change in use, e.g. from extensive cattle farming to intensive wine production, they have been greatly altered and their indigenous species are threatened with extinction.

The display provides information on the ecology of these areas and explains the need for landscape and species protection. The setting is intended to show how elements of dry-area grassland vegetation can be used in landscape design.

Each of the rare species displayed is cultivated from a documented single origin to help preserve their genetic integrity; all species can spread within the group. Thus, small *ex situ* populations of several endangered species can be established, and their seeds could be used for future re-introduction programmes.

B Heritage, Culture and Tourism

Chapter contributed by Esteban Hernández Bermejo and Joaquín Navarete Navarro, with Gianni Bedini, Fabio Garbari, Philippe Richard and Susan Black

The botanic gardens of Europe are a rich heritage for the citizens of Europe, an endowment of plant collections, landscapes and period gardens, historic buildings, architectural features, libraries, herbaria, museums and other preserved collections. The first botanic gardens were founded in Padua and Pisa in the sixteenth century (see *Case Studies 5 and 6*), and many diverse collections have been amassed since that time, resulting in a heritage spanning five centuries. In many countries botanic gardens have become sources of intellectual and aesthetic pride and an important part of the national heritage; they are part of the social, cultural and economic history of Europe. Their collections are not only scientifically important, but also of great artistic value.

Botanic gardens have a responsibility to safeguard the heritage of the past and to provide a legacy for the future. They need to look forward and look back, and to work together in seeking recognition of their value and to obtain funding to conserve, maintain and enrich their heritage for the benefit of future generations.

OBJECTIVE B1 Seek recognition of the heritage value of botanic gardens

Botanic gardens in the EU range from more than 450 to a few years old. The University of Padua Botanic Garden was the first botanic garden to be included by UNESCO on the World Heritage List (see *Case Study 6*).

To achieve Objective B1, EU botanic gardens should:

- compile an inventory and photographic archive of the heritage assets in botanic gardens in the EU
- seek recognition by the European Parliament and the European Commission of the importance of the heritage of EU botanic gardens
- propose resolutions to the European Commission for executive and financial measures to facilitate conservation of the architectural, landscape, plant and cultural heritage in botanic gardens and public access to it
- work with national museums and galleries, national and international heritage associations and other organisations in disseminating information about their heritage collections, through publications, meetings, exhibitions and other means
- mount joint or travelling exhibitions on the various aspects of their heritage, particularly at times of significant anniversaries
- exchange materials and expertise on restoration, conservation and management techniques for the various collections in their care
- seek to enrich their heritage by working together in encouraging donations and to expand their collections of cultural and heritage significance
- seek funding for and implement training programmes for curatorial staff working with museum, library and living collections.

OBJECTIVE B2 Raise awareness of the roles of botanic gardens in European history, development of botany, history of science and plant introduction

Botanic gardens have played an important part in European history since the sixteenth century, when the first university botanic gardens were created in Pisa and Padua, in 1543 and 1545, respectively. They have been central to many historical events related to economics, trade monopolies and wars (see *Box 7*).

BOX 7

Some economic, cultural and historic events in EU botanic gardens

Botanic Garden of Leiden

Directed by Carolo Clusius, it had nearly 1,000 species from Europe and East Asia in 1601, including oriental species such as sugarcane, ginger, castor oil plant; and American species such as potato, maize, tomato, sweet and hot peppers, prickly pear, canna lily and nasturtium

Royal Botanic Garden of Madrid

Promoted many botanical expeditions to the Americas since its founding in 1755

Botanic Garden and Museum of Berlin-Dahlem

Developed as an important taxonomic centre as a result of nineteenth-century exploration of the new German colonies in Africa and Oceania

Botanic Garden of la Orotava, Tenerife

Founded in 1788 to acclimate new and useful plants from the New World

Royal Botanic Gardens, Kew

Played a decisive role in breaking the monopoly held by Holland in the Asian spice trade by cultivating numerous Asian spices in the glasshouses and by introducing their cultivation to the Caribbean

Botanic Garden of Amsterdam

The Dutch managed to break the British coffee monopoly with a single coffee plant grown in the Garden

Botanic Garden of Palermo

Numerous varieties of cotton have reached the market as a result of experiments carried out in the Garden

Botanic Garden of Valencia

Director, Vicente Lorente, defended the Garden during the French invasion and was jailed and sentenced to death; he was saved thanks only to the intervention of the French botanist Léon Dufourny

Botanic Garden and Museum of Berlin-Dahlem

Nearly all its buildings and collections were destroyed during the Second World War; the library and herbarium were set alight, reducing the collection from almost 4 million sheets to just 500,000

Botanic Garden of Sanlucar

The Garden fell into the hands of a popular anti-liberal revolution and was razed to the ground; it no longer exists

Italian Alpine Garden 'la Chanousia'

The Garden was destroyed in the Second World War and the land passed into French hands after the international borders were redefined at the end of the War; but it re-opened in 1978 at a new site.

Many of the early developments in botany and taxonomy were associated with botanic gardens, through such notable people as Clusius, Linnaeus, Hooker and Lindley, and many others. Numerous botanical expeditions have been promoted by botanic gardens, some through trade connections or under royal or aristocratic patronage. The interest of naturalists, such as von Siebold, David Douglas, Joseph Banks and many others, was inspired by associations with particular botanic gardens and their staff. Plant collectors were sent on voyages of discovery to distant regions of the world to look for new plants, resulting in the introduction and study of many new species, particularly in the eighteenth and nineteenth centuries. Some of the species introduced into cultivation had major effects on the economic history of Europe.

To achieve Objective B2, EU botanic gardens should:

- disseminate information on their history to scientists, historians and other interested people
- celebrate significant anniversaries of botanists and plant collectors associated with their gardens, through special events and exhibitions, to make their endeavours and achievements better known
- form links with those teaching and taking courses on the history and philosophy of science.

OBJECTIVE B3 Promote the importance of the architectural heritage in EU botanic gardens

There is a range of historic buildings and architectural features from different periods in botanic gardens in the EU, dating from the sixteenth century to the present day: from beautiful wrought- and cast-iron glasshouses to orangeries, statuary, fountains, terraces, pergolas, loggias and ironwork (see Box 8). Some of these represent great architectural and engineering achievements in the context of their time, some are period gems, some are modern; it is important that all are well maintained and safeguarded for future generations to appreciate.

To achieve Objective B3, EU botanic gardens should:

- compile a combined inventory of architectural features in, or associated with, EU botanic gardens, with a photographic archive
- publish information and mount exhibitions on the special architectural features in their gardens, and their designers
- celebrate significant anniversaries of dates associated with relevant designers and architects of their buildings
- form links with associations relevant to features in their gardens, e.g garden history societies and architectural associations
- seek funding for the restoration and maintenance of historic buildings in their care
- ensure that new buildings constructed in their gardens are of the highest possible quality and design, to provide a legacy for future generations
- encourage the design and construction of new features of architectural merit in their gardens.



Jardin des Plantes, Paris, France

BOX 8**Examples of historic buildings and architectural features in EU botanic gardens**

University of Copenhagen Botanic Garden	Palm House	1872–74
National Botanic Gardens, Glasnevin	Curvilinear Glasshouse designed by Richard Turner	1843–69
National Botanic Garden of Belgium, Meise	Cactus and Succulent House	1890
University of Vienna Botanic Garden	Balat Greenhouse designed by Alphonse Balat.	1853
	Plant Palace, larger than 1 ha	
	Orangery	1755
	Greenhouses	1890–93
Palmengarten, Frankfurt	Palm House, one of the largest in Europe	1869
Botanical Garden of Palermo	Greenhouse donated by Queen Maria Carolina	1840–1860s
Botanic Garden of Valencia	Tropical Greenhouse, Spanish cast-iron	1860–62
Botanic Garden and Museum of Berlin-Dahlem	Tropical Greenhouse, one of the largest in the world	1906
Munich Botanic Garden	Victoria House	
Tapada d'Ajuda Botanic Garden	Construction commissioned by the Marquis of Pombal, and includes steps, balustrades, and a stone fountain with 40 jets	1768
Royal Botanic Garden of Madrid	King's Gate by Sabatini and wrought-iron fence	18th century
Jardin des Plantes, Paris	Labyrinth	1640
	Numerous statues	1890–1910
	Tomb of the botanist Daubenton (1716–1800)	
National Botanic Garden of Belgium, Meise	Twelfth-century castle, Flemish Farm, Hunting Pavilion, Temple of Diana, Orangery, Ice Cellars, Hermit's Hut	
Botanic Garden of Palermo	Neoclassical Gymnasium, Tepidarium and Calidarium	1795
Tropical Agriculture Garden-Museum, Lisbon	Palacio dos Condes da Calheta	
Royal Botanic Garden of Madrid	Villanueva Pavilion	18th century
Botanic Garden of Malaga	Mansion built for the Marquis and Marquise of Loring	18th century
University of Copenhagen Botanic Garden	Remains of the former bastions and fortifications of the city have been transformed into a rock garden	
Botanic Garden of Cagliari	Archaeological excavations	
Royal Botanic Gardens, Kew	Kew Palace	1631
	Temples by William Chambers	1758
	Mock ruined arch	1759
	Octagonal pagoda	1761
	Palm House	1844
Vienna Botanic Garden	Oldest alpine garden in Europe	1802

OBJECTIVE B4 Promote an appreciation of landscape and garden styles in botanic gardens

Botanic gardens in Europe show a wide range of garden and landscape styles from the sixteenth century to the present day: from traditional physic gardens to modern landscape gardens. Some are associated with famous garden designers or landscape architects, whose work is an integral part of the social and artistic history of Europe. The significance of the designs is appreciated by garden historians and those studying country estates, but is sometimes neglected in the context of botanic gardens.

New botanic gardens continue to be established in Europe with leading contemporary architects and designers, e.g. Barcelona Botanic Garden, Eden Botanical Institute, Jardin Botanique de Bordeaux and the National Botanic Garden of Wales. They provide an opportunity to promote innovative landscape and garden design specifically for the purposes of botanic gardens, unencumbered by the traditions of the past.

To achieve Objective B4, EU botanic gardens should:

- document the landscape history of their gardens and make it available to visitors
- organise events and symposia with garden history societies
- celebrate anniversaries of landscape architects and garden designers associated with their gardens
- stimulate interest in modern landscape and garden design specifically for botanic gardens.

OBJECTIVE B5 Recognise and promote botanic garden libraries, herbaria, museums, art and other collections as an important part of European culture and heritage

There are estimated to be more than 100 botanical and horticultural libraries, over 150 herbaria and at least 14 major museums in botanic gardens in the EU (see Box 9). Their combined collections form a priceless resource for study and scholarship in Europe.

BOX 9

Types of documented preserved collections in EU botanic gardens

Country or region	Herbaria	Libraries	Museums	Thematic collections*
Austria	6	0	0	0
Belgium	5	3	0	0
Denmark	1	1	0	0
Finland	9	2	0	0
France	19	6	1	4
Germany	32	12	3	0
Greece	1	0	0	0
Ireland	2	5	0	0
Italy	26	7	0	9
Luxembourg	0	0	0	0
Netherlands	7	1	0	0
Portugal	6	1	1	3
Spain	7	6	2	3
Sweden	7	0	2	0
UK + Gibraltar	30	56	5	1
EU total	158	100	14	20

*Such as ethnology, archaeology, biology, palaeontology or art collections.

Data from the European Botanical and Horticultural Libraries Group; BGCI; and the *PlantNet Directory of Botanical Collections in Britain and Ireland*, 1999.

Many botanic gardens have specialised botanical and horticultural libraries, containing a wealth of books, journals, papers, letters, maps, illustrations and engravings (see Box 10). They are of interest not only in a scientific and historic context, but also in terms of artistic merit. Their collections need to be stored and conserved properly, but be accessible for consultation by scientists, historians and others who are interested.

Some have wonderful collections of botanical illustrations and models, which may be little known and rarely on view to the public.

Herbaria in botanic gardens of the EU are amongst the largest in the world, holding some of the most important reference collections and many original type specimens. Some herbaria have numerous specimens of plants from former colonies.

BOX 10

Some major botanical and horticultural libraries in EU botanic gardens

Royal Botanic Gardens, Kew	Includes 120,000 monographs, 4,000 periodicals, 140,000 pamphlets, 10,000 maps and unpublished information on the exploration, discovery and investigation of plants and fungi, particularly in the nineteenth and twentieth centuries; as well as illustration collections of over 175,000 prints and drawings, including originals by G. D. Ehret, Franz and Ferdinand Bauer and special collections that include works by Linnaeus and his contemporaries
National Botanic Garden of Belgium, Meise	More than 60,000 volumes, including numerous old and precious books, e.g. rare sixteenth-century botanical works by Dodoens with beautiful illustrations
Paris	A collection of royal parchments includes more than 7,000 drawings of plants and animals, dating from 1630
Botanic Museum Library, Helsinki	A large archive with many notes taken by Finnish botanists in eastern Fennoscandia
Botanic Garden of Palermo	More than 40,000 monographs and a collection of antique books
University of Coimbra Botanic Garden	About 125,000 volumes
Royal Botanic Garden of Madrid	Manuscripts and drawings, including the famous colour drawings of American flora by José Celestino Mutis, of incalculable scientific and artistic value
Botanic Garden of Barcelona	Numerous manuscripts, correspondence and notes by famous Catalan botanists, as well as an antique book collection
Royal Botanic Garden Edinburgh	The 75,000 volumes make up the largest collection of botanical works in northern Britain, some dating as far back as 1486

Museums in botanic gardens care for many types of collection, providing a mass of information – historic and contemporary – related to their living collections (see *Box 11*). There are special preserved collections on, for example, ethnobotany (often concerned with exploration and particular people and cultures); agricultural and economic crops; medicinal plants; botanical illustrations and other types of art. Communication could be improved among those who manage living and preserved collections, both in and out of botanic gardens. Many of the issues they face in documenting and interpreting collections are common to both types of collection, and there is much to be gained from shared discussion.

- **To achieve Objective B5**, EU botanic gardens should:
- collaborate and exchange expertise and information through other networks, e.g. European Botanical and Horticultural Libraries Group, national networks of herbaria, museum associations, and with those curating natural history and other collections not located in botanic gardens
- promote access to their collections for potential users
- communicate with those involved in the management of living plant collections

- mount joint exhibitions and displays from their special collections, in association with exhibits of living collections and other types of collection in and out of botanic gardens
- disseminate information on the special historic associations of their collections and the people who assembled them
- facilitate training for staff involved in curation and preservation.

BOX 11

Some museum collections in EU botanic gardens

Botanic Museum of Berlin-Dahlem	Sections on palaeontology and phytogeography, Egyptian section with flower garlands and other decorative plant relics and reconstructions from Pharaohs' tombs
Loringiano Museum, Historic-Botanic Garden of Malaga	Collection of Roman ruins
Ethnobotany Museum, Botanic Garden of Córdoba	Plant-related objects and palaeobotanical collection of more than 150,000 plant fossils; the most complete record in existence of Spanish flora from the Carboniferous period (<i>see Case Study 7</i>)
Tropical Agriculture Garden-Museum, Lisbon	Collection of more than 3,000 types of wood, the most important collection of its kind in Portugal
University of Florence Botanic Garden	Over 6,000 wood specimens and plant fossils
Botanic Garden of Leiden	More than 15,000 spirit specimens and 25,000 wood specimens
Botanic Museum of Helsinki	Separate fruit and seed collections (2,635 specimens) and an extensive collection of pollen and plant anatomy slides

OBJECTIVE B6 Safeguard and document important artefacts, structures and collections of historical and cultural importance

A rich and diverse heritage is held in the extensive collections in botanic gardens (*see Boxes 9–11*).

A rich biological heritage is held in the extensive plant collections of botanic gardens, some bringing together plants from widely separated and often inaccessible localities for study under controlled conditions in one place. BGCI (Wyse Jackson 1999) estimates that botanic gardens in the EU grow representatives of up to 50,000 plant species, almost 20% of the world's known higher-plant flora. There are major well-known collections of species in, for example, the Royal Botanic Gardens, Kew; Royal Botanic Garden Edinburgh; Botanic Garden and Museum of Berlin-Dahlem; National Botanic Gardens, Glasnevin; Botanic Garden of Munich; Botanic Garden of Copenhagen; and Jardin des Plantes in Paris.

In addition to these major collections, some botanic gardens have special living collections.

The carnivorous plant collection at the University of Vienna Botanic Garden is one of the best in Europe

The collection of annuals at the Botanic Garden of Copenhagen is probably the largest in the world, with approximately 1,000 species from the Mediterranean, South Africa and the Caucasus

The woody plant collection at the University of Helsinki Botanic Garden has more than 2,000 species

The rose collection at the Botanic Garden of Lyon is one of the largest in Europe, with over 70,000 rose bushes, as well as rhododendrons, azaleas and hydrangeas

The Palmengarten in Frankfurt has an orchid collection of approximately 4,500 species

The Historical Rose Garden in Munich has some of the most important roses in the history of garden rose breeding

The Rock Garden at the Göteborg Botanical Garden contains 4,500 species

The Rock Garden at the Royal Botanic Garden of Edinburgh in Inverleith is considered by many to be the finest in the world, with more than 5,000 high-mountain, arctic and Mediterranean species.

Many botanic gardens have important environmental conservation collections.

Numerous Canary Islands endemics are grown at the 'Viera y Clavijo' Botanic Garden, Gran Canaria

The Botanic Garden of Copenhagen maintains 1,000 wild Danish species

The Millennium Seed Bank at Kew aims to conserve 10% of the world's flora and representatives of every native British species

Germplasm bank in Córdoba contains extensive collections of Andalusian species

Irish Rare and Threatened Plant Genebank at Trinity College Dublin Botanic Garden maintains wild germplasm of many *Irish Red Data Book* species.

Some of the specimens grown in botanic gardens are early introductions.

The cedar of Lebanon planted in 1734 at the Jardin des Plantes, Paris

An allée of yew trees known as Addison's Walk was planted before 1795 at the National Botanic Gardens, Glasnevin

At the University of Padua Botanic Garden there are specimens of *Chamaerops humilis*, the Goethe palm, planted in 1585; *Magnolia grandiflora* and *Ginkgo biloba*, both planted in 1786; and *Platanus orientalis* planted in the 1600s; these are all possibly the oldest examples of these species in Europe.

To achieve Objective B6, EU botanic gardens should:

- share information and expertise on the management of their collections
- ensure that the conservation of their heritage and cultural collections is an important part of their institutional mission
- maintain a database of information relating to their heritage and cultural collections.

OBJECTIVE B7 Promote botanic gardens as tourist attractions

Most countries with well-developed botanic gardens regard them as important tourist assets. Many now rely on income from visitors paying to come into their gardens. The larger institutions have public relations and marketing sections employing trained staff, but in smaller gardens such promotion is carried out by staff not specifically trained in this work.

Promotion of botanic gardens is often based on the undoubted beauty of the gardens, which can be an inspiration to visitors, but may obscure the conservation and scientific purposes of the plant collections. On the other hand, increasing the number of visitors to botanic gardens provides an opportunity to convey scientific and conservation and cultural messages to more members of the public. (See *Case Study 14*.)

To achieve Objective B7, EU botanic gardens should:

- develop an institutional policy relating to visitor services and tourism to ensure that visitors leave the garden with an understanding of its activities, importance and values
- work with local, national and international tourist authorities to publicise their gardens
- provide information for visitors on the historic and cultural heritage of their gardens, their plant collections, research in progress and conservation
- seek advice from professional public relations' organisations on how to promote their gardens to tourists.

CASE STUDY 5

Botanic Garden of the University of Pisa: the oldest botanic garden in Europe

The first physic garden in Europe was founded in 1543 at Pisa University. Since then, the botanic garden has been moved twice: in 1563 and in 1593. At the beginning of the twentieth century, several of the original trees remained at their original sites in the Garden.

The Garden has important collections of herbaceous plants, mainly geophytes. The living collections form the basic material for research in biosystematics and taxonomy at the University. Other sections of the Garden are used principally for the cultivation of species for geobotanic research, and for research in cellular differentiation, phytochemistry, ethnobotany and the physiology and metabolism of seeds.

CASE STUDY 6

Botanic Garden of the University of Padua: World Heritage Site

In 1997, the World Heritage Committee recognised Padua University Botanic Garden as a World Heritage Site, the first botanic garden to be so recognised. One of the two oldest botanic gardens in Europe, dating from 1545, the Garden remains on its original site in the centre of the city of Padua in northern Italy, and is still arranged in its original design. It was founded as an adjunct to the medical school of the University, where great medical advances in human anatomy were made in the sixteenth century by the anatomist Andreas Vesalius; Galileo was a professor at Padua University later in the century.

The World Heritage Committee noted that the Garden was the starting point for botanic gardens in the world and represents the cradle of science, scientific exchange and the understanding of the relationship between nature and culture. It has contributed greatly to the development of many modern scientific disciplines, notably botany, medicine, chemistry, ecology and pharmacy.

According to the founding Convention of 1972, countries that include World Heritage Sites assume a responsibility to maintain conserve them. Thus, the Italian national government is seeking parliamentary approval for a grant of 1.5 million Euros to create a buffer zone around Padua University Botanic Garden and to cater for educational and scientific developments.



Padua Botanic Garden, Italy

CASE STUDY 7

Ethnobotany Museum of Córdoba Botanic Garden

The Museum has a collection of more than 1,000 items, as well as 500 files of oral and bibliographical information related to ethnobotany. More than 2,500 uses of the items and plants in the collection are recorded in a database. The collection includes items from Spain, Mexico, Costa Rica, Cuba, Peru, Brazil and El Chaco. The most comprehensive parts deal with the olive tree, esparto grass and the cork oak in Andalusia; peyote, corn, tequila mescal and rubber plant in Mexico; and ethnobotanical objects in general from El Chaco. There is a grape press, over 200 years old, made of solid oak from the Alpujarras Mountains, and an elaborate 'chocolate machine' for making 'European style' chocolate.

CASE STUDY 8

Linnaeus's Garden in Uppsala Botanic Garden

Founded in 1655 by Olof Rudbeck the elder, the Hortus Upsaliensis is the oldest botanic garden in Sweden; about 1,800 plant species were grown there at the end of the seventeenth century. After a period of neglect, it rose to fame under Carl Linnaeus, the founder of modern systematic botany and the binomial system of nomenclature. His *Species Plantarum*, aiming to describe all plant species in the world, is still the basis for our naming of plants. As well as writing *Systema Sexualis*, he made significant contributions to ethnobotany and ecology, and the first serious attempt at a natural system of classification for angiosperms. Through his contacts and his 'apostles', he obtained plants from all over the world, mainly as herbarium specimens, but also for the Garden. Several descriptions in *Species Plantarum* are based on material grown in Hortus Upsaliensis, and studies in the Garden had a profound influence on his thinking.

The original construction and layout of the Garden remain, although the Orangery is no longer used for growing plants. Though few of the original plants remain, the same species are grown as in Linnaeus's time. The Garden, run by Linnaeus in 1741–78, is a living illustration of the Linnaean sexual system, of his utilitarian outlook and of his pedagogic principles. A permanent exhibition to be opened in the Orangery illustrates the Garden's chequered history and its scientific role, presenting the development of biological theories and ideas from the time of Linnaeus to the present and with anecdotal references to his remarkable and multifaceted career.

In his home (now the Linnémuseet), situated in a corner of the Garden, many of Linnaeus's household items can be seen together with plant and animal specimens, scientific instruments and paintings. These displays contribute to the experience offered to visitors, but the Garden itself is the heart. It is said that in early mornings in May one may still encounter the man himself, puffing his pipe, self-absorbedly counting the stamens of *Linnaea borealis*. The past is a key to the present and vice versa. Understanding our forebears helps us to understand ourselves. Herein lies part of the importance of historic botanic gardens, over and above their architectural history. The Linnéträdgården is a national heritage site.

C Conservation of Biodiversity

Chapter contributed by Steve Waldren and Peter Wyse Jackson

Biodiversity in Europe

Europe includes a range of habitats, from hot Mediterranean biomes to cold sub-polar regions; from oceanic Atlantic habitats to those in continental climates far from the sea; and from lowland plains to high mountains. Each has specialised ecosystems and plant associations. The flora of Europe changed dramatically during the Pleistocene, with large changes in the distribution of many taxa. The human population has a long history of interaction with the native flora through traditional agricultural systems, forestry and varied land-use. These factors have produced a variety of natural and semi-natural vegetation communities and a diverse flora which has provided European people with numerous resources. The varied climatic and edaphic conditions and different agricultural practices have resulted in a wide range of domesticated crops and semi-domesticated landraces. This wealth of wild and domesticated flora is now threatened by changes in climate, land management, urbanisation, increasing and unsustainable tourism, water abstraction and the spread of invasive plants.

European botanic gardens and institutions contain in their living collections, libraries, herbaria and museums a considerable body of information on diversity of tropical plants, though there is still a great deal yet to be elucidated. Several European countries have overseas territories in tropical areas of high biodiversity; where conservation is often a low priority but botanic gardens can do much to promote it. It is also high time for botanic gardens to devote more attention to monitoring and conservation of plants, *ex situ* and *in situ*, in Europe.

Current role of EU botanic gardens in biodiversity conservation

Botanic gardens in Europe offer a real opportunity for effective conservation of European plant diversity; though most are not necessarily sited in the areas of highest plant diversity. Many gardens have already adopted some conservation measures and grow threatened European plants. However, gardens could undertake much more, and this section provides some guidelines and examples. Most European countries have well-organised state conservation agencies, and botanic gardens should link with these rather than trying to do it all alone.

Biodiversity can be considered at the level of the:

- a) ecosystem, involving complex interactions between plants, animals, fungi and micro-organisms and with climatic, edaphic and human factors
- b) inter-taxon, involving the variety and richness of the taxa present
- c) intra-taxon, involving variation within and among populations of a given taxon, including genetic variation between individuals.

Because of the difficulties in defining taxa, it may be more appropriate to consider conservation of evolutionary lineages in (b) and (c). Botanic gardens have traditionally focused on level (c), by growing a range of species in their collections; but there are also opportunities for them to contribute at the ecosystem level. Collections that ignore conservation of adequate intra-specific variation may, at best, be of some conservation interest, but are unlikely to guarantee the long-term conservation of the species concerned.

Biodiversity and EU legislation

In the past two decades there has been a dramatic increase in regional, national and international legislation on conservation and the environment, much of which affects activities of botanic gardens. The legislation provides opportunities for individual botanic gardens and networks of botanic gardens to become involved in global and national conservation issues and the sustainable use of biodiversity in natural habitats of the EU. It offers botanic gardens a chance to demonstrate the use of their skills and resources as broadly based centres for the study and conservation of plant diversity. Botanic gardens need to be familiar with national and international legislation for the protection of wild flora. Each garden should have a code of conduct to ensure that staff do not violate these laws or legally binding agreements between the garden and other organisations. Some of the most significant and relevant legislation and Conventions are outlined on the next page. (See 'A review of International Conventions which affect the work of botanic gardens.' *Botanic Gardens Conservation News*, 1999, 3 (2) 29–54).

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 survival of humankind and life in general on this planet. 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 access to genetic resources and the transfer of relevant technologies.

Botanic gardens should also seek to contribute to national biodiversity strategies that are formulated by governments in response to the CBD. After signing and ratifying the CBD, many European countries and the European Commission have developed national *Biodiversity Action Plans*, or are in the process of doing so, and have developed the necessary legislation and legal mechanisms to incorporate biodiversity conservation into state law. See Boxes 12–14.

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

The aim of this Convention is to provide a mechanism to regulate and monitor the international trade in threatened plant and animal species. CITES operates through the issue and control of export and import permits for species listed in three levels, according to the degree of threat resulting from trade of the species. Botanic gardens have a central role in improving the implementation and awareness of CITES and they can serve as rescue centres for seized or confiscated plants (see Box 15).

Bern Convention

This European-centred Convention aims to:

- ensure conservation and protection of all wild plants and animal species
- increase co-operation between states in these activities
- afford special protection to the most vulnerable or threatened species.

Many of the most threatened European wild plants are listed by the Convention and scheduled for protection. At the species level, the *Bern Convention* provides a target list of European taxa of high conservation priority, and this may be used by botanic gardens to prioritise their conservation objectives.

European Commission Directive on the conservation of natural and semi-natural habitats and of wild fauna and flora (Habitats' Directive)

The aim of the Directive is to conserve fauna, flora and natural habitats of importance in the EU. The fundamental purpose is to establish a network of protected areas throughout the EU designed to maintain the distribution and abundance of threatened species and habitats, terrestrial and marine.

European Commission Directive on the conservation of wild birds (Birds' Directive)

This Directive applies to the conservation of birds' habitats and requires member states to take special measures to conserve the habitats of listed threatened species through the designation of Special Protection Areas (SPAs).

Other international instruments relevant to botanic gardens include the *Convention on Wetlands (Ramsar Convention)*, the *World Heritage Convention*, the *United Nations Framework Convention on Climate Change* and *Agenda 21*. Other international efforts in conservation have been developed in recent years, such as the *International Undertaking on Plant Genetic Resources*. All these not only provide a framework for biodiversity conservation by botanic gardens, but are also likely to provide increased opportunities through provision of funding and collaboration for conservation programmes. It is important for botanic gardens to take full advantage of these opportunities and to accept the responsibilities they present.

National legislation: Each country in the EU is required to have its own legislation to bring national laws in line with international Conventions to which they have acceded or to meet the requirements of European Commission directives. Botanic gardens need to be familiar with relevant national and regional legislation for the protection of wild flora. Each botanic garden should develop a policy that agrees with the national and international conventions and relevant legislation (see Box 13).

BOX 12

Key articles from the Convention on Biological Diversity relevant to botanic gardens and their primary contributions to their implementation

Article 6: General Measures for Conservation and Sustainable Use

General contributions made by botanic gardens to national biodiversity strategies and sustainable development.

Article 7: Identification and Monitoring

A wide body of work undertaken by botanic gardens in plant systematics, floristics, inventories, surveys, etc.

Article 8: *In situ* Conservation

Contributions made by botanic gardens through development, designation, care and management of protected areas, habitat restoration or re-creation and wild-plant population research, recovery or management.

Article 9: *Ex situ* Conservation

Botanic gardens are major practitioners of *ex situ* conservation through the development and maintenance of germplasm collections including seed banks, field genebanks, tissue collections in culture, individual species recovery programmes, databanks, etc.

Article 10: Sustainable Use of the Components of Biological Diversity

Many botanic gardens play important roles in the identification and development of economically important species, in commercial horticulture, forestry and agriculture, and in bioprospecting.

Article 12: Research and Training

Botanic gardens undertake research in many relevant fields, such as taxonomy, ecology, biochemistry, ethnobotany, education, horticulture, plant anatomy, biogeography. Many botanic gardens provide training opportunities and courses in conservation and related disciplines, often available to national and international trainees.

Article 13: Public Education and Awareness

Public education and developing environmental awareness, including programmes to promote public understanding of biodiversity, its importance and loss, are priority tasks of many botanic gardens. Many botanic gardens play important roles in school and university teaching.

Article 15: Access to Genetic Resources (and benefit sharing)

Botanic gardens worldwide currently hold more than 4 million accessions. These represent a vast conservation resource of stored and managed biodiversity for the future. Many botanic gardens already share benefits – collecting fees, research support, equipment, information, training, shared specimens – and in many other ways help to develop the capacity of partner institutions for biodiversity conservation.

Article 17: Exchange of Information

Most botanic gardens are active in making information on their collections and the results of their research widely available through published and unpublished literature and accessible databases. Many botanic gardens can share data on collections, using the International Transfer Format for Botanic Garden Plant Records (ITF).

Article 18: Technical and Scientific Co-operation

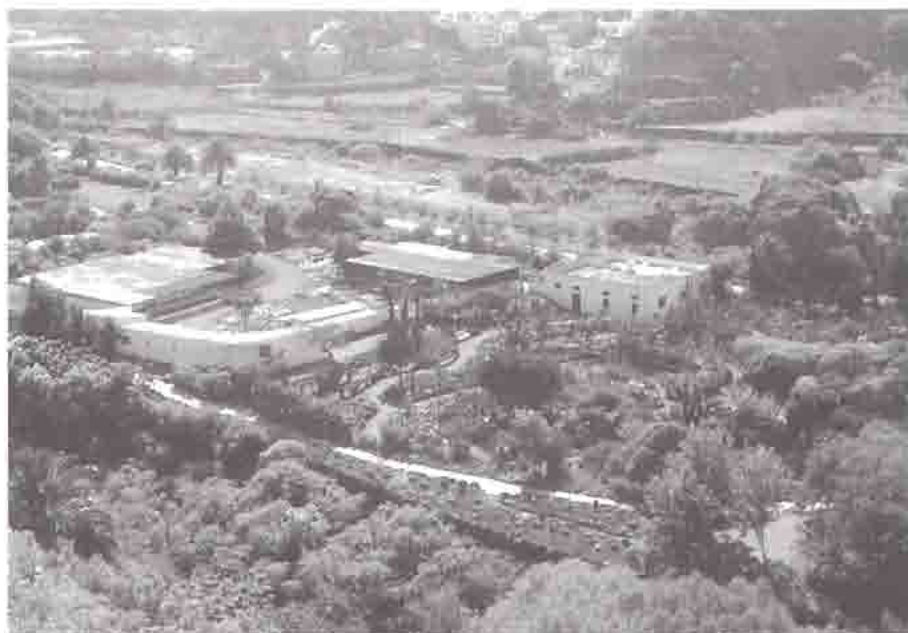
Technical and scientific co-operation is a hallmark of many major botanic gardens, often involving joint research and staff exchanges.

OBJECTIVE C1 Ensure *in situ* conservation and assessment

Botanic gardens have traditionally focused mostly on *ex situ* collections, although several manage areas of natural or semi-natural vegetation as reserves. However, there are many ways in which gardens can play a more active role in *in situ* conservation, which is generally the preferred method of conservation. By combining appropriate *in situ* and *ex situ* methodologies in a complimentary way, gardens may significantly strengthen their conservation abilities. Botanic gardens have developed taxonomy, propagation and others skills that can be combined with field survey techniques to enhance their role in conservation assessment, initiation of recovery plans for threatened taxa, and describing patterns of variation within and among plant species. (See also Objective E3.)

To achieve Objective C1, EU botanic gardens should:

- make available data generated from their scientific and horticultural programmes in a user-friendly form by traditional publication or through electronic publication
- develop research activities to assess the degree and type of threats to threatened plants and ecosystems, and to set up procedures to monitor changes in their status
- develop programmes to describe the extent of variation at the different hierarchical levels of biodiversity (ecosystem, species and gene)
- monitor and record local uses of plant diversity, and document urgently traditional uses of plant species and communities, including forestry, medicinal, agricultural, religious, horticultural and other uses
- assess local trade in native and introduced plants, and use the information gained to implement CITES
- make available their *ex situ* collections to support *in situ* conservation measures.



A view of the Jardín Botánico Canario 'Viera y Clavijo', Gran Canaria, Spain, showing the native and conservation plant collections and re-created laurel forest vegetation

BOX 13**A checklist for botanic gardens on the Convention on Biological Diversity**

- Obtain and read a copy of the text of the Convention on Biological Diversity and make it available to others in your botanic garden.
- Ensure that staff of your garden know about the CBD and understand its provisions and implications.
- Initiate a debate in your garden towards the formulation and agreement of an official policy on the CBD and a strategy for its implementation.
- Prepare and follow an institutional Code of Conduct on collecting and acquiring plant material.
- Develop Material Transfer Agreements to ensure that benefits arising from distributed plant material are fairly and equitably shared.
- Review the current activities in your garden that are relevant or contribute to the implementation of the CBD – undertake a ‘CBD-audit’ or strategic review for your garden and its collections.
- Consider how the mission of your garden is relevant to the CBD and to biodiversity conservation in general and consider reviewing your mission to become more involved in biodiversity conservation.
- Make sure that all staff are aware of and follow the garden’s policies, procedures and practices relating to implementing the CBD.
- Ensure that all the actions of your botanic garden are in line with the spirit and letter of the Convention.
- Seek to publicise the CBD and its objectives to your garden’s visitors and supporters.
- Become involved in the development of national biodiversity conservation strategies and offer advice on plant diversity matters to national policy-makers.
- Ask for your government’s support and official recognition for your garden’s role in implementing the CBD.
- 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 (see Box 14), or seek accreditation and attend meetings in your own right as a non-governmental organisation.
- Become involved in processes and working groups established by organisations such as BGCI, to develop 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.
- Remember that the CBD is relevant to the **national** situation, and that it is not only for gardens with **international** programmes.

Source: BGCI.

OBJECTIVE C2 Develop management of *ex situ* collections

Botanic gardens should expand their traditional role in *ex situ* conservation to ensure that they are conserving sufficient genetically controlled and documented diversity for the evolutionary potential of the conserved material not to be compromised. In practice, this will require many individuals to be maintained per accession, and this might pose severe constraints on garden resources. Gardens should therefore prioritise their conservation collections, ideally by concentrating their efforts on selected, high-priority, threatened, indigenous taxa. Field surveys may help to prioritise conservation actions. Many conservation collections can be used to assist recovery programmes by providing material for reinforcement of small and vulnerable populations; however, the problems of potential disease transfer and hybridisations in cultivated stock should not be ignored. Such recovery activities must very closely linked with appropriate field survey and data acquisition.

One cost-effective method of conserving large numbers of individuals is to store them in a dormant state as a seed or tissue gene bank. However, managers of collections should be aware of some of the problems associated with gene-banked material: loss of viability over time, evolutionary stasis as compared to wild plants, lack of

opportunity to store mutually dependent taxa such as pollinators and microflora; and 'recalcitrant' species cannot be conserved under typical seed storage conditions of low temperature and low moisture content.

To achieve Objective C2, EU botanic gardens should:

- integrate their *ex situ* conservation activities with *in situ* conservation programmes and conservation priorities
- ensure that collections of threatened taxa are used for detailed study of genetic variation, breeding biology, ecological requirements, etc.
- build up conservation collections in which priority is given to indigenous species, including crop varieties and their relatives and other economically important taxa
- ensure that their conservation collections are used as sources of material for species recovery programmes, and, subject to the provisions of the CBD and CITES, provide material for trade in order to alleviate or remove threats due to exploitation of wild plants
- develop herbaria, or at least actively contribute to national herbaria, by collecting voucher material, especially of local natural resources
- develop long-term seed and tissue storage capacity to augment and support their other *ex situ* conservation efforts
- ensure that the collections meet the needs of biodiversity education, especially through provision of appropriate displays (see *Case Studies 3 & 4*)
- ensure that collection policies are compatible with national and international legislation and agreements, and develop a code of conduct for field collectors and for the exchange of plant material between institutions and for other uses
- ensure that adequate high quality data is held to support *ex situ* collections.

OBJECTIVE C3 Develop management and analysis of data and information

Many gardens have developed sophisticated data storage systems, which take advantage of the tremendous developments in computer software and hardware, and use these systems to store and retrieve information on *ex situ* collections. The activities described in C2 above will also generate a great deal of valuable conservation data. Gardens should take advantage of their existing data storage activities and develop broader roles as holders and providers of conservation information, by collecting, maintaining and exchanging data on a variety of plant diversity and conservation issues. Botanic gardens should aim to become collectors and distributors of biodiversity and conservation information by collating relevant information and making this available to a variety of users. This will greatly add to their collaborative conservation efforts.

To achieve Objective C3, EU botanic gardens should:

- develop appropriate information systems to manage data storage and retrieval for a variety of users
- assemble and collect data relevant to biodiversity and conservation for wild and cultivated plants and other plant genetic resources, including data on their status, ecology, use, propagation of rare and threatened species
- assemble and collect floristic, vegetation and conservation data on local habitats
- ensure that the data collected can be adequately and appropriately disseminated to a wide variety of users, including national and international conservation agencies, policy makers, planners and developers, and the general public

- provide information in a variety of formats, including electronic contributions to co-ordinating and monitoring databases, printed guidebooks and newsletters, reports on plant genetic resources for agriculture and commerce; take advantage of the opportunities offered for information dissemination via the internet
- ensure that the information gained is used to support practical plant conservation and sustainable development programmes
- seek to contribute to and support electronic networking of data used for conservation purposes.

OBJECTIVE C4 Ensure garden management that promotes biodiversity conservation and sustainable use of plant resources

Application of the recommendations outlined in this section may require changes in institutional activities and policy. Garden administrators and managers should ensure that policies are adopted within their institutions that promote biodiversity conservation and sustainable use of plant resources.

To achieve Objective C4, EU botanic gardens should:

- ensure that the mission statement and strategic planning for the institution incorporates the principles of biodiversity conservation and sustainable development
- implement a conservation policy that focuses on native species
- become involved in international efforts to conserve rare plant species and plant genetic resources
- establish long-term programmes for the cultivation, propagation and distribution of plants threatened by trade, to reduce or remove the market in unsustainably harvested, wild-collected plants
- develop a checklist and audit of activities relating to the CBD implemented by botanic gardens (*Box 13*).

BOX 14

Notes on the Convention on Biological Diversity (CBD)

Contracting Parties

States that have ratified the Convention.

Plant Species Diversity

Should be interpreted to include the conservation of diversity of species at all taxonomic levels, including subspecies, varieties, forms (including cultivated forms – cultivars).

Conference of the Parties (COP)

Regular meetings are held by those who have ratified the CBD, to review its implementation, including its financing and administrative arrangements.

Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)

Article 25 of the CBD established this body, which meets regularly to provide the Conference of the Parties with expert advice on the implementation of the CBD and the conservation of biodiversity.

CBD Secretariat

The address is CBD Secretariat, World Trade Centre, 393 rue Saint Jacques, Suite 300, Montréal (Québec), Canada H2Y 1N9. *Tel:* (514) 288 2220, *Fax:* (514) 288 6588, *E-mail:* secretariat@biodiv.org

OBJECTIVE C5 Implement and influence national and international biodiversity policies

As already indicated, various national and international policies are relevant to plant diversity, its conservation and the sustainable utilisation of the resources this diversity provides. Gardens should not only seek to implement the recommendations and any relevant legislation resulting from these policies, but should also seek to influence national and international policy. For example, countries that are signatories to the CBD have an obligation to set up and implement a biodiversity action plan. Botanic gardens can play an important role in shaping and developing such policies by making available their expertise and information on plant diversity and its utilisation.

To achieve objective C5: EU botanic gardens should:

- seek government recognition and support for biodiversity work in the garden
- set up the infrastructures needed to become effective in implementing biodiversity policy
- become actively involved in the implementation and promotion of relevant national and international policies, agreements and legislation
- seek to influence national and local government and other policy makers in drafting and implementing policies relevant to biodiversity, possibly by direct involvement in official delegations to meetings of relevant international conservation conventions, including the CBD and CITES.

BOX 15

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 of, 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' policies 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.

CASE STUDY 9

Conservation programme at Córdoba Botanic Garden

Córdoba Botanic Garden was established in 1981 as an initiative of a research team with an established conservation programme for endangered Iberian plants (germplasm banks and reintroduction techniques).

Several projects were carried out in 1988–94, as a result of an agreement with the Andalusian Environmental Agency, leading to the setting up of the Andalusian Germ Plasm Bank, a seed-bank for the conservation of the Andalusian flora. Other programmes allowed the application of *ex situ* and integrated conservation strategies, including reinforcement and reintroduction techniques for the restitution of endangered species in the wild. A specific agreement also permitted a study of the possibilities of increasing the network of natural areas of Andalusia, based on their botanical value.

The Garden is taking action towards the restitution of 21 of the 72 taxa at greatest risk in the Andalusian flora. It has also collaborated with other institutions in Spain and abroad to protect endangered plants. The endangered species of the Balearic flora *Lysimachia minoricensis*, was successfully restored on Minorca in 1990, in collaboration with the Balearic Autonomous Government and the botanic garden of Brest, in France.



Seedbank at the Jardín Botánico de Córdoba, Spain (Margarita Clemente and Esteban Hernández Bermejo)

CASE STUDY 10

Mediterranean region as a subject for research for EU botanic gardens

Several European botanists (e.g. Quézel & Médail 1997) have recently drawn attention to the high biodiversity in southern Europe and the Mediterranean Basin. Smart (1998) stated that 'The most important geographical areas for maintaining bird diversity are now well known, but the plant habitats of Europe have been far less studied, and in many cases we simply do not yet know where the concentrations of plant diversity are located'. Initiatives have been taken towards the identification of Europe's Important Plant Areas (IPAs) by the Planta Europa Conference and EU botanic gardens should be able to generate and contribute significant data to the project. This, however, should only be the first step in an integrated conservation strategy for European and Mediterranean plant diversity, and EU botanic gardens should be prepared to take a major role in the implementation of such a strategy including providing scientific back-up and research support for non-European Mediterranean botanic gardens, especially newly established ones.

Quézel estimates that about 25,000 species occur in the Mediterranean Basin, with about 50% endemism and a high proportion of very rare and threatened taxa. Little, accurate information is available on most of them and so it is not yet possible to apply IUCN *Red Data Book* categories to them.

In many cases, little is known about their ecology, biology or distribution. How many *Red Data Sheets* on threatened species have any information on pollinator relationships, critical ecological factors and reproductive capacity or population dynamics? In these subjects there is considerable research potential for the European botanic garden community, especially as the major international conservation agencies have not been able to go beyond the basic *Red Data List* and take on board this next stage in plant species conservation.

Quézel, P. & Médail, F. (1997): Hot-Spots Analysis for Conservation of Plant Biodiversity in the Mediterranean Region. *Annals of the Missouri Botanical Garden* **84**, 112–127.

Smart, J. (1998): Finding the 'Hot Spots'. *World Conservation* **2**, p.21.

D Education, Training and Awareness

Chapter contributed by Julia Willison, in collaboration with European educators

Botanic gardens in the EU have a significant part to play in demonstrating that plants are of fundamental importance to our daily lives and that their sustainable use is critical for the future of humankind.

Most EU botanic gardens have long provided information about their collections to the public in the form of guided tours, lectures and labelling. Indeed, many of the earliest gardens were established specifically for educational purposes to provide material and instruction for students of medicine. During the past 10–15 years, in response to the current environmental situation, many gardens have begun to develop education programmes for schools and the general public. Around a third of EU botanic gardens now employ at least one person specifically to run an education programme.

As well as maintaining and researching extensive plant collections, many gardens are responsible for the upkeep of important historical sites and buildings and of precious cultural artefacts, including libraries and iconographic material. All these resources are unique for educating and informing the public about the past, present and future importance of EU botanic gardens and biodiversity (see also Objectives B1–B7). Botanic gardens also have a crucial role to play in disseminating information about scientific activities and new technology that will affect the lives of European citizens in the twenty-first century.

Many EU botanic gardens are situated in urban areas and, as such, provide a sanctuary where minds and spirits can be rejuvenated. Their plant collections also offer a significant opportunity for people to experience nature first hand. Research shows that this is a strong factor in developing a concern for the environment.

The imperative of education is stressed in all major international conservation strategies, including the CBD and Agenda 21, both of which have been endorsed at the highest level by over 150 governments. Agenda 21 states that 'Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues'. The importance of environmental education has also been acknowledged by the European Commission with the publication of *Environmental Education in the EU*, a report reflecting the diversity of environmental education orientations and practices in the member states of the EU. There is a clear call for environmental education to train and promote environmentally responsible citizens. Botanic gardens are exceptionally well placed to take up this challenge.

Building public awareness

All member countries of the European Community acknowledge the need to promote and increase public awareness about the environment. Botanic gardens in the EU are visited by approximately 50 million people every year (BGCI figures); 50% of the gardens already run education programmes for the general public. Such programmes include guided tours, trails, botanical activities, publications, exhibitions and labelling. There is a need, however, for botanic gardens to develop their potential for environmental education and to communicate more effectively with their local communities. Many gardens have skills and resources that can be shared with other botanic gardens in Europe to raise public awareness. To some extent this is already happening: for example, through national networks in the UK, Spain, Germany, France and Italy as well as through the BGCI network, which publishes a regular education magazine and environmental education guidelines. However, many European countries do not yet have botanic garden networks and it is important that gardens in these countries gain access to information and resources produced by other gardens and networks so that all gardens can play their part in raising public awareness. See *Case Studies 3 & 4, 7 & 8 and 11–14; and Objective E3*.

Working with different audiences

People visit botanic gardens for many reasons, and education programmes, correspondingly, cater for a wide spectrum of people – from pre-school age to the third age, from tourists to decision makers – but most botanic gardens, do not have sufficient staff to cater for every potential audience. Gardens therefore need to decide which priority groups they want to work with. This is critical to developing effective education programmes.

Raising the status of education

The number of botanic gardens developing education programmes has risen over the past 15 years. This can be seen as a result partly of growth of the environmental movement, as gardens realise their potential for education, and partly of gardens re-evaluating and justifying their role in society. Most gardens now claim to regard education as important, but the status of education within botanic gardens still appears to be low. While over half EU botanic gardens say that they run education programmes, only a third employ a full-time education officer and only a fifth designate funds specifically for education. If botanic gardens are to realise their potential in this field, staff and resources need to be allocated and support provided for the development of education programmes.

OBJECTIVE D1 Develop botanic gardens as centres for environmental education

Increasingly, the media are bringing the natural environment and its values to the attention of the general public and, as a consequence, the general public is seeking more information. Botanic gardens are well placed in urban areas to be centres of environmental education and can do so by identifying and prioritising conservation messages, target audiences and the facilities and resources available.

To achieve Objective D1, EU botanic gardens should

- employ education staff
- prepare a written environmental education plan that complements the garden's mission
- include their role in education in their mission statement
- use their education policy to guide the development of the garden's educational activities
- share their resources and information with other botanic gardens.

OBJECTIVE D2 Promote botanic gardens to schools as centres for environmental education

The children of today are the future guardians of our planet. The decisions they make will affect the health of the environment. Clearly, it is important for botanic gardens to be involved in schools education.

Botanic gardens make excellent outdoor classrooms and can be used to teach a wide range of curriculum subjects, such as biology, geography, science, social sciences, mathematics, art, history and languages. They also provide superb settings for non-traditional subjects such as information technology, futures education and education for sustainability. Teaching in a natural environment enables children to gain knowledge and to deepen their understanding of their relationship with nature and the importance of sustainability.

It is not possible, however, for every child to visit a botanic garden and those who do so may only be able to visit once during their entire school career. At present, gardens tend to work more with children than with teachers. Gardens should support teachers to bring their classes to the garden independently and to make the most of their trips by developing activities for before and after their visits. Support can be offered in the form of training, advice and materials.

For many children living in urban environments, school grounds provide their first experiences of nature. Botanic gardens have expertise in horticulture and can offer advice and materials to schools to create more conducive environments for learning which, in turn, will have a lasting effect on children's attitudes towards nature (see *Case Study 11*).

Many schools are too far from botanic gardens for children to visit. Gardens need to consider whether they have or can obtain sufficient resources to run outreach programmes.

To achieve Objective D2, EU botanic gardens should

- ensure that their education officers encourage the use of their garden as an outdoor classroom by all schools in their area
- support teachers to bring their classes to the garden by providing teacher-training programmes
- ensure that they have child-friendly policies, e.g. staff should be welcoming to children visiting the garden
- endeavour to make their gardens physically more child friendly, by, for example, ensuring that viewing facilities, access points, storage areas, lunch areas, and activity and play areas are safe and suitable for children
- establish research programmes and programmes for evaluation before and after visits, to gather base-line information about the effectiveness of education programmes in botanic gardens to aid development of new programmes or reorientation of existing ones.

OBJECTIVE D3 Promote botanic gardens as resources for higher education and training

Traditionally, EU botanic gardens have been involved in higher education and training. Over the last 20 years, however, the number of graduate and postgraduate courses concentrating on whole-plant science has decreased dramatically throughout Europe. There is concern that the lack of knowledge and development in botany and taxonomy could detrimentally affect decisions relating to, for example, habitat management and restoration and the development of medicines and foods from plant resources.

In response to this concern, *Systematics Agenda 2000: Charting the Biosphere* (American Society of Plant Taxonomists, Society of Systematic Biologists, Willi Hennig Society & Association of Systematic Collections, 1994, Technical Report) was launched in 1994 by the international community of systematic biologists to discover, describe and classify the world's species. The Agenda argues that basic systematic research on species diversity is urgently needed in order to provide necessary knowledge for policy makers and biological-resource managers to sustain and use species diversity and to monitor changes in climate and ecosystems. Botanic gardens have a significant role to play in implementing this Agenda through education (*see also Objective A3*).

A recent trend in European universities has been for new multidisciplinary courses. It is therefore important that botanic gardens are seen as resource centres for a wide range of disciplines, such as ecology, environmental science, teacher training and medicinal anthropology, as well as taxonomy.

With botanic gardens becoming increasingly involved in conservation education, there is also potential for them to offer training to teachers and students in environmental education and sustainable development. The establishment of research internships would also facilitate the exchange of staff between botanic gardens (*see also Objective E4*) and develop thinking about the role of botanic gardens in sustainable development (*see Case Studies 3 & 4*).

To achieve Objective D3, EU botanic gardens should

- be considered and used by universities and centres of higher education as resources for teaching a range of disciplines – botany, taxonomy, horticulture, zoology, geography, ethnobotany and social sciences
- be viewed as centres for educational research and for the training of scientific researchers
- be viewed as centres for teaching about research and the environment
- act as resource centres to support traditional activities currently in decline in university curricula, e.g. whole-plant studies and taxonomy

D: Education, Training and Awareness

- act as centres for growing and maintaining plants for research and teaching and provide nursery and experimental facilities; gardens need to identify the need for such facilities
- depending on their local circumstances, provide opportunities for continuing professional development in careers such as horticulture (*see also Objective A5*), ethnobotany, social science and education
- develop training courses for government officials, policy makers, developers, community leaders and other people who can influence local and national environmental policies.

OBJECTIVE D4 Present information to the public in a variety of ways

There are many methods available for lively and stimulating communication of information to particular audiences. Botanic gardens need to be aware of the potential of new techniques and seek to use them where appropriate, seeking advice from experts in the relevant fields, when necessary. Museums and marketing companies have been exploring new ways of presenting information and exhibiting objects; many of their findings are relevant for botanic gardens.

To achieve Objective D5, EU botanic gardens should

- use a range of techniques to present information to the public – guided tours, signage, exhibitions, printed materials, story telling, etc. – adapting techniques to suit particular audiences
- evaluate the methods they use in order to determine whether they are communicating their messages effectively
- seek advice from and work with other organisations, such as museums, galleries and marketing companies, developing and applying innovative presentation techniques
- develop new ways of attracting people into their gardens, for example by using new technology and the internet.



Interpretation panels at the Royal Botanic Gardens, Kew, UK (© Royal Botanic Gardens, Kew)

OBJECTIVE D5 Promote botanic gardens to the public as centres for information on plants

Public education caters for a wide range of people – such as general visitors, decision makers, horticultural groups, the media, farmers, church groups, women's groups, families, artists and tourists – who come to botanic gardens for reasons other than formal education. Visitors to botanic gardens come from all types of background and come for all sorts of reasons. At present, fewer than half EU botanic gardens cater for the general public in an active way, through running public programmes. There is an urgent need for such provision to be increased. Gardens already working with the public also have a greater potential for communicating their messages to wider audiences. *See Case Studies 13 & 14.*

To achieve Objective D4, EU botanic gardens should

- provide up-to-date information for a wide range of people about plants and their sustainable use
- conduct surveys to determine their visitor profiles and consider how to attract groups that are not visiting
- collectively develop a European pack that would provide information on our common plant heritage.

OBJECTIVE D6 Encourage public debate on issues relating to plants

News on issues involving plant life and the natural world is increasingly reported in the media, but often with very little factual, background information. Botanic gardens have a role to play in providing factual, unbiased information on some of these issues and stimulating informed debate and discussion.

To achieve Objective D6, EU botanic gardens should

- provide opportunities for local people to discuss and debate issues concerning plants and sustainability
- make available for the public unbiased information on current and topical issues on plants and the environment.

OBJECTIVE D7 Ensure that the garden's message is clear and consistent

Gardens communicate messages to their public subconsciously, often by example. It is difficult to promote a message of conservation and sustainability if, for example, a garden relies heavily on chemical pest-control, or if food sold in the cafeteria is presented on throw-away plates, or if the items sold in the shop are heavily packaged and non-biodegradable. Gardens therefore need to ensure that their operational practices do not contradict their overall message. There is great potential for botanic gardens to become models of sustainability and centres of excellence in environmental education.

To achieve Objective D7, EU botanic gardens should

- carry out a green audit in the garden and develop and implement a strategy for change if necessary
- set up a working group within the garden to ensure that the garden's message is consistent
- develop sustainable environmental programmes that are linked to the education programme
- ensure that all staff are trained in the garden's policy on sustainability and correct green practices.

OBJECTIVE D8 Raise the status of education

Botanic garden authorities also need to recognise education as one of the greatest assets and potentials for the development of the garden and its resources. *See also Objective E3.*

To achieve Objective D8, EU botanic gardens should

- ensure that education is written into the job description of all staff
- employ at least one full-time education officer, preferably trained in education
- allocate a budget to the education programme
- ensure that education staff run education training workshops for other members of staff
- include education staff in any necessary re-designing of the garden for educational purposes, in planning and design of new areas of the garden and in formulation of collections' policies
- publish their educational research in academic journals and relevant magazines
- promote and publicise their education programmes to all relevant groups using a variety of media.



BGCI's education magazine, Roots: providing news, information and views for the education network.

CASE STUDY 11

A natural garden in Paris

Paris-Nature, the natural environment education department of the City of Paris, has contributed to the creation of a 'Natural Garden' in the heart of the French capital. Using indigenous plant species, the garden has reconstructed some of the most representative natural areas in the Ile de France region. Plants are grown to attract pollinating insects and encourage the development of indigenous butterflies, many of which are endangered. The education centre at the garden offers Parisian schoolchildren opportunities to discover ecology in an urban environment while raising their awareness about the need to conserve nature.

CASE STUDY 12

A rare plants trail at the Conservatoire Botanique National de Brest

Created in 1975, the French Conservatoire Botanique National de Brest was one of the first botanic gardens in the world committed to the conservation of threatened plants. To raise public awareness, the garden has developed a trail focusing on the rescue of endangered plants. The trail, inside the educational glasshouses, consists of interpretative panels that provide general information and a pamphlet on 36 endangered plants. The arrangement of the glasshouses, in particular the footpaths, the layout of the boards and their contents, has been specifically designed to meet the needs of a diverse public (including groups, individuals, children and the physically disabled). The pamphlet is available in French, English and German. Part of the interest of the trail is that it is dedicated to the conservation of endangered plants. Between 1995 and 1997, the garden received 21,000 visitors to the glasshouses; a survey conducted in 1997 showed that 93% of visitors were satisfied with their visit.

CASE STUDY 13

Public education at the National Botanic Garden of Belgium

The Garden uses a wide array of activities to get its message across to the public. All activities stress the importance of plants and the environmental problems they face. The main activity is guided tours. Trained volunteer guides are on hand to accompany the public through the garden and specialised tours are available on particular themes, such as, plant myths, orchids, and local history. Permanent interpretation is another way in which the garden educates the public. Aimed at individuals, signs carry information on the economic, horticultural or scientific value of certain plants, while temporary exhibitions highlight the work of the Garden and various aspects of its collection. To reach a wider audience, the Garden collaborates with the local and national media on programmes of scientific and general interest.

CASE STUDY 14

Educational games for tourists in botanic gardens managed by the Trento Natural Science Museum

A programme of educational games for tourists was started in 1998 at 'Viotte' Alpine Botanic Garden (in the Italian Alps) and Arco Arboretum (at the northern end of Lake Garda), with the aim of raising awareness of the gardens and their role in conservation and research, by entertaining the public.

In Viotte, a treasure hunt was organised: six teams had to go through six stages to find clues to the whereabouts of the treasure, a packet of seeds hidden in the natural area close to the Garden. Each step involved a hands-on activity: painting or drawing a plant; matching seeds and cones; recognising, while blindfolded, the bark of a tree or the smell or taste of a plant; and preparing perfumes, oils and creams.

In Arco, old local traditions were revived, in making brooms from palm fronds, and flutes from bamboo stems (palms and bamboos are particularly abundant in the Arboretum). In interactive games, players were asked to match plants with their uses. At Arco Arboretum there has been a programme for schools: study tours, practical fieldwork, observation of flowering; and identification of a large number of trees from every continent.

E Networking and Co-operation

Chapter contributed by Jan Rammeloo, with Judith Cheney

Botanic gardens in Europe are diverse in size, age, resources and climate. On the whole, they have not in the past developed a common profile; but times have changed and there is now a shared international agenda for botanic gardens and a spirit of co-operation. Networking has become crucial for botanic gardens to strengthen their position in a competitive environment. This Action Plan is the basis of a common mission for EU botanic gardens. Implementing it requires organised collaboration that can only be realised by networking. Details of existing national networks in Europe are given on pages 65–68.

Responsibilities and opportunities in networking

Networks have a common agenda in response to national and international obligations and commitments. Networks provide a forum for members to exchange ideas and information, and for discussion and debate on matters of common interest. They can be an efficient and economic means of bringing people together for joint training and research initiatives, making the best use of the combined resources.

Networking can be effective at different levels, by botanic gardens working locally with other organisations in their area; regionally or nationally; with other countries in Europe, responding to EU initiatives; and internationally, in response to a global agenda, particularly on such issues as sustainable development, environmental education and conservation.

In all such networks, botanic gardens gain from working not only with other botanic gardens and arboreta, but also with other local, national or international institutions and networks, such as governments, museums, national parks, wildlife groups, gardens, horticultural societies, commercial growers, the media, tourist authorities, and many other groups mentioned elsewhere in this Action Plan. In this way, they can demonstrate the relevance of their roles in research, science, heritage, conservation, education and implementing legislation; and their contributions to local, national and international agendas. Networking with other networks can lead to joint conferences and projects, combining the expertise and resources of the networks concerned and providing botanic gardens with opportunities to explain their roles to new audiences. The aims and objectives of each network need to be clearly stated, to avoid too much overlap in effort; to maximise the use of resources, and to strike a balance between talking about issues and taking action on them.

OBJECTIVE E1 Develop a network for scientific research and horticultural activities

Many botanic gardens carry out scientific research, but often in relative isolation. There is considerable scope for collaboration and networking, in particular for comparing results. *See also Objective A1.*

In botanic garden horticulture, one of the major weaknesses is the lack of media for the exchange of horticultural information. The development of electronic or traditional publications on botanic garden horticulture should be given high priority. Links and interaction with organisations of commercial growers should be sought and strengthened. EU botanic gardens should endeavour to promote the application of high quality, scientific horticulture to the management of their living collections.

To achieve Objective E1, EU botanic gardens should:

in implementing scientific research

- develop national and international partnerships amongst themselves and with universities and other research centres to enable them to participate in the application of modern molecular and genetic techniques in botany and, in particular, to the problems of biodiversity conservation

E Networking and Co-operation

- strengthen their links to national and international governmental and non-governmental bodies to provide expertise and knowledge on plant conservation

in conservation science

- apply their networks to meeting goals in conservation research, particularly towards meeting the requirements of the CBD
- as part of their contribution to EU conservation programmes, establish co-ordinated European plant conservation science databases
- create a network of reference collections for the scientific study of rare and endangered plant species
- within a co-ordinated programme, set up a network of wild germplasm banks to cover as wide a range as possible of the genetic diversity of European threatened plant species
- co-operate with locally based conservation agencies, universities and other interested parties to establish scientifically based recovery programmes for the threatened species in their area of influence

in horticultural science

- encourage contacts and exchange between their scientific and horticultural staff
- organise meetings and workshops at both national and EU levels on the application of scientific horticulture to the management of their living collections
- establish contacts with national organisations of commercial growers to improve communication on horticultural and scientific aspects of plant cultivation
- establish an effective means of publication and exchange of botanic garden horticultural information, especially when this relates to the cultivation and propagation of rare or threatened European taxa.

OBJECTIVE E2 Develop and strengthen networks to improve conservation of biodiversity

Botanic gardens have, traditionally been repositories for the *ex situ* maintenance of rare and threatened species and between them they have in their living collections the largest array of plant diversity in cultivation (WRI, IUCN & UNEP, 1992; *Global Biodiversity Strategy*, World Resources Institute, Washington).

European gardens hold a large proportion of this wealth of plants and it gives them enormous potential as botanical resource centres both within the EU and elsewhere.

Many of them are already involved in *ex situ* conservation projects, including growing population samples of living plants, germplasm banks (usually in the form of low-temperature seed storage) and the micropropagation of endangered species. These projects, however, are generally not part of a co-ordinated effort to conserve Europe's threatened plants and rarely take into account conservation priorities on a national, regional or EU scale. They need to be part of a planned, integrated strategy for *ex situ* and *in situ* conservation of species and ecosystems.

In situ conservation activities are likely to involve close co-operation with land management agencies and state conservation authorities: botanic gardens have traditionally developed a suite of skills that would make such collaboration desirable; these include taxonomy and plant identification, propagation, and knowledge of reproductive systems in plants.

Plant conservation networks should, where appropriate, include private plant collections of horticultural or conservation value, natural history museums, nature parks and natural history organisations as well as botanic gardens.

To achieve Objective E2, EU botanic gardens should:

- participate in and be active members of such network organisations as Botanic Gardens Conservation International, established to promote biodiversity conservation
- develop conservation programmes in collaboration with the activities of NGOs, state conservation and development agencies, universities and appropriate international agencies to ensure *in situ* conservation and assessment
- develop research programmes and recovery plans in collaboration with national land and wildlife protection agencies, NGOs and universities, to promote biodiversity conservation and sustainable use of plant resources
- establish links with appropriate development projects and agencies, provide technical assistance for efforts to protect the natural environment to promote biodiversity conservation and the sustainable use of plant resources.

OBJECTIVE E3 Develop and strengthen national networks to improve education by botanic gardens

Many botanic gardens run a public education programme, but are not necessarily closely associated with universities or educational organisations. Botanic garden education can be developed more effectively through such networking (*see also Objective D1*).

To achieve Objective E3, EU botanic gardens should

- establish formal and informal links with national and local education authorities and keep up to date with national and European education policy, to raise the status of education in botanic gardens (*see also Objective D8*)
- establish an education network to:
 - ◇ facilitate the exchange of educational resources and information between botanic gardens and with BGCI, by means of publications, meetings, electronic media and in other forms
 - ◇ produce joint educational materials
 - ◇ develop an integrated education strategy for European botanic gardens based on the recommendations of this Action Plan
 - ◇ promote collaborative exchange programmes for education staff in botanic gardens throughout Europe
 - ◇ run practical training courses in education for staff in European botanic gardens
 - ◇ develop novel educational uses of botanic garden resources
 - ◇ raise the status of education (*see Objective D8*)
- develop links between botanic gardens and decision-makers in education; education officers in botanic gardens should establish links with the state education system to explore how the garden could support development of education curriculum content and encourage plant-based environmental education
- work closely with other organisations involved in environmental education; and develop links with other *in situ* and *ex situ* conservation groups (e.g. museums, zoos, national parks, wildlife trusts, conservation societies and other groups that work with plants), to promote plant-based environmental education.

OBJECTIVE E4 Develop closer networking to promote staff training in botanic gardens

See Case Studies 18–22.

To achieve Objective E4, EU botanic gardens should:

- organise regional workshops. Professional development and national co-ordination will be most effectively implemented via the regional networks
- develop policies for staff exchange with other institutions, to improved experience, skills and information flow (see also Objective D3).

OBJECTIVE E5 Participate in and form local networks

There is much to be gained from forming local networks to communicate and work with others in the local community. Local networks are often informal, members may come and go, in response to particular local circumstances or occasions. They often attract interest from local media and are thus particularly effective for publicity and public relations for botanic gardens. Groups of Friends of Botanic Gardens often have contacts that can be used for the benefit of their host gardens. Such groups include people from many occupations, who may have skills, time and influence not available within the staff of botanic gardens; as long as there is close liaison with the garden and a clear understanding of their roles, they can act as ambassadors for the garden, disseminating messages, making contacts and fostering much goodwill in the local community.

To achieve Objective E5, EU botanic gardens should:

- foster links with their local communities by participating in existing local networks
- contact people in local institutions, e.g. museums, tourist and heritage authorities, horticultural societies, community groups, universities, research establishments, local government, the media, on matters of common interest
- involve their Friends' organisations and support groups in making contacts, publicising their aims and fostering goodwill in the local community.

OBJECTIVE E6 Work together internationally

International organisations have to build up a network. The direct membership or affiliation of botanic gardens to an international organisation is the best way of developing a good network (see Case Studies 15–17).

National networks should develop close partnerships with international organisations and network bodies in other countries. Electronic networks, using the internet, can also be established and are often very effective means of exchanging information.

It is likely that in an international context this will become more and more important, although remaining complementary to the other components of an effective network.

To achieve Objective E6, EU botanic gardens should:

- join and become active members of international botanic garden organisations, such as BGCI and IABG and important electronic networks of botanic gardens

- support national networking between national bodies and other national networks in the EU and elsewhere in the world
- encourage and enable staff at all levels to attend national and international conferences.

OBJECTIVE E7 Develop an efficient network

To be effective, a network needs commitment and support from members; good communication (increasingly by electronic means such as bulletin boards and web pages); an organised structure run professionally; to provide information for its members on decisions to be taken; consensus (network partners have to realise that personal aims and priorities are not necessarily those of the network); and motivation to encourage members to take on new responsibilities.

To achieve Objective E7, EU botanic gardens should:

- ensure that network organisations have clear and well-understood sets of objectives, missions and action plans
- use their networks to provide a forum for members of staff at all levels, gardeners, botanical and horticultural staff, managers and directors, so that all can meet together and become involved in the network, helping to break down any existing barriers between different kinds of staff
- organise talks, workshops, meetings and training sessions open to staff members at all levels
- foster goodwill and a spirit of co-operation in the network between members, recognising their contributions at all levels and convincing them of the value of participating
- facilitate communication between and disseminate information about the network's activities between and within its membership (institutional and individual)
- aim to set up a permanent secretariat and resource centre to run the network and ensure that sufficient resources are accessed to enable it to achieve its mission
- organise regular meetings to review aims and objectives and progress in achieving them
- organise exchanges and working visits between members of staff within and between botanic gardens and other institutions, nationally and internationally
- use networks to raise awareness of the importance of botanic gardens in a national and international context.



CASE STUDY 15

Botanic Gardens Conservation International (BGCI)

In 1987, BGCI was founded to link botanic gardens as a co-operating global network for effective plant conservation. It now includes over 500 member institutions in 110 countries, working together to implement a worldwide *Botanic Gardens' Conservation Strategy*.

BGCI provides technical guidance, data and support for botanic gardens worldwide. It has a wide range of activities and has organised major meetings, workshops and training courses, such as a series of International Botanic Gardens Congresses and training courses in many countries.

BGCI has helped to create or strengthen national and regional networks of gardens in many parts of the world, such as Australia, Brazil, China, India and Indonesia, to focus their efforts on plant conservation in new co-operative partnerships.

BGCI has developed a computer database on the rare plants in over 350 institutions to bring worldwide co-ordination to the individual efforts of each garden. It has helped to create plans for new gardens or projects in many countries, such as Bangladesh, Brazil, Guatemala, Haiti, Honduras, Russia, St Vincent, the UK and Vietnam.

BGCI publications, such as the regular *Botanic Gardens Conservation News* and the education magazine *Roots* are important means for those working in botanic gardens to share experience and information. Technical publications have been prepared, to guide conservationists on such subjects as conservation techniques; illegal rare-plant trade; recording plant data on computers; re-introductions to the wild and other subjects.

BGCI education work has become an important means of enhancing the role of gardens in many countries in environmental education and awareness and it has produced and distributed a wide range of new educational materials, such as videos, a slide pack, posters and newsletters, in several languages.

BGCI has a support body, the Plant Charter Group, to focus new attention from the business community on the importance of plants and to develop partnerships for plant conservation projects.

BGCI has regional offices in the Netherlands and Spain, as well as in other non-European countries, including Russia and the USA. Its head office is in the UK.

CASE STUDY 16

The BGCI/IABG European Botanic Gardens Consortium

This body was created by BGCI and IABG in 1994 to plan Europe-wide initiatives for botanic gardens.

The Consortium has met twice a year since 1994 and organised *EuroGard*, the first European botanic garden conference, held in Edinburgh in 1997, at which ideas for an Action Plan for EU botanic gardens were presented and discussed.

A major concern of the Consortium has been to raise the profile of botanic gardens within the EU and promote wider recognition of their role, importance, potential and programmes, and thereby to attract new resources in support of their actions. It has also been very active in promoting links with the European Commission, to attract greater recognition and resources for botanic garden programmes from the Commission; several meetings have been held with European Commissioners and their staff and with European Parliamentarians in several countries.

One of the initiatives that has been extensively discussed by the Consortium is the launch of a new initiative to help co-ordinate and give new impetus to plant conservation actions by botanic gardens in Europe. Members of the Consortium are elected by the national network organisations in the EU. A secretariat for the Consortium is provided by BGCI.



Members of the BGCI/IABG European Botanic Gardens Consortium meeting at Copenhagen University Botanic Garden, Denmark

CASE STUDY 17

International Association of Botanical Gardens (IABG)

In 1954, the IABG was established as the first global network organisation for botanic gardens and arboreta. The aims of IABG are to:

- promote international co-operation between botanic gardens, arboreta and similar institutes maintaining scientific collection of living plants
- promote the study of taxonomy of plants to benefit the world community
- promote documentation and exchange of information, living plants and specimens between botanic gardens and similar institutes
- promote the conservation of plants through cultivation and other means within botanic gardens and similar institutes
- promote the introduction to cultivation of appropriate plants of benefit to the community
- promote habitat conservation by co-operation between IABG and other relevant bodies
- promote horticulture as an art and science.

The aims of IABG are pursued through publications, committee work, meetings, symposia and contact through regionally autonomous groups represented on the IABG Council.

The IABG has regional divisions in Europe, Ibero-Macaronesia, Latin America, Australasia and East Asia, with AABGA providing a corresponding service to institutions in North America.

CASE STUDY 18

Network of Italian Botanic Gardens

The Working Group for Botanic Gardens and Historic Gardens of the Italian Botanical Society (IBS) is responsible for the co-ordination of Italian Botanic Gardens. Established about 30 years ago by a group of IBS members involved in the management of botanic gardens, it is committed to maintaining a long-standing tradition of high-quality teaching and study.

Today, there are over 200 personal members and about 50 associated institutions, mostly academic botanic gardens, but also municipality botanic gardens, alpine gardens, arboreta and thematic (phenologic, conservation, medicinal-plant) gardens. The network is managed by a Directing Council, elected every three years by members, and representing a range of institutions, in particular, academic gardens linked to universities, and alpine gardens mainly linked to local administrative bodies or to NGOs.

It promotes and stimulates the action of Italian botanic gardens through technical and scientific meetings on various topics, such as management of botanical collections, didactics, education, garden history and architecture, management of amenity plantations, study and management of historic gardens, conservation of plant diversity, international legislation on plant germplasm exchange and CITES.

CASE STUDY 19

German gardens link with NGOs in a nationwide campaign

Many German botanic gardens have joined in a project run by the World Wide Fund for Nature and Natural Resources (WWF) Germany and the Association of German Centres of Environmental Education. The project, called the Ozone Campaign, involves botanic gardens cultivating and supplying schools nationwide with sets of tobacco plants that are ozone sensitive. Students are encouraged to plant them in their school gardens to observe the effects of low-level ozone on the leaves. They learn through hands-on experience and exchange their findings with other schools. Their results are usually displayed in their local botanic gardens. Through this collaboration, students can consider first-hand the effects of traffic pollution on plant life.

CASE STUDY 20

Jardins Botaniques de France et des Pays Francophones (JBFPF)

In the early 1970s, an association, now named the JBFPF, was formed in France to foster communication and activities between botanic gardens in French-speaking countries. There are some 160 member gardens: some are associated with universities or research institutes, others are private collections or funded through local town councils.

A primary objective of the JBFPF is to improve the institutional status of botanic gardens in the view of the French public and the various national government departments.

Recently, the JBFPF has developed a series of activities aimed at improving the gardens' commitment to plant conservation and environmental education through scientifically based collections which are made available freely for exchange between institutions. A garden may be awarded Charter status by the JBFPF if it carries out such activities, and it is reviewed regularly.

CASE STUDY 21

PlantNet: The Plant Collections Network of Britain and Ireland

PlantNet is a network of botanic gardens, arboreta and other important plant collections in Britain and Ireland. Co-operation and the exchange of information between holders of plant collections is facilitated through seminars, workshops and a regular newsletter. PlantNet, launched in 1996, now has over 100 members and liaises with other networks and organisations in Europe and elsewhere. Two focus groups were set up in 1999 to give practical discussion and training: the *PlantNet Tree Forum* and the *PlantNet Plant Records Group*. A database of scientifically based plant collections is being compiled, and the first hard-copy version was published in 1999 as the *PlantNet Directory of Botanical Collections in Britain and Ireland*.

PlantNet aims to:

- promote the use, for the public benefit, of plant collections in Britain and Ireland and of the education of the public in the use of plant collections for horticulture, science, education and conservation
- encourage the highest standards of practice in all aspects of the management of plant collections and their conservation for the public benefit.

CASE STUDY 22

National Plant Collection Foundation in the Netherlands

In 1988, a number of botanic gardens in the Netherlands decided that the time had come to formalise their existing collaboration and so came to establish the Dutch Botanic Gardens Foundation. Since then they have worked together closely on public relations and education, but mainly on the maintenance of the National Plant Collection, a conglomerate of various plant collections. Each contribution to the National Plant Collection is based on taxonomy and/or geography, and strict standards of maintenance and administration were agreed. This has helped to define the particular geographical or thematic specialisations of each of the botanic gardens in the Netherlands.

In 1998, the members of the Dutch Botanic Gardens Foundation agreed to divide its work between two new organisations: the Dutch Association of Botanic Gardens, constituted to promote and develop a wide range of activities relevant to the mission of 17 Dutch botanic gardens. This Association is constantly enlarging its scope and number of members.

The management of the ever-increasing National Plant Collection now falls under the jurisdiction of the National Plant Collection Foundation, in which all gardens contributing to the Collection collaborate. Membership of this organisation is limited to gardens that are able to contribute collections of high quality in terms of provenance, maintenance and administration of living plant material. Of course, most gardens are active in both organisations.

CASE STUDY 23

A meeting for all German-speaking botanic gardens

In 1997, the Verband Botanischer Gärten organised a meeting for all German-speaking botanic gardens entitled *Aktueller und potentieller Beitrag der Botanischen Gärten zur Biodiversitätserhaltung* (Actual and potential contribution of botanic gardens to the conservation of biodiversity), to discuss the implications of the Convention on Biological Diversity for botanic gardens. At the meeting, an initial attempt was made to draw up a national code of conduct for the exchange of germplasm.

CASE STUDY 24

Integrating conservation of endangered plants of the Galapagos: the case of *Calandrinia galapagosa*

The University of Copenhagen Botanic Garden has been involved in several conservation projects. One of these, started in 1994 at the Charles Darwin Research Station on the Galapagos through a joint programme with the Jardín Tropical, Esmeraldas, Ecuador, identified several endemic threatened species, one of which was *Calandrinia galapagosa*.

With support from the EU, a small population of *C. galapagosa* threatened by introduced goats was protected by fencing. A dangerous mining operation was stopped and an alternative extraction was proposed. Another population of *C. galapagosa* was discovered. Some seeds were sent to a seed bank at the Jardín Tropical, Esmeraldas, to serve as a back-up and for investigations on germination, growth requirements etc.

As result of this project, which combined *in situ* and *ex situ* measures with a strong public awareness campaign, this endemic species seems to have been saved from the brink of extinction.

F Capacity Building

Chapter contributed by Bert van den Wollenberg and Mike Maunder

The number of EU botanic gardens actively involved in botanical science, research, plant conservation and environmental education is still relatively small and their resources are not being used as effectively as they could be. With proper support and official endorsement, EU botanic gardens could contribute more effectively to conservation, education and the other topics considered in this Action Plan. Through building their capacity, strengthening their institutions and enhancing their professional skills, botanic gardens could be more focused and contribute more efficiently and effectively to plant conservation.

Not only should botanic gardens press for greater resources for this work in many fields, especially conservation, but they should also ensure that their existing resources are used efficiently and effectively, helping to justify greater support from governments and the public.

OBJECTIVE F1 Build effective management of resources

To achieve the objectives in this Action Plan, EU botanic gardens need to carry out an analysis of their strengths and weaknesses, and of the opportunities they have to be more effective in managing resources and gaining new support. On a European scale, the imbalances between the number and resources in northern Europe compared with some parts of the Mediterranean need to be considered and addressed.

The incidence of botanic gardens in countries with high biodiversity, such as Spain, Portugal and Greece, is lower than in countries with less biodiversity, such as England and Germany. Even within countries, the distribution of botanic gardens does not reflect the biodiversity. For example, only 12 of the 68 botanic gardens in France are in the Mediterranean region. Spain has fewer botanic gardens, but their distribution is more closely correlated with its biodiversity.

To achieve Objective F1, EU botanic gardens should

- ensure that each garden has a clearly defined and articulated development policy related to its mission and future activities
- support or develop new botanic gardens for biodiversity conservation in regions with high biodiversity
- analyse their available resources and future requirements needed to achieve their chosen mission
- vigorously pursue new support to enable them to achieve their missions in conservation, botanical research, education and other fields, seeking support where appropriate from national and local government and administrations, private and corporate donors and the general public, to build their institutional capacity.

OBJECTIVE F2 Improve and develop staff skills and training

To fulfil the objectives in this Action Plan, technical capacity of botanic gardens in plant science, horticulture, education, data management and communication needs to be improved. More theoretical and practical training is needed for staff, to ensure that they are well informed on current legislation, methodologies, technologies, techniques and scientific issues. Staff training courses and workshops should be set up through national networks, to share expertise and resources (*see also Objective E4*).

The value of existing skills and facilities in botanic gardens needs to be recognised, as well as their potential for training others. National and regional agencies need to be convinced that botanic gardens are key players in conservation and other disciplines, and ideal venues for professional and vocational training courses in conservation, horticulture and plant science (*see also Objective D3*).

F. Capacity Building

Training for botanic garden staff is required on the implications and implementation of international legislation and instruments, such as the CBD and CITES. Such training can be facilitated by national network organisations or by the BGCI/IABG European Botanic Gardens Consortium.

Whilst conservation biology is increasingly included in university courses, the practical aspects are not being sufficiently developed within the botanic garden community. Some gardens lack the necessary technical and staffing resources, facilities, funding and links with local, national and international conservation policies to take part in conservation programmes.

To achieve Objective F2, EU botanic gardens should:

- develop and offer training courses in conservation biology; management of botanic gardens, information technology, environmental education (*see Case Study 25*) and horticulture
- improve training in horticultural skills and raise the standard and status of horticulture as a profession, to broaden the skills base in EU botanic gardens
- establish professional standards for management of plant data and threatened species through the production of technical manuals, and staff training.

OBJECTIVE F3 **Build and implement a policy on collaboration to assist capacity building for botanic gardens and other partner organisations and institutions throughout the world**

A large proportion of the world's botanic gardens are in Europe, representing a massive capital and personnel investment. They have an established role in developing collaborative projects with overseas partners, which should be seen as complementary to their responsibilities within the European Union. In this way they can achieve more than by working alone (*see also chapter E*). There is scope for collaborative projects involving research and training. *See Case Study 26*.

To achieve Objective F3, EU botanic gardens should:

- further develop the BGCI and IABG advisory group, to provide an interface between national networks and international and European legal frameworks, ensuring the supply of information to botanic gardens and full representation of their interests in the appropriate international forum
- support the development of collaborative partnerships with botanic gardens and other institutions and organisations elsewhere in the world, with the primary purpose of assisting the development and strengthening of such institutions and raising their capacity in many areas, such as botanical research, biodiversity conservation and environmental education
- assess their potential contribution to conserving threatened species in Europe, and undertake a gap analysis to identify technologies and skills required
- establish regional and national, professional standards in documentation and cultivation of threatened plants
- seek to be involved in collaborative activities and training to facilitate the development of international projects, through BGCI, IABG and other appropriate organisations
- where appropriate, be active in collaborative programmes with other like-minded organisations and institutions in Eastern Europe and the countries of the former Soviet Union, to assist in building their capacity to adjust to changing economic, social and environmental conditions in these countries (*see Case Study 27*).

CASE STUDY 25

Professional training courses at the Royal Botanic Gardens, Kew

With BGCI, the Royal Botanic Gardens, Kew, organises international diploma courses in Botanic Garden Management and Botanic Garden Education. The Royal Botanic Gardens, Kew, also offers courses in Plant Conservation Techniques and Herbarium Techniques; and post-graduate courses in association with the universities of Reading and Birmingham.

In collaboration with the National Museums of Kenya, the Royal Botanic Gardens, Kew, is undertaking a 3-year programme of Plant Conservation Techniques courses for East Africa.

CASE STUDY 26

International training courses run for botanic gardens by BGCI

BGCI runs training courses worldwide with in-country partners. For example, BGCI has run a Botanic Garden Management course in Siberia, Russia, Ukraine and Kazakhstan, Indonesia and Ireland; and Biodiversity Conservation Training courses in Uganda and Russia. BGCI has organised workshops on Environmental Education in many countries, e.g. Russia, India, China, Cuba, Morocco, Colombia, Poland, Italy and South Africa.

CASE STUDY 27

BGCI information systems in botanic gardens of the former Soviet Union

In 1999, a workshop was held at Moscow Main Botanic Garden to consider the development of Information Management Strategies for botanic gardens in the former Soviet Union. The objective was to consider models for the implementation of appropriate information management systems and protocols in botanic gardens in the region.

The workshop marked the completion of a 3-year project, supported by the UK Government *Darwin Initiative for the Survival of Species*, on the development of information management systems of biodiversity collections in the former Soviet Union. BGCI's computer software program for collection management, BG-RECORDER, was distributed in Russian to 75 botanic gardens, and more than 60 staff were trained in its use.

Funding to Implement the Action Plan

Chapter contributed by Peter Wyse Jackson

Botanic gardens are funded from a range of sources. Traditionally, most have been funded primarily by national, regional and local governments, municipal authorities and university administrations. Most still rely on such support, but botanic gardens everywhere are increasingly expected to raise more of their own resources, not only for special projects, but also for basic running costs. Many botanic gardens are administered by trusts, private or semi-private charitable and educational foundations or similar authorities, with varying degrees of independence. These boards are often developed in direct response to the growing need for private funding.

Fund-raising strategies to implement the Action Plan

If EU botanic gardens are to achieve the objectives in this Action Plan, new sources of funding need to be found (see Box 16). Many gardens need to increase their funds to fulfil their roles as centres of taxonomy, identification, biodiversity conservation, sustainable use, horticulture, education and tourism. Substantial investment is required to strengthen infrastructure and build capacity for taking on new initiatives.

In responding to this Action Plan, institutions will need to decide which parts they can implement, and develop specific policies to do so. It is recommended that, to support this work, each institution should develop its own fund-raising strategy, including an estimate of the potential costs involved in undertaking any proposed action on biodiversity conservation or environmental education. An effective strategy should also establish clear targets and measures for evaluating the success of fund-raising efforts, as well as some fall-back options in case particular targets are not reached.

A sound financial plan should explore fund-raising opportunities in a variety of funding areas. In general, botanic gardens that receive funding from diverse sources are less vulnerable to changing political and economic circumstances than institutions supported by a single source.

BOX 16

Some potential sources of funds and other resources to support development and special projects in botanic gardens

- Domestic government programmes supporting the implementation of the CBD, CITES, Agenda 21, and other international instruments
- International governmental organisations and agencies, such as those of the United Nations, the World Bank and the Commission of the European Union
- International non-governmental agencies, such as WWF and IUCN–The World Conservation Union
- National or international private charitable trusts and foundations
- Contributions and sponsorship from commercial companies
- Local support groups, such as a Friends of Botanic Gardens, and associated volunteer programmes
- Legacies and other planned gifts from individuals and families
- Special public appeals
- Earned income or enterprise operations, such as entrance fees, retail sales, commercial outlets, facility rentals, special events, training courses, consultancies and contracts.

The strategy may include the development of a new or revised institutional image or 'corporate look'. This might involve the development of new logos, graphics, letter-heads, publication styles and presentation, which will enhance fund-raising efforts and support enterprise operations. Fund-raising programmes generally require the production of a range of support materials, such as brochures, an annual report and summaries of development plans and project proposal.

Effective fund-raising also requires continued communication with private donors and representatives of funding agencies. An important role of botanic garden management and governing boards is communicating information about the institution's work to key individuals and organisations in a position to provide support. This communication may be by printed material, garden tours and meetings, social events, formal or informal presentations, or simply networking among influential members of the donor community. Lobbying political leaders on the importance and role of a botanic garden may result in greater recognition of the institution and its programmes and hence lead to more sustainable government funding.

A regional approach

Fund-raising can also be undertaken at the regional level. A group of institutions can come together to co-operate in raising funds for a shared agenda. This Action Plan provides such a shared agenda on which to base the development of such collaboration.

Organisations such as BGCI, IABG, and their European Botanic Gardens Consortium and national networks of botanic gardens can co-operate in developing funding proposals for the implementation of a programme operating in several countries.

CASE STUDY 28

Commercial partnership supporting conservation: a nature reserve in French Guyana

The project concerns the acquisition of 2,464 ha of rainforest to develop into a nature reserve.

The project was initiated by the Netherlands Regional Office of BGCI. Such projects need to be mutually beneficial. The garden gains access to additional funding opportunities or support in kind. The sponsors can use the publicity to improve their 'green' image.

The project was made possible through political support from Utrecht University and financial support from several corporate partners, the main sponsor being Biohorma Beheer bv, which produces homoeopathic drugs.

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Key texts for botanic gardens are listed here. Other references are included in the text.

Networks of Botanic Gardens in the European Union

AUSTRIA

Arbeitsgemeinschaft Österreichischer Botanischer Gärten

Working Group of the Austrian Botanic Gardens (founded in 1997), 15 gardens

Objectives

- Improvement of exchange of information between Austrian botanic gardens
- Co-ordination of activities and representation of the gardens in national and international organisations

Network website: <http://sl.botanic.univie.ac.at/hbv/deutsch/oebotgar.htm>

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Michael Kiehn

Institute of Botanical Garden, University of Vienna, Rennweg 14, A-1030 Vienna, Austria

Phone +43 (0)1 4277-54198, Fax +43 (0)1 4277-9541, E-mail Michael.kiehn@univie.ac.at.

BELGIUM

Vereniging van Botanische Tuinen en Arboreta (VBTA)

Association of Botanic Gardens and Arboreta, 19 gardens

Objectives

- Co-ordination of activities of Belgian botanic gardens and arboreta
- Public awareness of plant conservation; some gardens and institutions research oriented, some mainly educational, but all active in the maintenance and conservation of plant collections; organises a nationwide botanic garden guide course
- Compilation of a single database to maintain the plant collections efficiently

Website of the National Botanic Garden of Belgium: <http://www.BR.fgov.be/>

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr J. Rammeloo

Nationale Plantentuin van België, Domein van Bouchout, B-1860 Belgium

Phone +32 (0)2 2693905, Fax +32 (0)2 2701567, E-mail rammeloo@BR.fgov.be

DENMARK

Informal network of 3 gardens

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Ole Hamann

Copenhagen University Botanic Garden, Oster Farigsgade 28, DK-1353, Copenhagen K, Denmark

Phone +45 (0)35 322222, Fax +45 (0)35 322221, E-mail ole@bot.ku.dk

FINLAND

National Botanic Garden Network of Finland, 5 gardens

Objectives

- Education and research, all the botanic gardens are part of a university
- Organisation of annual meetings
- Co-ordination of activities e.g. expeditions and collection and exchange of material
- Journal for botanic gardens is published twice a year in Finnish

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Kari Laine

Botanical Garden, University of Oulu, P O Box 333, FIN-90530 Oulu, Finland

Phone +358 (0)8 5531571, Fax +358 (0) 553158, E-mail kari.laine@oulu.fi

FRANCE

Jardins Botaniques de France et des Pays Francophones

Botanic gardens of France and French-speaking countries (founded in 1979)

230 members, including 76 botanic gardens and botanical reference collections

Objectives

- Promotion of co-operation between botanic gardens and their staff, encouragement and co-ordination of involvement in scientific research, plant conservation and education
- Organisation of seminars, workshops and field trips
- Encouragement of better management of plant collections and their presentation to the public
- Scientific research and conservation of threatened species.

Network website: <http://person.clubInternet.fr/jbfpf>

Representative on the BGCI/IABG European Botanic Gardens Consortium: Philippe Richard

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Service des Cultures, 43 rue Buffon – F-75005 Paris, France

Phone +33 (0)1 40793324, Fax +33 (0)1 4079382, E-mail delmas@mnhn.fr

GERMANY

Verband Botanischer Gärten e.V.

Association of Botanic Gardens

Network website: <http://www.biologie.uni-ulm.de/verband/index.html>

Representative on the BGCI/IABG European Botanic Gardens Consortium: Professor Dr Thomas Stützel

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Phone +49 (0)234 7004491, Fax +49 (0)234 7094284, E-mail thomas.stuetzel@ruhr-uni-bochum.de

GREECE

Informal network of 2 gardens

Objectives

- Establishment of new local botanic gardens and a formal network
- Education
- Research on germination and re-establishment of Mediterranean plants
- Conservation of endemic, rare and threatened plants of Greece.

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Kyriacos Georghiou

Department of Botany, University of Athens, Panepistimiopolis, Athens 15784, Greece

Phone +30 (0)1 7274656, Fax +30 (0)1 7234136, E-mail kgeorghi@mail.uoa.gr

IRELAND

PlantNet: The Plant Collections Network of Britain and Ireland

The gardens under state care are affiliated to the National Botanic Gardens, Glasnevin, under the Department of Arts, Heritage, Gaeltacht and the Islands; Trinity College Botanic Garden is a university garden; Talbot Botanic Garden is managed by Fingal County Council.

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Steve Waldren

Trinity College Botanic Garden, Palmerston Park, Dartry, Dublin 6, Republic of Ireland
Phone +353 (0)1 4972027, *Fax* +353 (0)1 6081147, *E-mail* swaldren@tcd.ie

ITALY

Gruppo di Lavoro per gli Orti Botanici et i Giardini Storici della Societa' Botanica Italiana

Working Group for Botanic and Historic Gardens of the Italian Botanical Society (founded in 1997)

51 institutions, mostly university but some municipal gardens

Objectives

- Promotion of activities through scientific meetings and excursions on plant collections, education, CITES, history, architecture, etc.
- Managing Board elected every year by members of the Italian Botanical Society; Board must hold an administrative meeting, prepare an annual report, and bring forward proposals for the following year.

Network website: <http://www.dsb.unipi.it/Horti>

Representative on the BGCI/IABG European Botanic Gardens Consortium:

Dr Gianni Bedini (Pisa Botanic Garden)

Dr Carlo Del Prete

Botanic Garden of the University of Modena, viale Caduti in Guerra 127, I- 41100 Modena, Italy

Phone +39 (0)59 236154/236132, *Fax* +39 (0)59 221829, *E-mail* dalai@unimo.it (secretary);
 delprete@unimo.it (co-ordinator)

NETHERLANDS

Nederlandse Vereniging van Botanische Tuinen

Dutch Association of Botanic Gardens (founded in 1998) 14 gardens.

In 1998, the Dutch Botanic Gardens Foundation (established in 1988), which formerly served as a platform for co-operation, decided to focus solely on the management of the Decentralised National Plant Collection; the platform function is now carried out by the Association.

Objectives

- Stimulation of outside contacts and contacts between members
- Consolidation of the members' position as museums
- Improvement of horticultural techniques

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Bert van den Wollenberg

Dutch Regional Office BGCI, Utrecht University Botanic Gardens, PO Box 80162, NL-3508 TD Utrecht, Netherlands

Phone +31 (0)30 2532876, *Fax* +31 (0)30 2535177, *E-mail* l.j.w.vandenwollenberg@bio.uu.nl

PORTUGAL

Associação Ibero-Macaronésica de Jardins Botânicos

Ibero-Macaronesian Network of Botanic Gardens (Portuguese Section; founded in 1985); 7 gardens, 1 institute

Objectives

- Fulfilment of the goals set by botanic gardens
- Organisation of symposia and workshops

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Susana Sa Fontinha
Jardim Botânico da Madeira, Caminho do Meio, Bom Sucesso – 9050 Funchal – Madeira, Portugal
Phone +351 (0)91 2002000, *Fax* +351 (0)91 2002006, *E-mail* porella@dragoeiro.uma.pt /
musschia@dragoeiro.uma.pt

SPAIN

Asociación Ibero-Macaronésica de Jardines Botánicos

Ibero-Macaronesian Association of Botanic Gardens (Spanish Section; founded in 1985), 12 gardens

Objectives

- Fulfilment of the goals set by botanic gardens
- Organisation of symposia and workshops

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr Arnaldo Santos
Jardín Botánico, Retama 2, 38400 Puerto de la Cruz, Tenerife, Canary Island, Spain
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SWEDEN

No formal network, but there are close contacts among the four major botanic gardens, in Stockholm, Gothenburgh; Lund and Uppsala. There has long been contact among the Nordic Botanic Gardens (Denmark, Finland, Iceland, Norway and Sweden), now being extended to the Baltic states.

Representative on the BGCI/IABG European Botanic Gardens Consortium: Professor Bergt Jonsell
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UNITED KINGDOM

PlantNet: The Plant Collections Network of Britain and Ireland

60 botanic gardens, arboreta and other plant collections; and over 40 personal members

Objectives

- Promotion of the use, for the public benefit, of plant collections in Britain and Ireland and of the education of the public in the use of plant collections for horticulture, science, education and conservation
- Encouragement of the highest standards of practice in all aspects of the management of plant collections and their conservation for the public benefit

Representative on the BGCI/IABG European Botanic Gardens Consortium: Dr David Rae
Royal Botanic Garden Edinburgh, Inverleith Row, Edinburgh EH3 5LR, Scotland, UK
Phone +44 (0) 131 248 2954, *Fax* +44 (0) 131131 248 2901, *E-mail* d.rae@rbge.org.uk

National Botanic Garden of Belgium

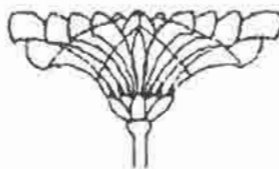
The National Botanic Garden of Belgium lies at the heart of Europe, only four km north of the Brussels Atomium, in Meise.

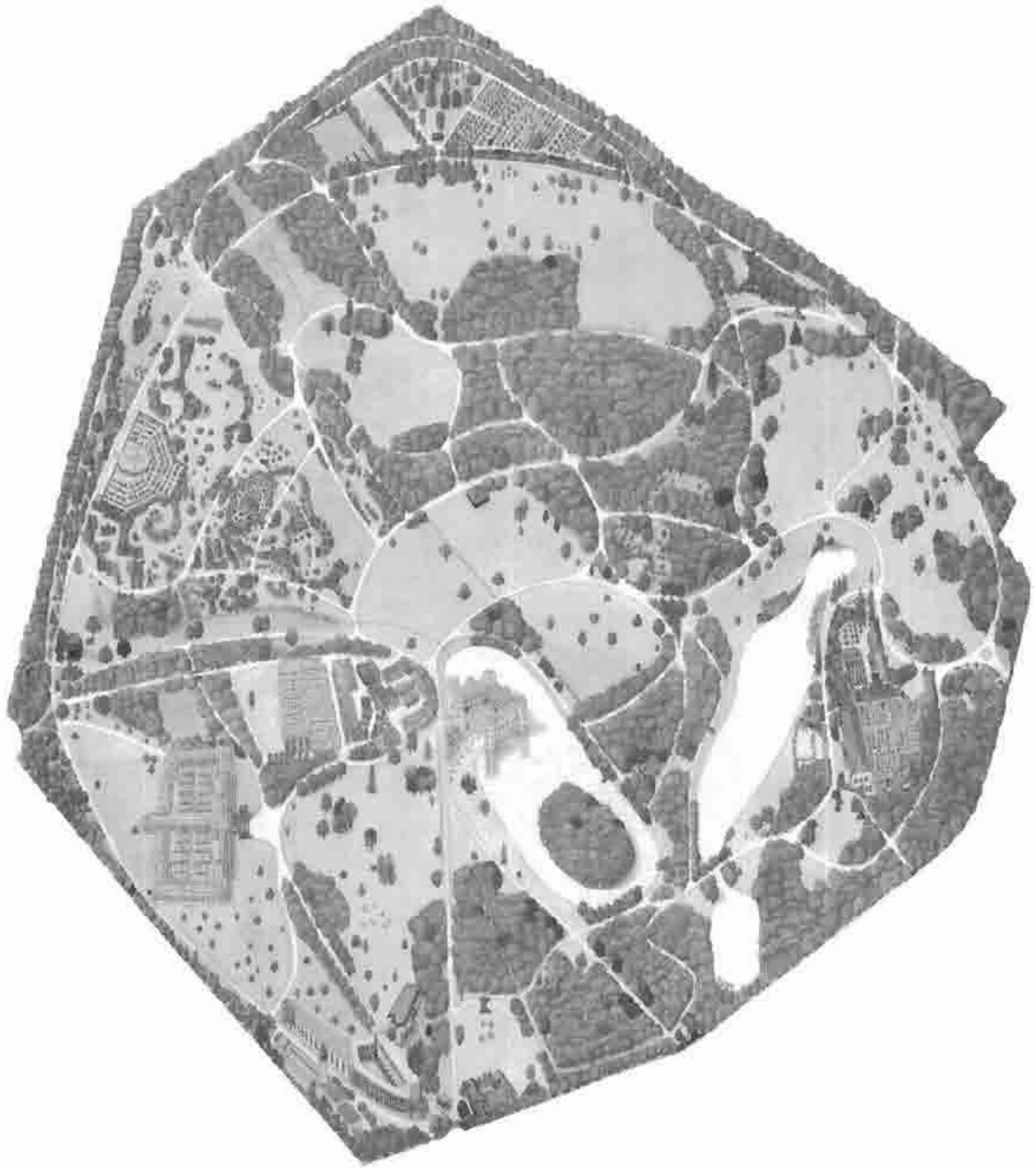
Botanic Gardens are both researchers and curators of the plant world. In their laboratories, herbaria, gardens and glasshouses, plants are studied, classified and cultivated. Without this vital knowledge we stand in danger of losing much of the biodiversity that is the world's richest asset.

Together with other Botanic Gardens throughout Europe, the National Botanic Garden of Belgium forms a network that focuses on conservation and study of the plant kingdom.

In the National Botanic Garden are found the features typical of botanic gardens in Europe.

- **Herbarium:** About three million specimens are conserved and studied in the herbarium which is rich in tropical African material. It contains thousands of type specimens. The eighteenth-century, private von Martius collection, renowned for palms and Brazilian plants, forms the historical core.
- **Library and publications:** The specialised library holds about 200,000 volumes on botanical subjects, particularly on systematics. The Garden has a long standing tradition in publishing books and journals disseminating the results of botanical research.
- **Research:** Two departments carry out research focused on systematics and plant geography; vascular and non vascular plants and fungi are studied. Changes in the Belgian flora are monitored closely. For the tropics, the emphasis is on tropical Africa and the study of such taxonomic groups as the Rubiaceae (the Coffee family) and ectomycorrhizal fungi.
- **History:** The Garden was established in 1870 and is now situated in the ancient Bouchout domain, once home to Carlotta, Empress of Mexico. The historic Castle of Bouchout provides opportunities for hosting symposia and meetings.
- **Living collections:** In all, 18,000 plant species are grown. The Plant Palace glasshouse complex, covering 1 hectare, is home to 10,000 taxa and is currently being renovated. The open air collections are expanding rapidly and are planted out in several themed gardens and areas. The Garden covers 92 ha.
- **Educational activities:** The Garden organises educational activities for schools and adult groups. Themed visits, hands-on activities and guided walks are offered.
- **Co-operation:** The National Botanic Garden participates in several national and international projects, ranging from training volunteer guides to scientific exchanges, botanical exploration and practical collaboration. The Garden is currently contributing to the development of the Chester's Field Botanic Garden in the "Centro Neotropico Sarapiquí" in Costa Rica.





For further information or for an introduction to the National Botanic Garden of Belgium, call the education service on +32 (0) 2 260 09 62.

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