Part C: The Plant Collection – Linchpin of the Botanic Garden

Chapter 4: The Plant Collection in the International Policy Context

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CHAPTER 4: THE PLANT COLLECTION IN THE INTERNATIONAL POLICY CONTEXT

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The Plant Collection in the International Policy Context

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4.1 INTRODUCTION

KEY MESSAGE

Comprehensive knowledge of global treaties can help botanic gardens grow their own influence locally, nationally and internationally.

With an awareness of the global multilateral environmental agreements (or 'MEAs') that shape many national laws and conservation initiatives, botanic garden managers can develop policies that foster outward-looking partnerships, support legal compliance, and connect with governments. This section introduces several MEAs that are particularly relevant to botanic gardens, with a focus on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Biological Diversity (CBD). These two MEAs affect the practices of virtually all botanic gardens, the latter including the Nagoya Protocol on access and benefit-sharing. For further information on international policy relevant to botanic gardens, see also the International Agenda for Botanic Gardens in Conservation.

4.2 OVERVIEW AND TIMELINE OF THE PRINCIPAL GLOBAL MEAS

The global efforts that led to today's major MEAs began to gather force in the mid-20th century, with recognition that international cooperation was needed to tackle cross-boundary issues such as species and habitat loss and over-exploitation. CITES is the oldest of the key international treaties relevant to botanic gardens, first drafted from a resolution adopted in 1963 by the International Union for the Conservation of Nature (IUCN), finally agreed in 1973, and in force from 1975. The Ramsar Convention on Wetlands and the World Heritage Convention also entered into force in 1975 (Box 4.1).

Since the 1970s, the global environment agenda has become ever more tightly linked to sustainable development. The United Nations Conference on the Human Environment, convened in 1972 to focus on human interactions with the environment, produced the Stockholm Declaration and influenced many regional and national actions. The Brundtland Commission, another UN initiative, defined sustainability as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' in its 1987 report 'Our Common Future'. The UN Conference on Environment and Development (UNCED, also called the Rio Earth Summit), held in Rio de Janeiro in 1992, launched Agenda 21: Programme for Action for Sustainable Development, and three international treaties: the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD) (Box 4.1). These treaties are often called the Rio Conventions and, like CITES, they are organised under the UN Environment Programme (UNEP).

The Millennium Development Goals (MDGs), arising from the UN's Millennium Summit in 2000, provided the umbrella for all international policies for biodiversity conservation and sustainable development from 2000-2015. They committed nations to 8 international development goals to reduce extreme poverty, including (as Goal 7) 'Ensure Environmental Sustainability'. In 2002, the World Summit on Sustainable Development (WSSD, also called Earth Summit 2002 or Rio+10) evaluated progress since UNCED, endorsed the MDGs and recognised the CBD as the key instrument for the conservation and use of biodiversity that is equitable and sustainable. In 2004, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) entered into force – a treaty under the UN's Food and Agriculture Organisation that focuses on exchange of plant resources for food security. In 2010, the CBD adopted a revised Strategic Plan for Biodiversity 2011-2020 including Aichi Biodiversity Targets and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization. The UN's Sustainable Development Summit (Rio+20) in 2012 reaffirmed international commitment to the CBD, its Strategic Plan and the Nagoya Protocol. It also began the process of developing the Sustainable Development Goals (SDGs) and taking forward the post-2015 development agenda. The SDGs, 'Transforming our world: the 2030 Agenda for Sustainable Development', replace the MDGs as the new umbrella for international biodiversity policies. They provide 17 aspirational goals, with 169 targets, covering many development issues, including conservation and sustainable use of terrestrial and marine ecosystems, halting biodiversity loss and combatting climate change.

Adoption of the Nagoya Protocol on access to genetic resources and benefit-sharing at the Tenth meeting of the Conference of the Parties (COP 10), Nagoya, Japan, on 29 October 2010. (Image: Kate Davis)

A country becomes a member nation, or 'Party', to a treaty by signing the treaty and then passing it through its national legislation, a process called ratification. A certain number of ratifications are needed before a treaty comes into force. The governing body for a convention (a type of treaty) is called the 'Conference of the Parties (COP)'. COPs are large meetings where Parties review progress and make decisions, and are generally convened every 2-3 years. Only Parties (governments) can make decisions or resolutions (in the case of CITES, by a 2/3 majority, with one vote per Party; in the case of the Rio Conventions, by consensus). However COPs are also attended by many observers from NGOs, industry, academia and other organisations – including botanic gardens.

Box 4.1 Wetlands, heritage and desertification: more global conventions relevant to botanic gardens

Convention on Wetlands of International Importance (Ramsar Convention): provides a framework for the conservation and wise use of wetlands and their resources. Botanic gardens can contribute by, for example: working in partnership to manage and restore wetland areas; undertaking research on conservation, cultivation and biology of threatened aquatic and wetland plants; raising public awareness about the importance of wetland habitats through education programmes and activities.

Convention Concerning the Protection of World Cultural and Natural Heritage (World Heritage Convention): aims to protect and preserve the world's cultural and natural heritage for present and future generations. Several botanic gardens have been designated as World Heritage Sites. Botanic gardens can: promote and support applications for natural and cultural sites; work in partnership to counteract dangers to natural and cultural heritage; develop educational materials to enhance knowledge of and respect for heritage sites; conduct inventories of plant diversity for sites included in the 'List of World Heritage in Danger'.

United Nations Convention to Combat Desertification (UNCCD): aims to combat desertification and mitigate effects of drought through national action programmes and international partnerships. Actions botanic gardens could take to contribute include: undertaking research on dryland plants; working in partnerships to prevent land degradation and undertake restoration; improving land utilisation by the introduction and cultivation of appropriate plants; improving and sharing knowledge of dryland plants; conserving dryland plants germplasm; providing training in plant conservation techniques for the management of dryland plant resources and ecosystems.

4.3 THE CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES)

KEY MESSAGE

CITES provides a legal framework to certify sustainable trade and control over-exploitation. It also assists in preventing illegally collected plants from coming into the botanic garden collections.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) – also known as the Washington Convention – provides an international legal framework for the regulation of trade in those plant and animal species that are exploited commercially for international trade – and covers many of the species that botanic gardens collect, cultivate, and exchange. Although trade issues can be complex and political, CITES is a relatively straightforward treaty; its provisions are translated into national legislation by Parties and there are strong enforcement measures.

Transplanting Echinocereus schmollii, a Mexican cactus. The vast majority of taxa of Cactaceae are listed either on CITES Appendices I or II; the Annotations specify which parts and derivatives are exempt from controls. (Image: Jardín Botánico Cadereyta, Mexico)

CITES operates through the issue and control of import and export permits for species listed in three Appendices (Box 4.2). CITES certifies sustainable trade in plant species that can withstand current rates of exploitation, but prevents trade in those that face extinction.

CITES provides a baseline for national legislation. Countries may develop measures that are stricter than the provisions in CITES. Countries that have developed stricter domestic measures include Australia, the USA, and the member countries of the European Union. Within the EU, CITES is implemented by EU regulations that require import permits or notifications for all CITES-listed species (and some others; all are organised into four Annexes) in addition to the basic CITES export permit from the country of origin.

4.3.1 The Appendices

The three Appendices (Box 4.2) contain many thousands of plant species: approximately 300 in Appendix I and over 28,000 in Appendix II, which includes the entire orchid and cactus families. The Appendices also include some other succulents, cycads, a range of timber and medicinal plants, and certain genera and species of geophytes, carnivorous plants, tree ferns, and palms. The Annotations to the Appendices specify exactly which parts and derivatives of species are controlled or exempt from CITES controls.

Box 4.2 CITES Appendices

Appendix I:
Lists plant species threatened with extinction, for which international trade must be subject to particularly strict regulation, and only authorized in exceptional circumstances.

Appendix II:
Lists species that are not threatened with extinction at present, but may become so if uncontrolled trade continues. Trade is permitted of both wild and artificially propagated material provided an appropriate permit is obtained.

Appendix III:
Lists species that are threatened locally with extinction through commercial exploitation and therefore subject to trade controls within certain nations. International trade in this material requires an export permit from the country that listed the species, or a certificate of origin.

4.3.2 CITES Authorities

International implementation of CITES is facilitated by the CITES Secretariat, based in Geneva, Switzerland. Several technical Committees meet between COPs: the Standing Committee provides policy guidance to the Secretariat and oversees the budget, while the Plants Committee and Animals Committee provide scientific guidance to other CITES bodies, deal with nomenclatural issues, review species to ensure appropriate categorisation, conduct reviews of significant trade, and draft COP resolutions. The Plants Committee meets once per year.

Each CITES Party is required to designate one or more national 'Management Authority' to administer the licencing system in that country. Management Authorities implement national policy on wildlife trade issues, provide information on CITES, issue permits and certificates, and inspect and monitor incoming plant material in cooperation with national customs officers. They also detain illegally traded material and pursue prosecution of the trader, undertake training, coordinate with the CITES Secretariat, liaise with the National Central Bureau of Interpol, monitor the levels of trade (via annual and biennial reports to CITES), and set up strategies for confiscated material.

Each CITES Party must also designate one or more 'Scientific Authority' to provide independent scientific advice to the Management Authority on the effects of trade on the status of the species. Scientific Authorities may be government agencies, research institutions or committees with membership reflecting the wide variety of CITES-listed species. The Scientific Authority is responsible for carrying out 'non-detriment findings (NDF)' for species listed in Appendix I and Appendix II prior to the granting of permits by the Management Authority – that is, advising that the export (or import) will not be detrimental to the survival of the species in the wild. The Scientific Authority has a wide range of other tasks, including monitoring exports and determining when export levels should be limited, advising as to whether scientific institutions meet the criteria for CITES registration, ensuring that recipients of Appendix I species have suitable facilities to care for them, and analysis of species' biological status to inform proposals to amend the Appendices.

The CITES website contains a country directory with full contact details for all CITES Management Authorities and Scientific Authorities.

4.3.3 Permits and Certificates

All specimens of species listed on CITES Appendices must have an 'export permit' (or re-export permit, for subsequent international transfers) from the country of export, obtained from that country's CITES Management Authority. The issuance of the permit confirms that the removal of the plant will not pose a threat to the survival of that species in the wild, that the export is in accordance with national law in the exporting country and, in the case of live Appendix I plants, that the proposed recipient can house and care for them.

Wild collected specimens of Appendix I species also require an 'import permit' (or re-import permit) obtained from the CITES Management Authority of the country to which the specimens are being imported. Many countries with stricter domestic measures also require an import permit for Appendix II species in addition to the export permit from the exporting country (for example, EU member countries require an EU import permit; see European Commission and TRAFFIC, 2015).

For Appendix III specimens, an export permit is required from the country that listed the species on Appendix III if the specimen is being exported from that country. If an Appendix III specimen is being exported from any other country, a 'certificate of origin' (or re-export certificate) is required from the CITES Management Authority of that other country.

To export a specimen that was acquired before the species concerned was first included on the Appendices (a 'Pre-Convention specimen'), a 'pre-Convention certificate' is required, issued by the Management Authority of the country of export if it is satisfied that the specimen was acquired before that date. The import must still be declared to customs.

When a specimen of a CITES-listed species is transferred between a country that is a Party to CITES and a country that is not, the country that is a Party may accept equivalent documentation that conforms to the CITES requirements for permits and certificates in addition to the basic CITES export permit from the country of origin.

4.3.4 Exemptions

KEY MESSAGE

Become a CITES registered scientific institution: this scheme facilitates scientific exchanges between institutions.

Certain types of specimens and exchanges are exempt from the requirement for CITES permits. For botanic gardens, the most relevant exemptions are for artificially-propagated plants and for scientific exchange between registered scientific institutions:

- Artificial propagation: CITES defines artificially propagated plants very specifically as those that are (a) grown under controlled conditions; and (b) grown from seeds, cuttings, divisions, callus tissues or other plant tissues, spores or other propagules that either are exempt or have been derived from cultivated parental stock. CITES also defines 'under controlled conditions' and 'cultivated parental stock' carefully; such stock must have been legally established in accordance with CITES provisions and national laws, and in a manner that is not detrimental to the survival of the species in the wild, and is maintained with only minimal or no augmentation from the wild.

- Registered scientific institutions: CITES also allows an exemption for non-commercial loan, donation or exchange between scientific institutions that are registered by their Management Authority. Herbarium specimens, other preserved, dried or embedded museum specimens and live plant material of CITES-listed species can be exchanged using a 'CITES label' issued or approved by the Management Authority; DNA samples are also covered. Both sender and recipient institutions must be registered, and all material must be accompanied by the CITES label, which contains the CITES logo, the names and addresses of the sender and recipient institution, the unique 5-digit CITES registration numbers of both institutions, and a description of the material. The label should then be fixed to the outside of the package. Any material collected in another country by collectors who are not working with a national registered institution and intend to take the material back to their home country will need a CITES export permit. The CITES website holds the updated global register of scientific institutions, including institutional details and registration numbers. It is important to remember that CITES regulations do cover the exchange of herbarium specimens and DNA for research, and the label scheme significantly facilitates the process between registered institutions; botanic gardens can benefit greatly by being included on their country's register.

4.3.5 Botanic Gardens and CITES

Botanic gardens have moral and legal responsibilities with regard to CITES and must be seen to be within the law and above reproach (Case study 4.1). Botanic gardens can also play a major role in improving implementation and awareness of CITES (Oldfield and McGough, 2007; BGCI, 2012). A botanic garden's collection policy (Chapter 3) should articulate how the botanic garden will comply with CITES, based on the individual institution's priorities for plant holdings.

For basic CITES compliance, botanic gardens should:

- Check collections for CITES-listed species, and maintain complete documentation;

- Assign clear staff responsibility for CITES matters;

- Always obtain CITES permits and labels when appropriate – work with collaborating institutions to compile procedures for obtaining the necessary export and import documents and remember that CITES also covers herbarium specimens, spirit collections, tissues and DNA samples as well as other specimens/samples of CITES-listed species;

- Disseminate CITES information and/or training to staff, and ensure they understand CITES issues to prevent infractions;

- Prevent any illegally collected plants from coming into the collections 'through the back door';

- Contact and find out about their national CITES authorities, and consider registering the institution with the Management Authority.

Other contributions comprise:

- Participating in the CITES process: Botanic gardens might seek to become members of their governmental delegations to the Plants Committee, and should be included on the regional representatives email list to keep up to date with activities in their region. Botanic gardens can participate at Plants Committee meetings and COPs, as active observers or on their government's delegation. They can also provide venues for regional or national CITES plants meetings and training workshops. Botanic gardens may also play a vital role as Scientific Authority in their own right or as part of a committee structure.

- Providing information for CITES: Botanic gardens with expertise in threatened plant groups can provide input for the development of CITES amendment proposals, development of NDFs and management plans for CITES-listed plants, and Significant Trade Reviews for plants. Botanical information is needed by national CITES Management and Scientific Authorities and internationally by the CITES Secretariat, CITES Plants Committee and relevant international organisations such as IUCN and TRAFFIC.

- Offering rescue centres for confiscated material: Botanic gardens can provide appropriate expertise and facilities for holding material that has been taken from individuals by the statutory authorities, either temporarily after initial confiscation, or permanently following formal seizure or successful legal action. Botanic gardens do need to consider carefully the implications of looking after this challenging material, which is unlikely to have phytosanitary documentation and may be in poor condition. However, confiscated material has value as prosecution evidence, and can raise public awareness of conservation, augment the botanic garden's collections, and potentially be used for the conservation of the species; on the other hand, this can also bring an additional onus on the institution as the plant material can neither be destroyed, exchanged or transferred.

- Advising and training customs and legal authorities: Botanic gardens staff with particular expertise in plant identification and horticulture can help members of the customs or legal professions with CITES enforcement issues, for example by identifying plant material, determining whether the material is of wild or cultivated origin, or providing advice on the commercial value of plants and their country of origin. Botanic gardens can also help to develop training guides and workshops for CITES enforcement personnel.

- Publicising CITES involvement: Botanic gardens can also support CITES by explaining and publicising their involvement, interpreting the need for sustainable trade in plants to the public, and encouraging the public to think about the origin of rare plants in trade. Botanic gardens can also encourage other gardens to become involved and register with the CITES Management Authority.

CASE STUDY 4.1

Botanic gardens and sustainable trade – conservation and cultivation of *Galanthus woronowii* in Georgia

Catherine Rutherford, Richard Wilford, Noel McGough London, United Kingdom; Kate Davis, Ottawa, Canada

The Royal Botanic Gardens, Kew (in its role as UK CITES Scientific Authority for Plants), the CITES Authorities of Georgia, Microsoft Research (Cambridge, UK), the Tbilisi Botanic Garden, the Institute of Botany and Batumi Botanical Garden are working in partnership to ensure sustainable harvest of snowdrop (*Galanthus woronowii*) bulbs for the international horticultural trade.

Georgia has been exporting *G. woronowii* since 1997, with the European Union as the major importer and the Netherlands dominating this trade. All *Galanthus* species are listed on CITES Appendix II, and CITES requires that the Scientific Authority in the country of export must provide a 'non-detriment finding' for international trade in wild-harvested Appendix II species – a statement that the trade will not be detrimental to the species' survival. The CITES Plants Committee expressed concern at the high level of *Galanthus* exports from Georgia, but there was little information on the conservation status of the species in trade, the full extent of *G. woronowii* populations in the wild in Georgia, levels of artificial propagation, how CITES non-detriment findings were made, or the scientific data behind the setting of export quotas. A CITES project funded by the Netherlands was established in 2008 to review the conservation status and distribution of *G. woronowii* in Georgia and determine whether the annual harvest of 15 million bulbs from the wild was sustainable.

The project partners conducted field surveys in 2009 at 41 sites to assess the status of wild populations, including some in semi-natural habitats (wild areas in Batumi Botanic Garden) and agricultural habitats, and assessed the conservation value of each site. A workshop held later in 2009 delivered the results of the surveys and training on artificial propagation and cultivation. The partners also surveyed 23 cultivated populations in 2009 and 2010, interviewing local traders, landowners and local government representatives about the sites' histories. Potential sustainable harvest was then modelled to recommend annual export quotas and the management systems needed to meet CITES requirements. Additionally, a checklist was developed for local application of the CITES definition of Artificial Propagation and a registration system for propagation fields was established and embedded in government regulations.

The project continues, with funding from Germany, to establish the sustainable export quota for wild-sourced *G. woronowii* for 2014-2016, assess the artificial propagation of the species in cultivation fields, and review and enhance the monitoring scheme for wild populations, cultivation fields and registered artificial propagation sites. The partners hope that this extensive research will provide an exemplar and benchmark on how to harvest wild resources for the sustainability of both the wild plants and the livelihoods of the local and national stakeholders.

One of the largest Galanthus woronowii populations in Georgia, extending over 30-50 ha of alder woodland near Kirnati, Khelvachauri municipality, Adjara Autonomous Republic. (Image: David Kikodze)

4.4 THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

The Convention on Biological Diversity (CBD) – also called the Biodiversity Convention – is the key international instrument for the conservation and sustainable use of biodiversity, and its Strategic Plan is the overarching framework on biodiversity for the entire United Nations system. The CBD came into force on 29 December 1993, and has been ratified by all but three countries (the USA, Andorra and the Holy See). Although the USA is not a Party, many US botanic gardens are actively implementing the CBD, and they are affected by other countries' CBD-related laws when they work internationally.

4.4.1 CBD Bodies and National Authorities

Several CBD bodies support the COP. The CBD Secretariat is based in Montreal, Canada. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) provides recommendations to the COP and various working groups are set up to tackle complex issues. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) convenes Task Forces and Working Groups on many of the technical issues identified by SBSTTA. The mainly web-based Clearing House Mechanism (CHM) facilitates global information exchange on CBD implementation. At the national level, each Party must designate a National Focal Point (NFP) to provide information on national CBD actions. Countries may also choose to nominate additional NFPs to handle certain areas of the CBD. A list of NFPs is available from the CBD website.

4.4.2 Objectives, Programmes, Strategic Plan and National Actions

KEY MESSAGE

Each country decides how it will address the CBD's objectives and targets – botanic gardens can play key roles in their development and implementation.

The CBD's three objectives are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilisation of genetic resources. Its scope covers all levels of biodiversity, though human genetic resources are excluded. Its text includes articles on identification and monitoring, *in situ* conservation (including provisions on traditional knowledge and invasive species), *ex situ* conservation, sustainable use, research, public education, access to genetic resources, technology transfer and scientific cooperation.

To tackle this ambitious mandate, the CBD established thematic and cross-cutting programmes of work focusing on seven major biomes and issues relevant to all biomes, then adopted a Strategic Plan in 2002. The revised Strategic Plan for Biodiversity 2011-2020, comprising five strategic goals and the 20 Aichi Biodiversity Targets, captures elements of all of the programmes and is now the primary structure against which countries develop national strategies and report progress, although the original cross-cutting programmes are still relevant. Key programmes for botanic gardens include the Global Strategy for Plant Conservation, invasive alien species, traditional knowledge, and access to genetic resources and benefit-sharing; additional relevant cross-cutting issues are introduced in Box 4.3.

Box 4.3 Other CBD cross-cutting issues relevant to botanic gardens

In addition to the GSPC, invasive alien species and ABS, botanic gardens can also make important contributions to the following CBD programmes:

Communication, education and public awareness (CEPA): seeks to communicate the scientific and technical work of the CBD, to integrate biodiversity into education systems, and to raise awareness of the importance of biodiversity to our lives and its intrinsic value. Botanic gardens offer enjoyment and learning and are perfectly placed to engage and inform the public about biodiversity.

Global Taxonomy Initiative (GTI): recognises that taxonomy is crucial to CBD implementation so tackles the 'taxonomic impediment' caused by lack of taxonomic knowledge and experts. Botanic gardens with active taxonomic research can contribute to GTI implementation through their GTI National Focal Point, or consider becoming the GTI National Focal Point.

Sustainable use of biodiversity: one of the CBD's objectives, also covered in the GSPC and Aichi Targets; this programme produced the Addis Ababa Principles and Guidelines. Botanic gardens can be powerful advocates for sustainable use of plant diversity by adopting sustainable management practices, by conducting research on sustainable uses of plants, and by raising public awareness of the issue.

Technology Transfer and Cooperation: helps countries to achieve equitable benefit-sharing and conduct their own research and development; the CBD website hosts a technology transfer database. Botanic gardens make use of many technologies and can offer technical advice, training opportunities, or funds for equipment and renovation to other gardens.

The Strategic Plan for Biodiversity 2011-2020 provides the framework for international and national action on biodiversity.

The CBD sets out general provisions and international targets but respecting countries' sovereign rights over their biological resources allows each country to determine how it will implement the CBD. Parties are expected to develop National Biodiversity Strategies and Action Plans (NBSAPs) as a starting point, and to update them in line with the Strategic Plan, integrating national targets that are based on the Aichi Biodiversity Targets. Then, depending on existing national circumstances, each country decides its actions to meet CBD goals. Countries provide updates on their implementation via periodic national reports.

4.4.3 Global Strategy for Plant Conservation (GSPC)

Originating from the botanic gardens community and adopted by COP in 2002, the Global Strategy for Plant Conservation (GSPC) is an international framework to support and facilitate plant conservation at all levels. It piloted the use of 16 measurable, time-limited, outcome-oriented targets in the CBD, organised in five objectives (Box 4.4).

A number of countries have developed national plant conservation strategies, with national targets relating to the 16 GSPC targets. There are also several regional responses, such as the European Plant Conservation Strategy, and regional GSPC implementation workshops in Southeast Asia and Central America.

Updated GSPC 2020 targets were adopted in 2010, for attainment by 2020. The GSPC targets provide more focus to aid practical implementation by plant conservation stakeholders (Case study 4.2) than do the much broader Aichi Biodiversity Targets, but botanic gardens that wish to have their GSPC actions and accomplishments noted by national authorities and the CBD via National Reports may need additionally to relate them to the corresponding Aichi Biodiversity Targets (see also Box I Introduction).

Box 4.4 Objectives and targets of the Global Strategy for Plant Conservation (GSPC)

Objective I: Plant diversity is well understood, documented and recognized

Target 1: An online Flora of all known plants.

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

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

Objective II: Plant diversity is urgently and effectively conserved

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

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

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

Target 7: At least 75 per cent of known threatened plant species conserved *in situ*.

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

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

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

Objective III: Plant diversity is used in a sustainable and equitable manner

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

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

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

Objective IV: Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on earth is promoted

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

Objective V: The capacities and public engagement necessary to implement the Strategy have been developed

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

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

CASE STUDY 4.2

Botanic gardens hitting the targets: examples of GSPC actions

Kate Davis, Ottawa, Canada

The GSPC's success depends on local, national and international partnerships between many actors: botanic gardens, government agencies, non-governmental organisations and communities. Recent examples of botanic garden involvement include:

Target 1: The World Flora Online project involves botanic gardens worldwide in a growing consortium, spearheaded by the Missouri Botanical Garden, the New York Botanical Garden, the Royal Botanic Garden Edinburgh and Royal Botanic Gardens Kew. It is bringing together existing resources and collecting and generating new information to build an open access compendium of all known plants.

Target 8: The Millennium Seed Bank Partnership is the largest ex situ plant conservation programme in the world. Led by RBG Kew, it involves a network of partners including many botanic gardens in 80 countries, and aims to save 25% of species with bankable seeds by 2020.

Project Budburst. (Image: Carlye Calvin)

Targets 2, 7 and 8: The Zero-extinction Project, led by the Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences, addresses the loss and fragmentation of highly biodiverse forest in Xishuangbanna, and aims to reduce plant extinctions to zero over a five year period. After initial assessments, field surveys are checking the endangered and data-deficient species (T2) and identifying unprotected forest fragments of high conservation value to be recommended for addition to the protected area system (addressing T5 and T7). Seeds of endangered and vulnerable species will be collected for storage in the XTBG seed bank or grown in the living collections (T8).

Targets 3, 8, 14 and 16: The Phoenix-2014 Project involves 16 botanic gardens, seed banks and plant conservation centres in the Asociación Iberomacaronésica de Jardines Botánicos. It aims to develop protocols for the germination and cultivation of endangered and endemic species in Spain (T3), to optimise the timing for re-introduction to their natural habitats, to cultivate and exhibit selected species in botanic gardens (T8) and to develop plans for public awareness of these endangered species and the problem of biodiversity loss (T14). The project also builds partnerships in the national network (T16).

Target 4: The Ecological Restoration Alliance of Botanic Gardens brings together botanic gardens, arboreta and seed banks on six continents in a plan to restore damaged, degraded or destroyed ecosystems in biologically and culturally diverse contexts.

Targets 5 and 13: As part of the Micronesia Challenge, a regional conservation programme that aims to preserve the natural resources crucial to the survival of Pacific traditions, cultures and livelihoods, New York Botanical Garden scientists are collaborating with local researchers to document plants and their traditional uses, with the goal of identifying key habitats for conservation (addressing Target 5) and producing a checklist of vascular plants, an ethnobotanical manual, and a primary healthcare manual based on traditional plant medicines (T13).

Targets 14 and 16: Project Budburst, led by Chicago Botanic Garden and involving other botanic gardens as well as wildlife refuges, national parks and community partners (T16), is a network of people across the United States who monitor plants as the seasons change, engaging the public in the collection of plant phenological data (T14), to learn more about the responsiveness of species to climate change.

4.4.4 Invasive Alien Species (IAS)

The spread of alien, or non-native, invasive species is one of the most important drivers of biodiversity loss. The CBD (in Article 8(h)) determines that Parties should prevent the introduction of, and control or eradicate those alien species that threaten ecosystems, habitats or species. GSPC Target 10 and Aichi Biodiversity Target 9 call for effective management plans for invasive species. Many global and national organisations are tackling invasive species issues; cooperation between core international organisations (including CBD and CITES) is facilitated by the Inter-agency Liaison Group on Invasive Alien Species. A number of countries maintain lists of known invasive species, and there are also global information resources that can be used by botanic gardens to find out about invasive species, share information and develop partnerships, such as the Invasive Species Compendium, the Global Invasive Species Database and the Global Invasive Species Information Network.

4.4.5 Traditional Knowledge, Innovations and Practices (TK)

As biodiversity loss accelerates, traditional communities that have lived closely with, used and managed such resources for thousands of years are also under threat, as are the knowledge, innovations and practices (often abbreviated to 'TK') that they have developed. The CBD recognises that TK of indigenous and local communities relevant for the conservation and sustainable use of biodiversity should be respected, preserved and maintained with the approval and involvement of the holders (Article 8j). The GSPC's Target 13 emphasises the importance of TK for sustainable livelihoods, local food security and health care. Aichi Biodiversity Target 18 further points out that TK should be fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels. The Nagoya Protocol covers the sharing of benefits from utilisation of TK associated with genetic resources. The Tkarihwaié:ri Code of Ethical Conduct (SCBD, 2011a) was adopted in 2010 as a model to assist the development of codes of ethical conduct for research, access to, use, exchange and management of information concerning TK for conservation and sustainable use for different countries', communities' and stakeholders' circumstances. The code sets out general ethical principles (e.g. transparency, prior informed consent and/or approval and involvement, and benefit-sharing), specific considerations (e.g. recognition of community social structures, repatriation of information, and supporting communities' research initiatives) and methods (e.g. negotiations in good faith, participatory approach and reciprocity).

4.4.6 Botanic Gardens and the CBD

KEY MESSAGE

Botanic gardens can be the problem or the solution: accept and dispose of plants carefully, monitor collections for signs of invasiveness, and share information.

As with CITES, the CBD is of major relevance to the work:

Participation in the CBD process: Botanic gardens can participate actively in CBD meetings as government representatives or observers at COP, SBSTTA and other CBD meetings, and can potentially play a role as a National Focal Point for programmes such as the Global Strategy for Plant Conservation or the Global Taxonomy Initiative. Botanic garden personnel are included in the IPBES Task Forces and Expert Groups.

Global Strategy for Plant Conservation (GSPC): The GSPC provides the clearest framework for CBD implementation by botanic gardens, except for the complex issue of ABS (Section 4.5). Botanic gardens are at the forefront of implementing many of the GSPC targets, especially those on taxonomy, development of protocols for conservation and sustainable use, *ex situ* conservation, education and public awareness and capacity-building. Countries with botanic garden-based GSPC National Focal Points currently include Belgium, Brazil, Canada, China, Colombia, Finland, France, Honduras, Ireland and Russia. The

Tree nursery at Brackenhurst Botanic Garden, Kenya, part of a larger project to restore native trees in the Kenyan Highlands, addressing GSPC targets on ecological restoration, important areas of plant diversity and integrated in and ex situ conservation. (Image: BGCI)

Global Partnership for Plant Conservation (GPPC), which includes many botanic gardens, provides coordination to support international and national GSPC implementation. BGCI has produced a GSPC Toolkit that includes a simplified guide (Sharrock, 2011) and a website to provide updated information and resources for each target.

To take action on the GSPC, botanic gardens should:

- Find out about and participate in GSPC-related international and national network initiatives;
- Include GSPC targets in the botanic garden's institutional policy and use them to focus activities;
- Report progress to GSPC National Focal Points, BGCI and national botanic garden networks;
- Educate staff about the GSPC and encourage them to find opportunities to share knowledge and develop partnerships;
- Publicise the GSPC and CBD via displays and education.

Invasive species: Many invasive plants have been introduced as ornamental plants and therefore owe their introduction to botanic gardens and nurseries. Botanic gardens need to be aware of their responsibilities to prevent future invasions. Several codes of conduct have been developed by and for botanic gardens, for example the Invasive Plant Species Voluntary Code of Conduct for Botanic Gardens and Arboreta and the European Code of Conduct for Botanic Gardens on Invasive Alien Species.

To take action on invasive species, botanic gardens should:

- Find out about local/national/regional guidelines and policies;
- Address the issue in the institutional policy by endorsing a code and/or by setting out specific measures to be taken, e.g. avoiding known invasives, monitoring plants for signs of invasiveness, conducting risk assessments, disposing of unwanted plant material carefully, sharing information, educating visitors, and refraining from supplying invasive plants via plant sales or *Indices seminum* (Chapter 3, Section 3.4.3);
- Ensure all botanic garden staff are aware of the issues and problems posed by invasive plants.

Traditional knowledge: Botanic gardens can play a valuable role in raising awareness of TK and helping to promote and preserve TK, but must be mindful of their responsibilities to involve and acknowledge TK holders. Botanic gardens with ethnobotanical research programmes or that share information on traditional knowledge should work within relevant codes of conduct, community protocols and customary laws. The International Society of Ethnobiology's Code of Ethics is a useful tool for botanic gardens.

To operate responsibly and ethically with respect to TK, botanic gardens should:

- Find out about national and customary laws on TK and indigenous and local communities;
- Comply with relevant codes of practice and/or community protocols and the ethical principles of the Tkarihwaié:ri Code of Ethical Conduct;
- Conduct research and share information with the approval and involvement of communities;
- When working with TK already in the public domain, consider how to acknowledge and share benefits with the original knowledge-holders.

4.5 THE NAGOYA PROTOCOL ON ACCESS TO GENETIC RESOURCES AND THE FAIR AND EQUITABLE SHARING OF BENEFITS ARISING FROM THEIR UTILISATION

The Nagoya Protocol (SCBD, 2011b) is a treaty under the CBD that focuses on the implementation of the CBD's third objective, the fair and equitable sharing of benefits that arise from utilisation of genetic resources. It also covers traditional knowledge associated with genetic resources. The Protocol came into force on 12 October 2014. Its governing body is the Conference of the Parties serving as the meeting of the Parties to the Nagoya Protocol (COP-MOP).

4.5.1 Access and Benefit-Sharing (ABS) in the CBD and the Nagoya Protocol

KEY MESSAGE

The ABC of ABS: Access (to genetic resources), Benefit-sharing (from utilisation) and Compliance (with national laws).

The CBD's core provisions on access to genetic resources and benefit-sharing (ABS), which apply to post-CBD material (obtained after the CBD came into force on 29 December 1993), are that:

- Access is subject to the 'prior informed consent (PIC)' of the provider country (i.e., intended uses need to be declared up-front), unless the provider country determines otherwise;
- Access should be on 'mutually agreed terms (MAT)' (agreed between provider and user);
- Benefits from utilisation of genetic resources should be shared fairly and equitably with the provider country.

These provisions (set out in CBD Article 15) have been interpreted very differently by different countries. The voluntary Bonn Guidelines (SCBD, 2002) provide more detail but were felt to be too weak to ensure benefit-sharing; consequently, the legally-binding Nagoya Protocol was developed.

The Nagoya Protocol provides a detailed framework for ABS implementation, including new measures to ensure that users are complying with provider countries' laws and MAT. ABS obligations thus depend both on the laws of the countries providing genetic resources and on the laws of the countries where resources are utilised. Countries that require PIC must have clear and fair procedures for granting it, involving local communities where relevant. The Protocol also sets out requirements for users to gain PIC or the approval and involvement of the indigenous and local communities that hold traditional knowledge, to establish MAT with them and to share benefits with them. ABS National Focal Points provide ABS information to applicants and Competent National Authorities are responsible for granting access or providing evidence that access requirements were met; their details and other national ABS information are made available via the ABS Clearing House (ABS CH).

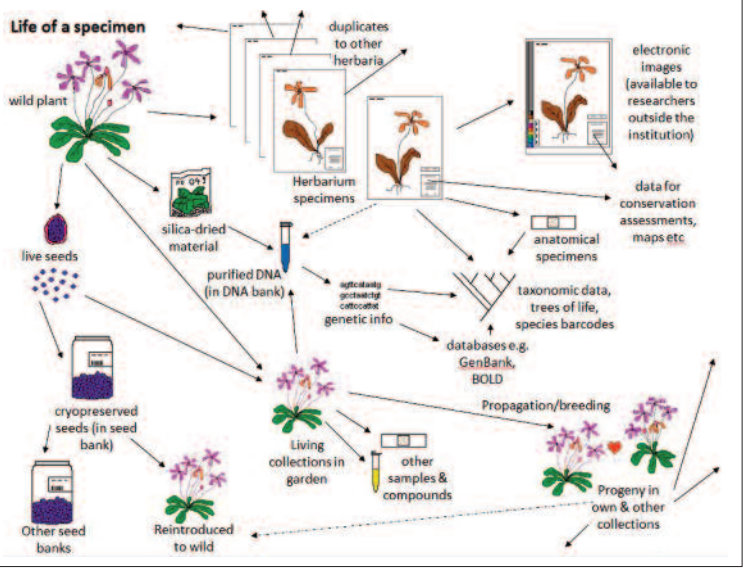
The Protocol defines 'utilisation' as research and development on the genetic and/or biochemical composition of genetic resources. Much non-commercial research (e.g. molecular systematics) is covered, though countries are meant to encourage such research, for example via simplified access measures. The Protocol requires the 'monitoring of the utilisation of genetic resources', with designated 'checkpoints' in each country to collect information to check that PIC has been obtained and MAT established (countries decide for themselves the nature of the checkpoints, e.g. patent offices, research funding agencies). Internationally recognised certificates of compliance (trackable permits with details of PIC and MAT) serve as evidence of compliance with provider country laws, and will be posted on the ABS CH. The Protocol encourages different sectors to develop voluntary measures such as 'guidelines and codes of conduct', and 'model contracts'; these will also be posted on the ABS CH.

4.5.2 Botanic Gardens and ABS

As users and providers of genetic resources, botanic gardens must be aware of their responsibilities and relevant laws when acquiring, using and providing plant material and associated traditional knowledge to other botanic gardens, academic and commercial sectors and the public – whether or not an institution is situated in a country that is a Party to the Nagoya Protocol. Botanic gardens collecting or requesting wild-collected plant material originally gathered on or after 29 December 1993 should have records demonstrating that the material was obtained according to the national laws or policies of the country providing the resource.

PIC, MAT and monitoring: For CBD and Nagoya Protocol compliance, botanic gardens need to obtain PIC (if required) and establish MAT with providers. Parties to the Protocol will be issuing internationally-recognised certificates to serve as evidence of users gaining PIC and establishing MAT, and their checkpoints will expect to see evidence of those certificates at later stages. Model agreements can be used to set out MAT (e.g. Biber-Klemm *et al*., 2016). Post-Nagoya, botanic gardens will need to document exchanges and uses of material (Figure 4.1) – particularly

Figure 4.1 Life of a specimen



Life of a specimen: the 'chain of use' is not linear. Botanic gardens should keep information about the original provider and terms of use linked with material, however the material has been sampled and wherever it moves. (Image: Kate Davis)

'utilisation' of genetic resources – thoroughly, for example by using Material Transfer Agreements (Chapter 3, Section 3.6.1) to communicate terms and keeping links to any permits, agreements and internationally-recognised certificates. Increasingly, *ex situ* collections will be expected to use unique identifiers to assist in the tracking of genetic resources (e.g. IPEN numbers (Box 4.5)). Botanic gardens will need to ensure that their data management systems can handle ABS-related information (Chapter 5, Section 5.2). Some botanic gardens are depositing records with their ABS National Focal Point (NFP) of all their pre-Nagoya collections so that it will be clear in future which material is potentially outside the scope of the Protocol.

KEY MESSAGE

Don't pick without PIC and keep track of terms, materials, uses and benefit-sharing. A policy, data management system and staff training are key ABS tools.

Benefit-sharing: Botanic gardens can share a huge range of benefits, though many arise through partnerships rather than through actual utilisation of genetic resources. Possible benefits include: joint expeditions, collaborative research, sharing research results; sharing taxonomic and/or horticultural knowledge and resources; staff exchanges, training courses, workshops; sharing educational materials; technical support; donations of equipment; access to collections, databases and publications; sharing results with communities; helping to establish local gardens/microenterprises; and monetary benefits, e.g. direct financial contributions to partners, access fees, salaries, and royalties/licences in case of commercialisation projects. It is a good idea to document shared benefits (and report them to NFPs) to demonstrate commitment to the CBD's objectives and build trust with partners and their governments.

Box 4.5 ABS policy-building tools for botanic gardens

The Principles on ABS offer a one-page general framework to help botanical institutions develop a customised policy to cover all of their ABS-related activities. They can be used to cover living and preserved collections and non-commercial and commercial uses. They provide concise guidance on getting PIC from *in situ* conditions and *ex situ* collections; outline procedures for the use, exchange and supply of material, and responsibilities for benefit-sharing; and stress the importance of documentation for curation and tracking.

The International Plant Exchange Network (IPEN) provides a system to facilitate the exchange of living plants for non-commercial purposes. IPEN member botanic gardens sign and abide by the IPEN Code of Conduct, which sets out responsibilities for acquisition, maintenance and supply, and associated benefit-sharing. The first botanic garden to introduce an accession to IPEN keeps full documentation linking the accession to the original provider (PIC and MAT), and assigns an IPEN number, a unique identifier that encodes provider information and travels with the material. Transfers outside IPEN require an IPEN Material Transfer Agreement, and, for uses not covered by the Code of Conduct, new PIC from the country of origin.

The CETAF Code of Conduct and Best Practices is a post-Nagoya ABS tool developed by European museums and botanic gardens. It offers a Code of Conduct, based upon the Principles but comprehensively updated to assist compliance with the Nagoya Protocol. Several annexes provide more detail and support for the implementation of the Code: best practices, a statement on use of material (for institutions seeking PIC from providers), templates for material transfer agreements, and a glossary. This tool provides helpful guidance that is tailored to the needs of taxonomic research institutions but can also assist other institutional types.

A botanic garden's collection policy (Chapter 3) should reflect the ABS responsibilities that arise from the institution's living and preserved collections, its research and horticultural activities, and its partners. The policy should also indicate how pre-CBD (accessed before 29 December 1993) and pre-Nagoya (accessed before 12 October 2014) material will be handled. Though PIC may not have been required before the CBD, it is good practice to consider benefit-sharing for resources accessed pre- and post-CBD. Botanic gardens have developed several voluntary initiatives to guide ABS policy and practice (Box 4.5 and Case study 4.3). For basic ABS compliance, botanic gardens should:

- Find out about national ABS laws, procedures, authorities and relevant stakeholders in the botanic garden's country and in countries where it conducts work and, if traditional communities are involved, about relevant customary laws, codes of practice and community protocols;
- Address ABS in institutional policy (e.g. by using the policy frameworks referred to in Box 4.5);
- Always get appropriate PIC and MAT detailing how the material will be used back at the institution (never assume permits can be shared between institutions);

- Use written documents to record PIC and MAT (e.g. permits, benefit-sharing agreements, internationally-recognised certificates of compliance, Material Transfer Agreements);
- Use and transfer material only as those terms allow (new PIC may be needed if the original terms do not cover a new use or a different user);
- Train staff, associates and volunteers, and assign ABS responsibilities regarding how acquisitions and transfers will be handled;
- Share benefits;
- Keep track of terms and, as far as possible, use, transfer and benefit-sharing.

CASE STUDY 4.3

Compliance with CBD and ABS provisions – Royal Botanic Garden Edinburgh, United Kingdom

Kate Hughes and David Rae, Edinburgh, United Kingdom

The Royal Botanic Garden Edinburgh (RBGE) uses a range of tools to ensure that its extensive collections of living plants, herbarium specimens, DNA and pollen specimens are managed in compliance with the CBD.

Policy: RBGE's Collection Policy (Rae *et al.*, 2006), distributed to all staff, lays down the rules of engagement, regulations and procedures to be followed by all staff and associated workers, and states RBGE's commitment to comply with both the law and spirit of the CBD and GSPC. RBGE has endorsed the Principles on ABS and is a member of IPEN.

Agreements and permits: All wild collections are made and brought to the botanic garden with the appropriate permits. RBGE has Memoranda of Understanding with a number of overseas botanical and research institutes, typically including agreement to share collections, to provide and attend training sessions, to publish the outcomes of collaborations jointly and, importantly, to act within the CBD.

Database: All plant material is given a unique identifying number allocated by the centralised plant record system (BG-BASE software) on entry to the collection, whether herbarium, living or DNA material, and regulatory documents such as permits, phytosanitary certificates and plant passports are permanently linked to the relevant accessions in the database (which can also be used to record publications and studies generated from plants and samples). New herbarium specimens are barcoded but a backlog of non-barcoded historic material remains.

An example of benefit-sharing: Royal Botanic Garden Edinburgh staff demonstrating Rhododendron propagation at Cibodas Botanic Garden, Indonesia. (Image: BGCI)

Material Transfer Agreements (MTAs): RBGE publishes a catalogue online so that organisations and individuals can request plant material. A 'Conditions of use' form must be completed before material is released (RBGE, 2014a; 2014b). An IPEN number is generated for material destined for IPEN botanic gardens. The IPEN number and/or the Conditions of Use form serve as MTAs. The plant record system links these MTAs to accessions so that RBGE can keep track of all material which has been sent out. RBGE's shop only sells commercially available plants, not wild collected material.

Benefit-sharing: Benefits frequently result from years of inter-institutional staff collaboration. For example, an RBGE staff member is a professor at the University of Bogota, resulting in a number of Colombian PhD studies being completed in Edinburgh, supporting Colombian botanical research. RBGE also has long-standing working relationships with several botanical institutions in Chile, resulting in many Chilean collections at RBGE and extensive experience in cultivating Chilean species. In early 2014, collaborators in Chile sent spores of an endangered fern to RBGE to establish horticultural protocols for the species which can then be used in Chile. Similarly many Chilean individuals have travelled to Edinburgh to study the cultivation of Chilean and other flora with the prospect of applying this knowledge on their return.

Other benefit-sharing examples include joint expeditions, delivery of training workshops and courses, study visits to RBGE by partners, and the publishing and distribution of resources such as books, field guides and websites. Projects have also included the testing of ABS protocols for the commercialisation of selected plant species, covering issues of prior informed consent, monetary benefits and monitoring of material transfer from the provider country to the UK.

Rice farming in Ninh Binh, Vietnam. Oryza is one of the crops listed on Annex 1 of the ITPGRFA. (Image: Kate Davis)

4.6 THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (ITPGRFA)

The CBD is not the only international treaty to address ABS. The objectives of The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the Food and Agriculture Organisation of the United Nations are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of benefits arising out of their use, in harmony with the CBD, for sustainable agriculture and food security.

4.6.1 The Multilateral System

KEY MESSAGE

The Multilateral System facilitates access to certain crop species for conservation, research, breeding and training for food and agriculture only – not for other purposes.

The ITPGRFA was negotiated by the Commission on Plant Genetic Resources and came into effect in 2004. It establishes a 'Multilateral System (MS)' to facilitate the exchange of 64 food and forage crop species listed in its Annex 1 (crops that account for around 80% of human consumption). Parties to the Treaty may use the MS to access these materials in other Parties' gene banks in the public domain, for research, breeding and training for food and agriculture purposes only. Exchanges within the MS use the Treaty's 'Standard Material Transfer Agreement (SMTA)'. Users agree to share freely any new developments for further research, or, if they wish to restrict material derived from the MS (for example by using plant breeder's rights or a patent), they agree to pay a percentage of commercial benefits into a common Benefit-sharing Fund, for use by farmers in developing countries. Unlike the CBD, there is no distinction between pre- or post-ITPGRFA material: Parties are invited to include all Annex 1 material that is under their control and in the public domain. The ITPGRFA also encourages private collections and non-Parties to place Annex 1 material into the MS.

4.6.2 Botanic Gardens and the ITPGRFA

Botanic gardens, especially those with seed banks, need to know when plant exchange should use the ITPGRFA system rather than national CBD or Nagoya Protocol systems.

Botanic gardens should use the SMTA for exchanges of material (rather than another MTA) if:

- The material is from Annex 1; and
- It is requested for purposes related to food and agriculture, by a potential user in a Party to the Treaty; and
- The botanic garden is in a country that is Party to the Treaty, and its collections are considered to be in the public domain; or if it has agreed to include its Annex 1 materials in the MS.

The ITPGRFA promotes farmers' rights, and it provides for several different forms of benefit-sharing including information exchange, access to and transfer of technology, and capacity-building, as well as a funding strategy to help mobilise funds for small farmers. Botanic gardens are in an excellent position to educate the public on sustainable food production, and the conservation and use of crop wild relatives.

4.7 THE INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS (UPOV)

The International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organisation that provides a system of plant variety protection, 'breeder's rights', to encourage the development of new varieties of plants, for the benefit of society. UPOV was established by the International Convention for the Protection of New Varieties of Plants (the UPOV Convention). The UPOV Convention has been revised several times to reflect technological developments.

To be granted breeder's rights, a type of intellectual property right, a breeder needs to show that a variety (whether developed via conventional breeding or genetic modification) is novel, distinct, uniform and stable. When a variety is protected by a breeder's right, the breeder's authorisation is needed to propagate the variety for commercial purposes – for selling, marketing, importing and exporting, keeping stock of, and reproducing. In such cases, the breeder may require a licencing fee. Breeder's rights are granted for at least 20 years (25 years for tree or vine varieties). There are specific exceptions to this need for authorisation, such as use for experimental, private or non-commercial purposes.

Botanic gardens should be aware of any plants in their collections that are covered by breeder's rights so that they can comply with the terms on the plants.

4.8 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system. The treaty came into force in 1994. The UNFCCC contains no binding emissions limits and

no enforcement mechanism; it provides a framework for the negotiation of subsidiary treaties such as the Kyoto Protocol, which came into force in 2005. The Kyoto Protocol commits its Parties to internationally binding greenhouse gas (GHG) emission reduction targets, measured against 1990 levels. It requires heavier reduction targets for developed countries, and specifies commitment periods for those reductions (for emissions during 2008-2012, and during 2013-2020). UNFCCC negotiations have produced the non-binding Copenhagen Accord (2009) and Cancun Agreements (2010, at COP-16), which do not commit countries to Kyoto targets or a 1990 baseline, instead allowing developed countries to pledge reductions and developing countries to plan reductions. In 2011 (at COP-17), countries committed to the Durban Platform for Enhanced Action, which set out a process for negotiation of a new universal agreement to deal with climate change beyond 2020. In 2015, at COP-21, the Paris Agreement was signed, which is an enduring, legally binding treaty containing emission reduction commitments from 187 countries, starting in 2020. The Paris Agreement will enter into force once 55 countries covering 55% of emissions have acceded to it.

4.8.1 Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD+

The Kyoto Protocol focuses on action by developed countries to reduce emissions. However, forests store some 50% of terrestrial carbon, and their destruction and degradation result in the second largest source of global GHG emissions. Reducing Emissions from Deforestation and Forest Degradation (REDD) in developing countries is an effort to combat forest loss by providing incentives and rewards for reductions in deforestation. UNFCCC talks are gradually addressing REDD. The Cancun Agreements provide a preliminary REDD framework for developing countries. REDD was expanded in 2008 to REDD+, to include the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

The core elements of REDD+ were finalised and agreed to in 2013 and REDD+ is being developed and supported by many initiatives.

4.8.2 Botanic Gardens and Climate Change Action

Botanic gardens, as custodians of living plant diversity and as landscape managers, can play an increasingly critical role by working collaboratively and sharing their specialist expertise with local communities to mitigate and adapt to climate change. A botanic garden's policy may indicate how the institution will engage in climate change issues and actions, including what measures it will take to reduce carbon emissions from its own operations.

Botanic gardens can contribute significantly to REDD+ projects, for example by:

- Informing site selection at project planning stages by providing detailed species-level data;
- Identifying local livelihood issues in proposed sites and promoting wide stakeholder consultation;
- Conducting baseline biodiversity and carbon surveys, and carrying out forest monitoring;
- Sharing skills in forest survey and mapping techniques, species identification and taxonomy, forest management, climate modelling, and working with local communities;
- Sharing species selection knowledge, seed supply and propagation protocols for afforestation programmes;
- Carrying out phenological studies to monitor the impacts of climate change on plant behaviour.

Botanic gardens can also contribute their technical expertise, propagation and seed banking facilities and collections to assist communities to respond to and adapt to climate change-related landscape and food crises (Case study 4.4). More information on REDD+ and botanic garden participation is available from Probert *et al*. (2011), which includes a REDD+ checklist; (also see BGCI, 2012).

Natural forest giving way to tea plantations, Kenya. (Image: Barney Wilczak)

CASE STUDY 4.4

Collaborative seed production for a drought-stricken community, Project Semillatón – Jardín Botánico IB UNAM, Mexico

Robert Bye and Edelmira Linares, Mexico

Due to the exceptional drought that occurred in 2011 and 2012 in Chihuahua, the Rarámuri (Tarahumara) Indians faced a scarcity of native maize seeds for the 2013 planting cycle and subsequent food shortages. The Botanical Garden of the Institute of Biology, UNAM (Mexico) responded to the Rarámuri community's request for assistance in the conservation of their maize races. With financial support from the Mexican 'Gastronomic Family' administered through Foundation UNAM, the UNAM Botanical Garden initiated a conservation programme bringing together local NGOs (e.g. Rakema, agricultural producers) with government organisations (e.g. INIFAP-SAGARPA and CONANP-SEMARNAT). All parties share a commitment to the conservation of local food crop resources through increasing the supply of local seeds for subsequent sowing and supporting their in situ conservation.

The project's objectives were: (i) to multiply seeds of five races of native maize from the Sierra Tarahumara that had seriously diminished; (ii) to distribute these seeds to indigenous farmers and key mestizos of the Sierra Tarahumara for planting; (iii) to encourage seed conservation in community seed banks so that this seed could be used to replenish supplies in case of future crop failures; and (iv) to train key community members on rainwater harvesting and soil improvement.

Seeds of six races of native maize were obtained in collaboration with local NGOs and key farmers, and suitable land was rented. In 2012, 11 ha were planted with five land races. In 2013, a further 8 ha were planted with two of the previous land races plus a scarce, culturally valued land race. To ensure the purity of the land races, corn cobs were hand-harvested from the center of each plot and distributed directly to the beneficiary farmers. Ears from the marginal rows (subjected to pollination by outside pollen) were de-grained and distributed to communities in exchange for community service. INIFAP (National Institute of Agricultural and Livestock Research of Mexico) supervised the initial planting, while CONANP (National Commission of Protected Natural Areas) of the SEMARNAT (Secretariat of Environment and Natural Resources) distributed the multiplied seed to the communities in need.

In 2013, the maize seed was distributed to 54 dispersed communities located in five counties in western Chihuahua. 561 farmers (200 women and 361 men) received maize seed for planting and a further 2,234 people benefited indirectly. This resulted in 20,870 kg of seed being sown across an estimated 1,739 ha. UNAM Botanical Garden also conducted capacity-building workshops for the Rarámuri community on: creation, implementation and management of family and community seed banks; rainwater harvest; intensified cultivation of quelites (edible native green vegetables); and conservation techniques for native maize and quelites.

The project's success was influenced by factors such as: the rapid detection of the problem (due to regular contact between the botanic garden personnel and the collaborating communities); the efficiency, transparency and integrity of Foundation UNAM in administering the donations; timely multiplication of seed; respect for traditional values; use of traditional practices where feasible; distribution and delivery through traditional social organisation; acceptance of seed for planting because of its local origin; financing by Mexico's Gastronomic Family (Cultura Culinaria AC, Slow Food Mexico, Conservatorio de la Cultura Gastronómica de México, independent chefs and cooks, as well as the general public); and the integration of government agencies with specific actions at critical steps.

Three of the six maize races multiplied by Project Semillatón: 'maíz azul', which is preferred to prepared kobisi (pinole) and remeke (tortilla); 'cristalino amarillo, used for several purposes; and 'apachito', highly valued because of its precocity. (Image: Robert Bye)

The spikes and cane above the ears of the maize plants are removed after pollination and subsequently used as forage, while the mature maize ears are hand-harvested traditionally by the Rarámuri. (Image: Edelmira Linares)

4.9 AGENDA 21

4.9.1 A Plan for Sustainable Development

Agenda 21 is a comprehensive action plan for sustainable development into the 21st century, providing the basis for a global partnership to encourage cooperation at international, national, regional and local levels. It was adopted by 178 governments at UNCED in 1992. Unlike the Rio Conventions, it is a non-binding statement of intent rather than a treaty. Governments are responsible for Agenda 21 implementation through national strategies, plans, policies and procedures, but broad public participation and NGO involvement are critical. Agenda 21's 40 chapters, in four sections, each set out a programme area with four parts: the basis for action, objectives, activities and means of implementation. Chapter 28 on local authorities' initiatives in support of Agenda 21 has led to many local authorities consulting their communities and preparing a 'Local Agenda 21', based on local priorities.

4.9.2 Botanic Gardens and Agenda 21

Botanic gardens can substantially contribute to Agenda 21 and Local Agenda 21 in many of the same ways that they can help to implement other sustainability initiatives, such as the CBD. Regarding social and economic dimensions (Agenda 21's Section I), botanic gardens can help to provide opportunities for community enterprises, to combat poverty and contribute to economic development; for example, by helping to develop non-timber forest products, medicinal crops, or floricultural techniques. Botanic gardens also attract tourists, and can raise public awareness of development and trade issues and promote fair trade initiatives. Botanic gardens can contribute to conservation and resource management (Section II) initiatives, for example by working with local partners to manage and restore natural and protected areas and to support sustainable tourism, and also by supporting equitable and sustainable use of biodiversity. Botanic gardens can also help to strengthen the role of major groups such as women, children, indigenous people, NGOs and the scientific community (Section III) via community projects and by providing a conduit and location for debates and communication. Botanic gardens also offer many means of implementation for sustainable development (Section IV), including environmental education programmes and training.

Botanic gardens can support Agenda 21 and other sustainability initiatives by:

- Finding out about, supporting and encouraging implementation of their government's national and local sustainable development policies;
- Developing an institutional policy on sustainable development, covering sustainable horticultural practices, low-impact resource use and equitable sourcing;
- Supporting the needs and interests of visitors and the local community;
- Collaborating with local partners to address plant conservation and sustainable living;
- Sharing materials and expertise in networks and participating in international partnerships.

For many practical examples showing how botanic gardens are contributing to Agenda 21, and a detailed checklist, see Anon., 1999.

Engaging visitors at the 'Wall of hopes' in the Bioenergy Garden, Xishuangbanna Tropical Botanical Garden (XTBG), showing various seeds of species with bioenergy potential in heart-shaped glass bottles. (Image: XTBG)

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