Technical background document in support of the mid-term review of the Global Strategy for Plant Conservation (GSPC)

Compiled by Botanic Gardens Conservation International (BGCI) in association with the Global Partnership for Plant Conservation (GPPC) and the Secretariat of the Convention on Biological Diversity

Contents

Introduction

The conservation of plant species depends on the implementation of effective policies and supportive decision making. In 2010, at the 10th meeting of the Conference of the Parties to the CBD, an updated Global Strategy for Plant Conservation (GSPC) was adopted through Decision X/17. In the same Decision, it was agreed that the GSPC should be implemented in the framework of the Strategic Plan for Biodiversity and that the GSPC targets should be incorporated into updated and revised National Biodiversity Strategies and Action Plans (NBSAPs)[1]. To date, relatively few countries have done this and plant conservation activities are therefore not always well integrated into national biodiversity policies. Furthermore, inadequate linkages between on-the-ground plant conservation practitioners and governmental reporting process means that inspiring activities and encouraging progress towards GSPC targets are not fully captured in national biodiversity reports.

This report provides information on progress in GSPC implementation at the national and global levels based on information provided mainly by members of the Global Partnership for Plant Conservation[2], but also incorporating information from 5th National CBD reports, National Biodiversity Strategies and Action Plans (NBSAPs) and other sources where this is available. A list of major contributors is provided at the end of this report and full list of GPPC members is available in Annex 1.

This report covers the period 2011-2013. The report is divided into three sections:

- **Section 1**: provides information on **national / regional** responses to the GSPC (pages 6-12)
- **Section 2:** focuses on a review of progress **target by target**. Each GSPC target is presented in detail, with an overview section providing an introduction to the target and a brief assessment of progress. This is followed by details of individual actions and case studies that contribute to the achievement of the target (pages 13-84)
- **Section 3**: provides a summary of progress towards the GSPC targets, with linkages made to the relevant Aichi target (pages 85-89).

[1] http://www.cbd.int/decisions/cop/?m=cop-10

[2]The Global Partnership for Plant Conservation brings together international, regional and national organisations in order to contribute to the implementation of the GSPC. The partnership aims to provide a framework to facilitate harmony between existing plant conservation initiatives, identify gaps where new initiatives are required, and promote mobilization of the necessary resources. The GPPC presently includes 49 members.

Section 1: Progress in national / regional implementation of the GSPC

The GSPC and National / Regional Biodiversity Strategies and Action Plans

By mid May 2014, the Secretariat of the Convention on Biological Diversity had received updated National Biodiversity Strategies and Action Plans from 24 Parties and a Regional Biodiversity Strategy from the European Union. These strategies provide ample evidence of the socio-economic and cultural Importance of plant diversity, levels of endemism and diversity, uses and threats to plants. Given the multiple links between the 16 targets of the GSPC and the 20 Aichi Biodiversity Targets[3] the majority of targets evidenced in the 23 National/Regional Biodiversity Strategies and Action Plans apply to plants as an integral part of biodiversity but do not always identify plant-specific targets or relevant stakeholders for activities related to plant conservation.

However, six of these strategies do make an explicit reference to GSPC (Belgium, DPR Korea, Finland, Ireland, Italy and Spain). Moreover, five of the 23 Parties have distinct national/regional plant conservation strategies (Colombia, European Union, Japan, Spain and United Kingdom).

Almost all Parties identify national (or regional) targets or activities that explicitly or implicitly relate to selected targets of the Global Strategy for Plant Conservation (Table 1).

Table 1: Activities that relate to GSPC targets as mentioned in National / Regional Biodiversity Strategies and Action Plans

GSPC Target / Country	4	5	6	7	8	9	10	11	12	13	14	16
Belarus		x		x								
Belgium					x			x				
Cameroon		x	x			x		x	x			
Colombia				x	x							
DPR Korea		x	x								x	
Dominica				x					x			
Dominican Republic				x						x		
England	x	x	x	x		x	x				x	x
EU			x				x					
Finland			x	x	x	x	x				x	
France			x	x	x							
Ireland	x	x		x	x		x	x				
Italy					x	x						x

[3] See Annex 4 of report of the fourth meeting of the Liaison Group on the Global Strategy for Plant Conservation http://www.cbd.int/doc/meetings/pc/gspclg-04/official/gspclg-04-02-en.pdf

Japan						x						
Malta						x					x	
Myanmar					x	x	x	x				
Serbia		x			x	x					x	
Surinam	x		x	x					x	x		
Switzerland	x			x		x	x				x	x
Timor Leste	x											
Tuvalu						x				x		
Venezuela					x							

Among the major stakeholders referred to as partners in implementing plant conservation targets are botanical gardens, seed banks and other *ex situ* collections, the agricultural and forestry sectors and phytosanitary services. Key processes referenced include the work of the Commission on Plant Genetic Resources for Food and Agriculture, the International Treaty for Plant Genetic Resources for Food and Agriculture, the International Plant Protection Convention and the Convention on the International Trade in Endangered Species of Fauna and Flora.

Progress in plant conservation as reported in 5th National Reports to the CBD

As of May 22nd, 58 countries had submitted their 5th National Reports to the CBD. A review of the 54 English-, French- and Spanish-language reports reveals that 37 make no mention of the GSPC at all, and six reports have mentions of the Strategy which are somewhat brief or entirely superficial, with no meaningful discussion of how its targets have been met. However, the remaining 11 national reports[4] go into some detail on the GSPC, often giving a target-by-target review of progress since the 4th National Reports in annexes or appendices, along with other such cross-cutting initiatives. Some National Reports were analysed in greater depth, allowing a comparison to be drawn between the conservation actions they detailed and the targets of the GSPC. Plant-specific conservation activities are discussed in many of the National Reports, including ones which do not specifically mention the GSPC.

Efforts to document countries' botanical diversity and assess the threats it faces (GSPC targets 1 and 2) were regularly mentioned. Some countries (e.g. Madagascar, China and Pakistan) have their national Floras available online, whereas others highlighted surveys and taxonomic work underway which will improve the knowledge of the country's plant diversity – Malaysia's Heart of Borneo initiative and Australia's Bush Blitz being examples. Red Lists and species conservation assessments were also commonly mentioned in the National Reports: many countries have national lists or databases of threatened species and several have IUCN-standard Red Lists for their entire known flora.

However, the format of the National Reports can render extracting further information about plant-specific conservation activities difficult. Conservation measures were mentioned in all reports, but while

[4] Countries which discussed their contribution to the GSPC were the United Kingdom, Italy, Australia, Namibia, China, Pakistan, Myanmar, Madagascar, Cameroon, Niger and Cuba.

the botanical focus of *ex situ* conservation (GSPC targets 8 and 9) was frequently evident – including germplasm banks for crop wild relatives, threatened species and native plants – it was generally less clear with discussions of *in situ* activities (Targets 5 and 7). These are often set out at landscape-level without reference to specific taxa (e.g. the conservation of habitat types such as grasslands and forests). Similarly with conservation-oriented legal frameworks, action plans and policies, these would likely benefit plant species, but as this is not discussed at species level the picture of national progress in plant conservation as described in National Reports is somewhat incomplete. Annex 2 provides an overview of activities that relate to specific GSPC targets as reported in selected National Reports.

Reviews from regional workshops

In CBD Decision X/17, the Conference of the Parties requested the CBD Secretariat to organize regional capacity building and training workshops on national, subregional and regional implementation of the GSPC. In response to this request, three regional workshops (Southern and Eastern Africa; Spanish-speaking Caribbean and Central America; and South East Asia) have been organised by **Botanic Gardens Conservation International** (BGCI) in partnership with the **CBD Secretariat** since 2010. These workshops aimed to help GSPC focal points understand the linkages between the GSPC and Strategic Plan for Biodiversity 2011-2020, so that plant conservation targets could be incorporated into updated NBSAPs[5]. During these workshops, progress at the national level towards the GSPC targets was reviewed and the results are provided in Annex 3. It can be seen that, in general:

- In the **Caribbean/Central America**: good progress is being made towards Targets 1, 5, and 11 while progress towards Targets 2, 6, 8, 9 and 13 is slower.
- In **South East Asia**: good progress is being made towards Targets 4, 7 and 14, while progress towards Targets 6, 8, 12 and 13 is slower.
- Countries in **Southern and Eastern Africa** reported variable progress in plant conservation activities, but particularly noted a lack of supportive policies and a lack of capacity to achieve the targets.

Progress in China[6]

The Chinese Strategy for Plant Conservation (CSPC) was adopted in 2008 as a joint initiative of the **Chinese Academy of Sciences, the State Forestry Administration** and **the State Environmental Protection Agency**[7]. In late 2011, a review of progress in implementing the CSPC was carried out by BGCI[8]. Focussing on the implementation of CSPC Targets pertaining directly to *in* and *ex situ*

[5] Reports of the workshops are available to download: http://www.plants2020.net/regional-strategies/
[6] See also Hong, D-Y. & Blackmore, S. (Eds) 2013. *Plants of China – A companion to the Flora of China*. Science Press (Beijing). ISBN 978-7-03-038574-1
[7] http://www.bgci.org/china_en/2022/
[8] http://www.bgci.org/resources/news/0940/

conservation (Targets 7 and 8), this analysis also considered progress made in interrelated CSPC objectives including Targets 1, 2, 14, 15 and 16. The review noted that tremendous and commendable efforts to safeguard the country's extraordinarily rich and diverse botanical wealth had been undertaken by numerous CSPC stakeholders These included an enhanced network of sites and people dedicated to *in situ* and *ex situ* conservation and a multi-volume Chinese flora, giving evidence of both China's plant diversity and botanical expertise, and many other projects and programmes to strengthen conservation capacity, education and public outreach. However, as elsewhere in the world, enormous conservation challenges continue to constrain progress in securing China's plant diversity for future generations. The analysis offered a number of recommendations on how to address these challenges:

- Strengthening the linkages between *in* and *ex situ* conservation at species and ecosystem levels, as well as stakeholder and policy levels.
- Improving national coordination of *ex situ* collection policies and curatorial efforts to secure conservation and research value.
- Enhancing partnerships between scientists, conservationists and education specialists to promote a new generation of amateur botanists and naturalists.
- Ensuring close linkages of CSPC stakeholders with policy and decision makers who influence and negotiate national and global conservation and development objectives.

Progress in Brazil

The nomination of Dr. Gustavo Martinelli as the focal point of the Strategy in Brazil, was the first step towards its implementation in the country. After that, the creation of the National Centre for Flora Conservation – CNCFlora, and the idea of having its objectives and actions based on the GSPC, built a strong baseline for mainstreaming flora conservation in Brazil. Since its creation, CNCFlora has focused efforts on achieving advances in five specific GSPC targets: 1, 2, 3, 15 and 16. In April 2013 CNCFlora created the Action Planning Project to work on Target 7, focusing on planning actions for *in situ* conservation of threatened plant species.

CNCFlora has also been assisting scientists from the Humboldt Institute, Colombia develop and implement a national Red Listing process for the country (See Target 2). The Brazilian Red Listing Project has also helped the Zoobotanic Foundation from Rio Grande do Sul state to achieve their goal of assessing the state's flora. Furthermore, the Action Planning Project has acted as adviser for the Arboretum program from Bahia state in northeastern Brazil, identifying species to be included for forest restoration in this region and instructing on how to do so.

Progress in Europe

In early 2014, Plantlife, Planta Europa and BGCI in Europe surveyed their members and partners to assess national implementation of the Global and European Plant Conservation Strategies[9]. The initial analysis of over 80 respondents (covering 37 European countries, including Turkey and Armenia) indicates that the most progress has been made in targets covering *ex situ* species conservation (Target 8), the development of check lists (targets 1 and 2) and awareness raising (Target 14). The target areas with the least progress (according to survey respondents) are those which require cross-sectoral engagement, specifically - sustainable management of production lands (Target 6) and ensuring the sustainable sourcing of wild plant products (Target 12). Despite numerous innovative raising awareness activities there is still concern that decision makers do not yet understand the fundamental importance of conserving plants.

Some key facts and statistics from the survey include the following:

- 95% of European countries have national floras and threatened species lists – all covering vascular plants, but some also including bryophytes, fungi, lichens and algae. Nearly 50% of these are on line. Gap filling is needed for Montenegro, Macedonia FYR and Bosnia Herzegovina.
- 1,901 Important Plant Areas (IPAs) have been identified in 19 countries across Europe, many of these and other important areas for plants are included in the 27,221 Natura 2000 sites and the Emerald Network of the Council of Europe countries. Up to 75% of IPAs are in protected areas but there few are active plant conservation projects in these sites.
- 54% of countries have a national strategy for the conservation of threatened plant species. 13 European countries (35%) believe 50% of their threatened plant species are in protected areas.
- Sustainable land management policies are not well known by network members or believed to be well implemented.
- 78% of countries have at least one gene bank with an average of 0-25% of threatened species held within it. A slightly higher proportion of threatened species are believed to be in botanic garden collections.
- Over 50 species of plants are believed to be threatened by trade in Turkey, Spain and Greece.

[9] The European Strategy for Plant Conservation (EPCS) 2008-2014 is the regional response to the implementation of the GSPC. The first European Strategy was developed by the Planta Europa Network and the Council of Europe in 2001 and ran until 2007. After a review of the first strategy a new strategy (2008-2014) was developed at the Fifth Planta Europa Conference in Romania in 2007 and published in 2008.
http://www.plantlife.org.uk/international/campaigns/policies_strategies/european_plant_conservation_strategy/

The development of national / regional plant conservation strategies

During the reporting period two countries (South Africa and Mexico) developed national plant conservation strategies and a regional strategy was developed for the Caucasus.

South Africa

In March 2013, the **South African National Biodiversity Institute** (SANBI) hosted a workshop to develop South Africa's National Strategy for Plant Conservation. The majority of South Africa's active botanists and conservationists gathered at this workshop specifically to discuss the GSPC and its implementation nationally. The workshop was very well attended with a wide range of stakeholders from national and provincial conservation authorities, taxonomists, NGOs (e.g. the **Botanical Society of South Africa**), independent botanists, conservationists working on business and biodiversity initiatives and conservation planners. The workshop resulted in national level targets being developed for all 16 targets. In addition, milestones were identified for measuring progress with implementation, and commitment from various organisations and individuals to lead on the different targets, were made. Task teams of between 5 and 10 individuals were constituted to take the implementation of each target forward. South Africa will host an evaluation meeting every 2.5 years to measure progress towards implementation of our national targets. During the workshop, global targets were modified to ensure that they are achievable in the megadiverse flora context in which plant conservation work takes place - South Africa has ca 20 500 plant taxa. For example, the global target for *ex situ* conservation - Target 8: *At least 75 per cent of threatened plant species in* ex situ *collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes* - is unachievable for South Africa due to the very high numbers of threatened plants (2,551 taxa). In order to achieve Target 8, 1,913 species would need to be included in *ex situ* collections. This number is too high, as insufficient space exists within horticultural facilities in South Africa's nine national botanical gardens to include adequate genetic representation of each species, and even seed banking initiatives are unable to conserve this number of taxa by 2020. To date (2013) only 35% of threatened taxa are represented in *ex situ* collections. South Africa has chosen to modify this target to be more achievable to: *At least 60% (1,530 taxa) of threatened plants in* ex situ *collections, preferably in the country of origin, and available for recovery (restoration) programmes, with 1% in active reintroduction programmes*. Many of the other targets in the Strategy have been similarly modified and it is hoped that this should result in the Strategy being achieved in South Africa by 2020.

Mexico

The Mexican Strategy for Plant Conservation 2012-2030 was launched in November 2012 by the **Mexican National Commission on the Conservation and Use of Biodiversity** (CONABIO). The National Strategy is based on the GSPC and provides an instrument to catalyse efforts in Mexico to conserve and sustainably use its natural resources. The objectives of the National Strategy are to increase and integrate knowledge of Mexican plants to achieve their conservation, sustainable use, the fair and equitable sharing of the benefits of their use, and promote education and social awareness about

plants. The process for developing the national strategy began in 2007, with the convening of a group of experts including the **Mexican Association of Botanic Gardens** (MABG). A National Committee was established to develop the Strategy and to monitor and evaluate the implementation of the actions outlined in the Strategy. Monitoring is done through annual work plans which identify priority activities to be conducted and where results are reported. The Committee is composed of 10 members representing institutions, government, research and education and civil society.. Progress towards the GSPC targets in Mexico was assessed during a regional workshop held in 2012 (see p.8) and is reported in Annex 3.

A Regional Strategy for the Caucasus

Missouri Botanical Garden's Centre for Conservation and Sustainable Development, in collaboration with **Botanic Gardens Conservation International** (BGCI) in 2013 published a Regional Plant Conservation Strategy for the Caucasus region[10].

The Strategy was developed as a result of the project 'Coordination and Development of Plant Red List Assessments for the Caucasus Biodiversity Hotspot' which was implemented by the **IUCN Species Survival Commission** in collaboration with Missouri Botanical Garden, USA, the **WWF Caucasus Programme Office**, and botanists from six countries of the Caucasus (**Armenia, Azerbaijan, Georgia, Iran, Russia,** and **Turkey**) from 2006 to 2010.

The Caucasus Plant Red List Authority, which was established under the auspices of the IUCN Species Survival Commission within the framework of this project, developed the Regional Plant Conservation Strategy, the targets of which correspond to the targets of the Global Strategy for Plant Conservation (GSPC) 2011-2020. The publication illustrates the relevance of the plant conservation targets to the targets/actions in the revised and updated Ecoregion Conservation Plan (ECP) for the Caucasus.

[10] http://www.bgci.org/resources/news/1056/

Section 2 Progress in implementing the GSPC targets

Target 1: An online flora of all known plants

Target 1 overview

The achievement of Target 1 of the GSPC is a fundamental requirement for the GSPC as it provides the baseline for work and for monitoring progress towards many other GSPC targets.

GPPC members acting at both national and global levels played a key role in both the achievement of the 2010 target[11] and are putting in place actions to ensure the achievement of the 2020 target. The establishment of the World Flora Online Consortium is a major step towards this target. The Consortium has 20 member institutions and many other institutions are planning to join. A preliminary World Flora Online prototype, hosted by the Missouri Botanical Garden, provides a potential means for hosting and presenting World Flora Online content.

Another ambitious eTaxonomy project, *e-monocot*, led by the **Royal Botanic Gardens, Kew** (RBG Kew) represents both another partner in the development of, and potential host for World Flora Online content.

The Global Plants Initiative is a major undertaking involving a number of GPPC partners that makes available more than 1.8 million plant type specimens and other resources to support floristic research around the world. In 2013, JSTOR released "Global Plants," a new community-contributed online database for scientific researchers, conservationists and others engaged in studying the world's plant biodiversity.

At the national level, good progress has been made in a number of mega-diverse countries. For example, the completion of the Flora of China (after 25 years) and the publication of the Brazil Flora checklist are both significant achievements, while in Colombia, a Catalogue of Colombian Plants is in the process of consolidation with 26,567 species identified, 29.3% of them endemic. 171 botanists from 45 institutions and 19 countries have participated in this project. Similarly in Mexico, many groups are working towards completing regional floras.

It is clear that Target 1 has provided an important focus for botanical institutions around the world and it is widely acknowledged that much greater progress has been made, both in creating new floristic information and bringing together existing knowledge, than would have been achieved without this target.

[11] A widely accessible working list of known plant species, as a step towards a complete world flora

On the basis of existing evidence, it seems likely that this target is on track to be achieved by 2020 and in doing so, will make a significant contribution to the achievement of Aichi Target 19 (*Knowledge improved shared and applied*).

Progress towards the target

The Plant List

The original GSPC Target 1 adopted in 2002 aimed to develop "*a widely accessible working list of known plant species as a step towards a complete world flora*" and this target was achieved in December 2010 through the development of The Plant List[12], which represented the first available comprehensive list of plant species.

Collaboration between **RBG, Kew,** U.K. and **Missouri Botanical Garden**, St Louis, U.S.A. enabled the creation of The Plant List, by combining multiple data sets held by these institutions and other collaborators.

In 2010 the Plant List included 620 plant families, 16,167 plant genera and 298,900 accepted plant species names. It also contained 477,601 synonyms (alternatives for the accepted names) and 263,925 names that were yet to be determined as accepted names or synonyms. While efforts to complete the working list continue, the focus beyond 2010 has been to enhance the list and make it more useful, accessible and functional for end-users by progressing to the second part of the 2010 target – 'as a step towards a complete flora'.

Version 1.1, of the Plant List, which was released in September 2013, includes new data sets, updated versions of the original data sets and improved algorithms to resolve logical conflicts between those data sets. Version 1.1. includes: 642 plant families, 17,020 plant genera and 1,064,035 scientific plant names of species rank. Of these 350,699 are accepted species names and 242,712 names are yet to be resolved.

Developing a World Flora Online Initiative

In January 2012 in St Louis, Missouri, U.S.A., representatives from four institutions: the **Missouri Botanical Garden, the New York Botanical Garden, the Royal Botanic Garden Edinburgh (RBGE),** and **RBG, Kew** took the initiative to meet and discuss how to achieve GSPC Target 1 by 2020. These four plant science institutions agreed to collaborate to support the development of the World Flora Online and signed a Memorandum of Understanding on 29th February, 2012. The intent of the group was that they would be joined in this work by a large number of other botanical institutions worldwide collaborating to deliver this vital new initiative.

[12] http://www.theplantlist.org/

It was agreed that the World Flora Online would be an open-access, web-based compendium of the world's plant species. It would also be a collaborative, international project building upon existing knowledge and published floras, checklists and revisions but also requiring the collection and generation of new information on poorly know plant groups and plants in unexplored regions.

Establishment of a World Flora Online Consortium[13]

In July 2012, a first World Flora Online Consortium Meeting was held at Missouri Botanical Garden, USA. 35 representatives from botanical gardens, botanical organizations and other institutions in 26 countries attended the meeting.

The meeting aimed at drawing in a wide level of community commitment to the World Flora Online. The meeting was very successful with four committees (Working Groups) created. The Governance committee drafted a Memorandum of Understanding (MOU) for the project which, when signed, would mark the official establishment of the botanical community's commitment to the World Flora Online.

The World Flora Online project was subsequently launched in India, at an event held during the 11th Conference of the Parties to the Convention on Biological Diversity in Hyderabad, India in October, 2012 and the COP adopted a decision welcoming the World Flora Online initiative.

In January, 2013 the *Memorandum of Understanding on the World Flora Online*, was opened for signature. Up to the end of January 2014, 20 institutions and organizations had signed the MOU. A full list of these organizations, as well as the additional institutions that have indicated that they will join the initiative, but have not yet signed the MOU is available in Annex 4. A range of other institutions and organizations worldwide are also being invited to participate in the WFO Consortium.

A further meeting on the World Flora Online was organized and held in Edinburgh, Scotland, hosted by the RBGE in November, 2013. This represented the first meeting of the Council of the World Flora Online Consortium. It is expected that the Council will meet annually. Representatives of other organizations that had not yet signed the WFO Memorandum of Understanding were invited to attend the meeting as Observers.

The draft report of the Council meeting is available on the website of the GPPC[14]. This report includes technical information on progress made to date in developing the World Flora Online and outlines the immediate next steps in WFO implementation. The report of the Council meeting remains a draft until it is adopted at its next meeting.

A preliminary World Flora Online prototype[15], hosted by the Missouri Botanical Garden, provides a potential means for hosting and presenting World Flora Online content.

[13] http://www.plants2020.net/world_flora/

[14] http://www.plants2020.net/world_flora/

[15] www.worldfloraonline.org

e-monocot

A collaborative team from the UK, consisting of **RBG, Kew, the Natural History Museum (NHM) and Oxford University** has secured a consortium grant from the UK's Natural Environment Research Council (NERC) to build *eMonocot*, a novel biodiversity web-resource for monocot plants[16]. Monocots constitute approximately 20% (70,000 species) of all higher plants and include numerous groups of the highest conservation, ecological and economic importance, such as grasses, sedges, orchids, palms and aroids. The objective of this project is to produce a web-based treatment of monocot plants, targeted at biodiversity and environmental scientists, but available to all users including volunteer biologists, the general public and schools. This site will provide information such as nomenclature, taxonomic descriptions, images, identification guides, geographical, ecological, DNA sequence and conservation data.

Though focused on a specific plant group, eMonocot is among the most ambitious eTaxonomy projects yet attempted and has the potential to revolutionise the way taxonomic data are accessed by both the practitioners and users of taxonomy. The project also provides a potential mechanism for hosting and presenting World Flora Online content.

The Global Plants Initiative (GPI)

The GPI is an international undertaking by leading herbaria to digitize and make available plant type specimens and other holdings used by botanists and others working in botany and other fields every day[17]. Partners include more than 270 institutions in more than 70 countries. Founding partners include members of the GPPC: **Missouri Botanical Garden; Muséum National d'Histoire Naturelle (MNHN); The National Herbarium, Addis Ababa University; New York Botanical Garden; RBG, Kew;** and the **South African National Biodiversity Institute.** The extent of activity is exemplified by the work of MNHN in Paris. This herbarium has digitized over 6 million vascular plants plus 3 million cyprogams[18]. The team at MNHN also coordinated the GPI project in Francophone West Africa including Mauritania, Senegal, Guinea, Burkina Faso and Togo.

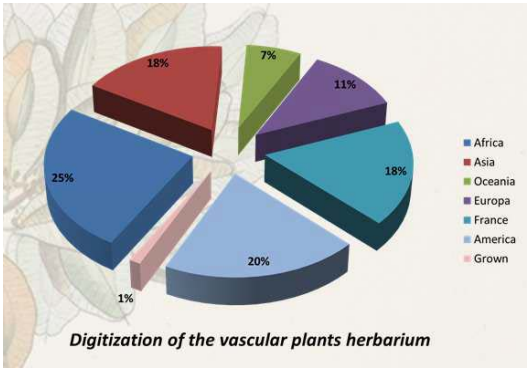


Figure. 1: Digitization of specimens in the MNHN herbarium

[16] http://e-monocot.org/
[17] http://plants.jstor.org/
[18] The 6 million scanned images are now stored on a server. The photographs are available to scientists and amateurs on the Museum website. http://science.mnhn.fr/institution/mnhn/search

Working towards national floras

Work towards producing national floras is ongoing in many countries. This is exemplified by examples from **Australia** and **Mexico**:

The **Australian Biological Resources Study** (ABRS) is producing the Flora of Australia On-line, based on published volumes of the Flora of Australia and new family treatments in preparation. This new version of the Flora is being built on the technical infrastructure of the Atlas of Living Australia (ALA), using the nomenclatural and taxonomic backbone of the Australian Plant Name Index (APNI) and the Australian Plant Census (APC) (continent-scale checklist of the 28,269 Australian vascular plant taxa), integrating descriptions, keys, illustrations and maps from other ALA applications and services such as the Australia's Virtual Herbarium (AVH). The infrastructure will provide a platform and resources for other specialist local and regional Floras.

A contribution to the Flora of Australia On-line is the development of a framework to gather and deliver interactive electronic keys to all vascular plants in Australia. All available keys to Australian plants have been collated into a single, flexible and structured identification key covering (at present) more than 80% of Australia's 2,868 genera.

In **Mexico**, there was an increase in floristic studies during the second half of the twentieth century that led to several regional floras being developed by Mexican and foreign researchers from universities, research institutes and non-governmental organisations. A number of botanical gardens were also created where the study of Mexican plants and their conservation was undertaken. Lists of plants for about 20 Mexican states and numerous smaller regions are now available.

Partnership projects

Many botanic gardens are working in partnership with institutions in other countries, providing support for the development of biodiversity inventories and floras. This is particularly important in countries where taxonomic capacity may be limited. Some specific examples include:

- Flora projects at **Missouri Botanical Garden** cover the Flora Mesoamericana, Flora of China and several national projects, all of which will contribute in a substantial way to the achievement of the WFO.

- The **National Herbarium of MNHN**, one of the largest in the world with more than 8 million specimens, representing a true historical record of plant diversity on the surface of our planet. The Museum is involved in ongoing work on Floras of countries including New Caledonia, Madagascar, Gabon, Cambodia and Laos.

- **New York Botanical Garden** scientists are collaborating with local researchers in Micronesia to document the plants of selected islands and their traditional uses with the goal of identifying key habitats for conservation and producing a checklist of vascular plants, an ethnobotanical manual, and a primary healthcare manual based on traditional plant medicines.

- **RBG, Kew**, in collaboration with botanists at University of Khartoum (Republic of Sudan) and University of Juba (Republic of South Sudan), are working on a complete checklist for Sudan and South Sudan countries (2,059 spp. in Sudan; 2,950 in South Sudan), including habitat and distribution (global and regional) data for each species. They have developed a working list of 248 conservation priority species for the 2 countries. This information will be published as a book and a database as a contribution to the World Flora Online.

- In Portugal, the **Tropical Botanic Garden'**s (JBT) research activities are focussed in the Community of Portuguese-Speaking Countries (CPLP). It particularly works with African partners that still have an incomplete knowledge of the flora of their own countries, carrying out fieldwork and using scientific collections housed in LISC and other worldwide herbaria. The **Ajuda Botanical Garden** been collaborating with JBT in studies of flora of Cape Verde and Angola.

- **RBGE** is coordinating the Flora of Nepal project, which is a collaboration with the Department of Plant Resources and Tribhuvan University in Kathmandu and the University of Tokyo. The accounts of Nepal's 7,000 species are being published in ten volumes, and all this information and the data from which they have been compiled is also available through the project's website[19].

Case study: Supporting Brazil's response to Target 1

RBG, Kew and the **Muséum National d'Histoire Naturelle,** Paris (MNHN) are working in partnership with the **Brazilian Council for Research in Science and Technology**, **Rio de Janeiro Botanical Garden** (JBRJ), and a range of Brazil-based sponsors to deliver the REFLORA programme, designed to facilitate the creation of 'Flora do Brasil Digital', Brazil's response to Target 1[20]. Within the framework of REFLORA, Kew and MNHN are creating high resolution images of herbarium specimens of most relevance for study of the Brazilian flora and making these available to JBRJ for inclusion in Brazil's Virtual Herbarium. The Virtual Herbarium is fully integrated with the List of the Brazilian Flora published in 2010 and updated regularly since, and together this online resource will form the basis for the development of a comprehensive treatment of the Brazilian flora by 2020.

The REFLORA programme has enabled Kew and MNHN to host unprecedented numbers of Brazilian researchers during 2012-2014, resulting in the addition to the Brazilian flora of dozens of species new to science.

[19] www.floraofnepal.org

[20] http://reflora.jbrj.gov.br/jabot/PrincipalUC/PrincipalUC.do;jsessionid=2803485EDE3EE6E25C459290FBF21B7C

Case study: Studying the flora of Cape Verde

Islands are 'natural laboratories' for evolutionary and ecological studies due to conditions of spatial isolation, ecological divergent habitats and small population sizes. Cape Verde are the least studied islands of Macaronesia being characterized with a high degree of endemism, as a result of an ecological continuum along the coast-mountain gradient, thus promoting adaptive radiation into ecoclines of populations. Wild species from Cape Verde yield an unexplored repertoire of genes related to drought tolerance traits, since ecotypes of endemic species arise under dry conditions. The study, done by the **Tropical Botanic Garden, Portugal**, of the endemic flora of Cape Verde (taxonomy, phylogeny and ecology) with the collaboration of the **INIDA (Instituto National de Investigação e Desenvolvimento Agrário**) and **DGA (Direcção Geral do Ambiente**) from Cape Verde and other European partners is expected to give comprehensive inputs to the assessment and conservation of the Cape Verdean flora.

Case study: A collaborative national approach to continental plant taxonomy.

The Australian Plant Name Index (APNI) is a comprehensive national and continental nomenclature of Australia's native and introduced vascular flora; cryptogamic groups and fungi are being added to the APNI infrastructure. In addition to details of initial publication and typification, APNI records secondary publication of subsequent taxonomic concepts and synonymies. In time APNI will document all published alternative classifications of the Australian Flora.

The Australian Plant Census (APC) is a nationally agreed view of the current 'best fit' taxonomy of the Australian flora. It is derived from the accumulated taxonomies and most recent research documented in the Australian Plant Name Index; APC taxonomy is concordant with the APGIII classification. A national working group of nomenclatural expert taxonomists from each National and State herbarium considers all available prior published work on a plant group and makes recommendations to the Council of Heads of Australasian Herbaria (CHAH), which endorses the proposed taxonomy for use at a national level. In the rare case of deadlock by the working group, CHAH makes an executive decision. Evidence for new taxonomies is considered by the working group as they are published. The Australian Plant Census, and the underlying Australian Plant Name Index is an ongoing work in progress. They are the evolving backbone to the Flora of Australia On-line and the botanical component of the National Species List of the Atlas of Living Australia. They represent an Australian contribution to international projects such as the Global Biodiversity Information Facility (GBIF), the International Plant Names Index (IPNI), the World Flora on-line (WFO), etc.

Case study: Web platform of the French Flora Atlas

The Federation of National Conservatoires botaniques (CBN) has recently launched a web-based platform for the Atlas of the Flora of France. Over 20 million observations for 7,687 plant species of metropolitan France and Reunion are now publicly accessible. The establishment of this national resource center was made possible by the work of the CBN network and their partners conducted over some twenty years. Aggregated data are based primarily on field surveys but also bibliographic data and data from herbarium collections. The aim is to gradually establish a comprehensive national information

system on plants, vegetation and habitats. The development of this resource center will be expanded from the end of 2014 by a "vegetation" component to allow short-term aggregation of some 234,000 records of vegetation from CBN.

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

Target 2 overview

The **IUCN Red List of Threatened Species™** is recognized as the most comprehensive objective global approach for evaluating the extinction risk of species and is the scientific basis underpinning many of the indicators adopted by the CBD for monitoring progress towards the achievement of the GSPC and Aichi Targets. One critical gap however results from the limited information available for use in IUCN assessments on the conservation status of wild plants. By the end of 2013, only 6% of plant species had been assessed at the global level using the IUCN criteria. This in turn makes monitoring progress towards Targets 7 and 8 of the GSPC particularly difficult.

To help address the challenge of data availability, IUCN has reduced the amount of information required to complete assessments using the IUCN Red List methodology. Despite this, it is still recognised that it is unrealistic to expect all plant species to be fully assessed at the global level using the IUCN criteria by 2020. IUCN's target (based on the IUCN SSC Barometer of Life analysis[21]) is to have 38,500 plants published online on the IUCN Red List by 2020. Considering that to date 18,291 plant species have been published, this means that 20,209 new plant species would need to be assessed by 2020. That is an average of 3,370 species per year from 2014, which is considered an achievable target.

IUCN has also developed, a Sampled Red List Index (SRLI)[22] which documents threat status trends for a representative sample of a species group. Both this and the IUCN Red List Index[23] will be important tools for monitoring the progress of global efforts to reduce plant biodiversity loss and guiding decision-makers as to what species need attention and where conservation action is necessary.

As an interim measure to support the achievement of Target 2, **RBG Kew** is leading an effort to produce a list of plant conservation assessments by compiling existing datasets, including the IUCN Red List. The

[21] Reference: Stuart, S.N., Wilson, E.O., McNeely, J.A., Mittermeier, R.A. & Rodriguez, J.P.(2010). The Barometer of Life. Science, 328, 177.

[22] Vié, J.-C., Hilton-Taylor, C. and Stuart, S.N. (eds.) (2009). Wildlife in a Changing World – An Analysis of the 2008 IUCN Red List of Threatened Species. Gland, Switzerland: IUCN. 180 pp.
Baillie, J. E. M., Collen, B., Amin, R., Akçakaya, H. R., Butchart, S. H. M., Brummitt, N., Meagher, T. R., Ram, M., Hilton-Taylor, C. and Mace, G.M. 2008. Towards monitoring global biodiversity.Conservation Letters 1:18-26.

[23] Butchart, S.H.M., Akçakaya, H.R., Kennedy, E. and Hilton-Taylor, C. 2006. Biodiversity indicators based on trends in conservation status: strengths of the IUCN Red List Index. Conservation Biology 20: 579–581. DOI: 10.1111/j.1523-1739.2006.00410.x

interim list of plant assessments (for 2013) includes 58,494 unique plant assessments (approx. 16% of all plants). Of these, 43% plants assessed are categorised as 'threatened' with extinction, and more than half of the assessments are at regional/national level.

Good progress with Red Listing is being made at the national level, in some cases using nationally developed instruments for assessing extinction risk[24]. A unique South-South partnership involving South Africa, Brazil and Colombia has been established to share experiences and accelerate progress in Red Listing in mega-diverse countries based on the IUCN Red List Categories and Criteria. This has resulted in the publication of the Brazilian Red data book ((http://cncflora.jbrj.gov.br/portal/pt-br/livro) – a significant contribution to the achievement of Target 2.

The evidence suggests that progress is being made towards this target, but the rate of progress is currently insufficient to meet the target by 2020. Lack of progress towards this target may constrain efforts to meet Aichi Target 19 on improving, sharing and applying biodiversity knowledge.

Progress towards the target

In 2010, less than 4% of known plant species (around 13,000 species) had been fully assessed for their conservation status at the global level using the IUCN Categories and Criteria. However, 96 countries were reported to have national Red Lists and a number of groups of species (especially trees) had been assessed globally by **the IUCN Plant Specialist Groups.**

The IUCN Red List of Threatened Species™

By the end of 2013, 6% of the world's species had been assessed on the current IUCN global Red List[25]. Figure 2 shows also the increasing institutional commitment to and support for red listing efforts by the botanical community since 2009, certainly stimulated by the GSPC. **IUCN a**nd its **Red List Partners, BGCI and RBG, Kew** together with the **SSC Plant Specialist Groups** have secured technical support and funding for a number of global assessments, such as the Global Conifer reassessment, the Global Cacti assessment, and the Sampled Red List assessment approach. These important achievements demonstrate that with focused attention on specific taxonomic groups and modest financial support, the IUCN SSC Plant SGs and the Red List Partners have significantly contributed to increase the coverage of plant species on the IUCN Red List and to improve our understanding of the conservation status of plants at the global scale.

[24] . For example, Mexico developed a national method to assess species extinction risk (see Método de Evaluación del Riesgo de Extinción de las Especies Silvestres en México, MER).

[25] http://www.iucnredlist.org/

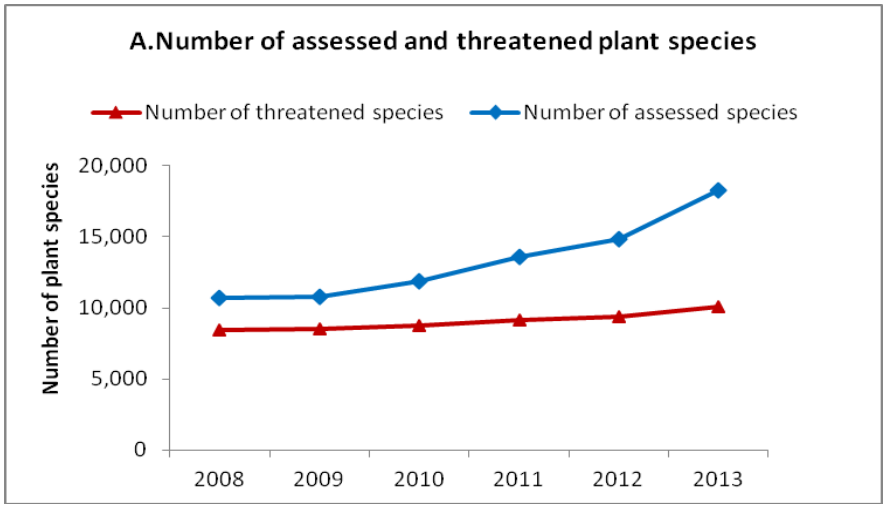


Figure 2. Total number of assessed species and threatened species included in The IUCN Red List from 2008-2013

There were two updates to the Red List in 2013, which now include assessments for 18,291 plant species, 10,065 (55%) of which are threatened with extinction. The addition of 3,419 new plant assessments to the Red List in 2013 means that IUCN is on target to achieve 38,500 plants on the Red List by 2020[26].

The significant increase in the number of plant species published on the IUCN Red List was, in part due to IUCN simplifying the 'Required and Recommended Supporting Information' for the IUCN Red List assessments which reduced the minimum amount of information required, but sustained the scientific integrity of the assessment and review process. This is of great importance enabling species to be assessed using the limited data that is available for many plant species. These new standards will continue to accelerate the review and the publication rate of plant assessments on the IUCN Red List. In addition, one of the driving focuses of the IUCN Global Species Programme and SSC over the next few years will be to develop the IUCN Red List in a manner that allows the Red List Index (RLI) and Sampled Red List Index (SRLI)[27] for plant taxa to be calculated and measured over time.

The RLI measures trends in extinction risk over time and is based on the number of species that moved between Red List Categories as a result of genuine changes in threat status (excluding moves resulting from improved knowledge or taxonomic changes). The RLI can only be calculated for taxa that have been completely assessed. The Conifer SG achieved a major goal in this regard in 2013 by delivering a Red List re-assessment of all conifer taxa (species and lower ranks), allowing the calculation of the RLI for this taxon. Of the 605 species re-assessed, 202 are threatened with extinction. A sampled approach

[26] Stuart, S.N., Wilson, E.O., McNeely, J.A., Mittermeier, R.A. & Rodriguez, J.P.(2010). The Barometer of Life. Science, 328, 177.

[27] http://www.kew.org/science-conservation/research-data/science-directory/projects/sampled-red-list-index-plants

to the Red List Index (SRLI) has been developed in order to determine the threat status and trends of lesser-known species groups. Both the IUCN Red List Index and the Sampled Red List Index will be central to monitoring the progress of global efforts to reduce plant biodiversity loss and will be critical for guiding decision makers as to what and where conservation action is necessary.

IUCN SSC Specialist Groups

Plants for People (P4P) is a new initiative to assess the global conservation status (following the IUCN Red List Categories and Criteria) of at least 1,500 highest priority species in each of the following groups: crop wild relatives; medicinal plants; timber trees; and palms (6,000 species in total), contributing significantly to Target 2. This is a joint initiative of the IUCN Global Species Programme (GSP) and the IUCN Species Survival Commission (SSC), involving four IUCN SSC Specialist Groups (Crop Wild Relatives, Medicinal Plants, Global Trees and Palms). P4P will also collaborate with national, regional, and international specialist organizations working on economically valuable plants. All assessments (including the species range maps) will be published on the IUCN Red List and made available online for public use, therefore contributing at the same time to GSPC Target 14.

Some specific achievements of the SSC Specialist Groups over the period 2011-2013 are outlined below:

- **The Global Tree SG** is hosted by BGCI, one of the two IUCN Red List partners for plants. During 2013, BGCI has ensured that all conservation assessments of tree species undertaken by the Global Tree SG are fully compliant with the data requirements for inclusion on the IUCN Red List. In 2011 two Red List reports were produced: **The Red List of Mexican Cloud Forest Trees** published in association with the Mexican botanical community and **The Red List of Rhododendrons**, with research led by BGCI and RBGE. Data collection, mapping and analysis of the conservation status of trees of the Northern Andes was completed in 2013 with publication of **The Red List of trees of montane forests of the northern Andes** in preparation following extensive review. The **Red List of Betulaceae** will be published in 2014.

- 2011: The **Cuban Plant SG**: Launch of the **Red Book of the Vascular Flora of Pinar del Rio Province**. Edited by the late Dr. A. Urquiola and other colleagues. Cuban Plant SG members contributed to the publication of the book TOP 50 – the 50 most threatened plants of Cuba.

- 2011: The **Orchid SG** conducted 153 European level red list assessments for orchids (44 of which are also global); they were included on the IUCN Red List in late 2011. In 2013 the Orchid SG red-listed all Cypripedium species as part of a project to assess all slipper orchids. These will be published on the IUCN Red List in 2014.

- 2011-2013: **The East African Plants RLA** has run eight assessment workshops over the last few years, and the results of those workshops are slowly being published on the IUCN Red List (370 species assessments were published on the Red List in 2013). The results of their work are being used to inform land use planning in East Africa.

- 2012: **Temperate South American Plant SG**: The preliminary evaluation of threat for more than 1,980 plant species endemic to Argentina was carried out by members of the SG with the assistance of numerous botanists and conservationists of the country. The list was adopted as the official reference for plant conservation by the Argentine Federal Government. The database can be visited at www.listaplanear.org. In 2013 the SG assessed 53 endemic species of the San Juan province, Argentina.

- 2013: **The Madagascar Plant SG** carried out field work on various species of succulents and precious woods which led to a Red List assessment of these species.

- 2013: **The Arctic Plant SG** prepared an assessment based on a review of over 300 scientific publications in the field of floristics of vascular plants, bryophytes and algae; reviewed status and trends in Arctic biodiversity of these plants; and prepared a list of 20 rare endemic Arctic vascular plant species that may be threatened. Floristic specialists made final selections of vascular Arctic plants to be proposed to the IUCN for Red Listing. The final candidate list comprises 126 species.

- 2013: Members of the **Cactus and Succulent Plant SG**, along with a large contingent of regional experts, including professional botanist, ecologists, conservation biologists, and plant amateurs, assessed the totality of species of the Cactaceae family.

- 2013: The **Galapagos Plant SG**: The entire endemic vascular plant flora has been evaluated, as have the marine algae. Red-listing of lichens is in progress, and plans are being made for a re-evaluation of the endemic vascular flora.

- 2013: **The Palm SG** released the biodiversity information portal Palmweb.org which consolidates rich taxonomic content for around half of the ca. 2,600 extant palm species; basic content is available for the remainder species. The SG also conducted assessments of all the palm species on Madagascar which were published on the IUCN Red List in 2012 (190 species, 149 of which are threatened) and selected Mexican palms have been evaluated in collaboration with CONABIO

- 2013: **The Caucasus Red List Authority (RLA)** has completed almost a 1,000 assessments which we are being finalised to be published on the IUCN Red List. A book with the results is also due to be published in 2014 in collaboration with Missouri Botanic Garden.

Other global initiatives

The **RBG, Kew** works in partnership with many organisations around the world to assess threat faced by plants today. Kew has recently set up an internal conservation assessment tracking system (CATS) to

monitor its own conservation assessment output, but also to gather assessments in grey literature[28]. To date, Kew's database holds 10,419 assessments.

Kew has also initiated a project to compile all the national and regional Red List assessments that are held in libraries or grey literature. Approximately 16,000 have been compiled so far including information from New Zealand, India, the Maltese Islands, the Seychelles, Rodrigues, Southern Africa and Malaysia. These assessments are available to view via the National Red List website[29].

Kew has initiated a project to produce an interim list of plant assessments to directly respond to GPSC Target 2. This involves a compilation of existing datasets: (1) Kew's own conservation assessments; (2) compilation of national and regional red list information from grey literature; and (3) the global IUCN Red List. The interim list of plant assessments based on these 3 inputs (for 2013) shows that 58,494 unique plant assessments have been compiled (approx. 16% of all plants). Of these, 43% plants assessed are categorised as 'threatened' with extinction, and more than half of the assessments are at regional/national level.

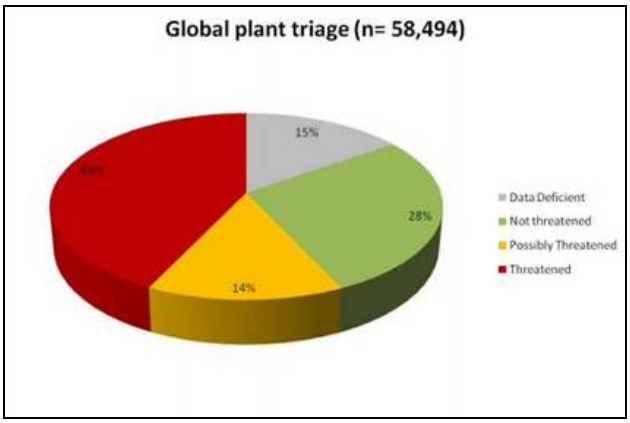


Figure 3: Interim results of the global plant assessment.
*SP Bachman***,** *Species Conservation Assessment Officer, RBG, Kew*[30].

National and regional initiatives

As with Target 1, many botanical institutions are working alone or in partnerships to identify threatened species at the local, national and regional level. Some specific examples are provided below:

- The **New York Botanical Garden's** Caribbean Biodiversity Program focuses on the Wider Caribbean Region. The goal of the project is to bring the knowledge that the Garden has been building about the plants and fungi of the Caribbean region over the past century to bear on the

[28] Outputs are updated here: http://www.kew.org/science-research-data/kew-in-depth/gis/species-conservation/cats/index.htm
[29] http://www.nationalredlist.org/
[30] For more information see this poster: http://www.flickr.com/photos/kewgis/10442367454/ and: http://www.kew.org/science-research-data/kew-in-depth/gis/species-conservation/cats/index.htm

conservation challenges that the region is facing due to deforestation and climate change through a GIS-based assessment of plants at risk and capacity building in Caribbean institutions (see also Puerto Rico Case Study below)

- The **Missouri Botanical Garden**: In conjunction with environmental impact assessments at mining sites in Gabon, New Caledonia and Panama, the Garden's staff have identified Species of Concern by conducting IUCN Red List assessments of over 300 species to determine which taxa (Critically Endangered, Endangered, and those assessed as Vulnerable for which mining activities will result in an immediate reassessment of Endangered) require mitigation in compliance with the International Finance Corporation Performance Standard 6. MBG staff have participated in and led Red Listing workshops in Central and East Africa, Madagascar (Malagasy and Mascarene ebonies), and Vietnam, which have resulted in assessments of over 1,000 species. The Garden has also contributed to Red List assessments in several Latin American countries including Nicaragua, Guatemala, Peru, Ecuador and Bolivia. 1,788 plant species from the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania were evaluated for inclusion in the IUCN Red List. 607 plant species from Indochina were also evaluated for inclusion in the IUCN Red List during the period. Other on-going or developing projects contributing to the achievement of this target include a worldwide integrated conservation and Red List status review on ebonies that will be undertaken from 2014.

- The Italian Botanical Society funded by The Italian Ministry for Environment, Land and Sea started a National Red List assessment of the Italian Flora included lichens, bryophytes and fungi with the assessment of about 400 species, among which are species listed in the Convention on the Conservation of European Wildlife and Natural Habitats (Council of Europe) and Directive 92/43/CE. A second assessment phase is expected by the end of 2014, with the assessment of other 500 species, mostly endemic to Italy[31].

Case study: The Puerto Rican Endangered Plants Initiative

This project—led by **New York Botanical Garden** scientists with Puerto Rican colleagues—is using novel rapid-assessment protocols to evaluate which of the some 3,300 Puerto Rican plant species are threatened with extinction and which are not. A preliminary study using the new protocols and readily available Puerto Rican specimen data from the Garden's C. V. Starr Virtual Herbarium and the Global Biodiversity Information Facility (GBIF) indicate that as many as one in five Puerto Rican plant species are threatened or near threatened.

Case Study: South-south collaboration on Target 2

The **South African National Biodiversity Institute** (SANBI) worked with Brazil's **National Centre for Plant Conservation** (CNC-Flora) between 2010 and 2012 to help Brazilian botanists conduct conservation

[31] www.iucn.it

assessments using the IUCN 3.1 system, making the best use of available data on plants. This two-way partnership expanded in 2013 to include Colombia. A plan to assess the entire Colombian flora (ca 23,000 taxa) was developed during a workshop involving botanists from the **Humboldt Institute**, Colombia, CNC Flora and SANBI. This relationship will continue over the next two years with SANBI providing continuing support to the Colombians on conducting threat assessments. In this way, Brazil, Colombia and South Africa have established a relationship to exchange lessons on implementation of the GSPC.

Case Study: Documenting and conserving the flora of Nicaragua

Partnering with the Ministry of the Environment and with the **Botanical Garden and Herbarium in León**, the **Missouri Botanical Gardens** Center for Conservation and Sustainable Development (CCSD) is conducting a species-by-species conservation analysis of the entire flora of Nicaragua. The Garden's publication of a complete, modern Flora of the country in 2001, with an associated database of more than 120,000 records that includes most of the plant specimens ever collected in Nicaragua, gave the country an unprecedented opportunity to evaluate and act on the conservation of its diverse flora. In carrying out the analysis, CCSD scientists are using the database to identify candidate species for conservation, evaluate the present distribution of these species with respect to currently protected areas, and make recommendations for their preservation. After identifying the species of greatest conservation concern using the IUCN Red List Categories and Criteria, they are studying the species that fall within the IUCN threat categories on the ground, one by one. The most critically endangered species will be considered for *ex situ* conservation:

- 16% of the most threatened (100) plant species of Nicaragua are now growing *ex situ* at the Botanical Garden in León.
- all known 8,000 plant species from Nicaragua have been evaluated using the IUCN Red List criteria and preliminary assessments produced.

Case study: The zero-extinction project in Xishuangbanna, Yunnan, China

Xishuangbanna borders Myanmar and Laos in southern Yunnan, on the northern margins of the Asian tropics. It includes only 0.2% of China's total land area (c. 20,000 km^2) but supports more than 10% (>3000 species) of China's flowering plant flora. During the last 20-50 years, the expansion of crop monocultures, particularly rubber, has resulted in the loss and fragmentation of much of the remaining forest, threatening many species. Over the next five years, the **Xishuangbanna Tropical Botanical Garden** (XTBG) of the Chinese Academy of Sciences is targeting the reduction of plant extinctions to zero in Xishuangbanna. An initial expert assessment of the native flora in 2012 identified 3% as endangered or critically endangered, 13% as vulnerable, 71% as least concern, and 13% as data deficient. On-going field surveys are checking the endangered and data-deficient species, identifying unprotected forest fragments of high conservation value and, after a review of the progress of *ex-situ* conservation within XTBG, collecting seeds of endangered and vulnerable species. The most valuable fragments will be

recommended for addition to the protected area system, while the seeds will be stored in the seed bank and, for the estimated 30% of species with drying sensitive seeds, grown in the living collections.

Case study: Multi-scale French Red Lists

In collaboration with IUCN and the National Museum of Natural History, the **Federation of National Conservatoires botaniques** published in 2012 the Red List of the Vascular Flora of France for the first 1,000 species. Work continues on the database of 21 million records aggregated by the network of National Botanical Conservatories.

Meanwhile, the National Conservatoires botaniques are involved in the drafting of regional Red Lists. At present, nearly 40% of metropolitan and overseas territories are covered by a regional Red List and in the short term, 80% of the regions will possess their own Red List. These regional Red Lists help prioritize conservation issues at the local scale, thus taking into account the specificities of local flora and the better conservation of species throughout their range.

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

Target 3 overview

Plant conservation research, methodologies and practical techniques are fundamental to the conservation of plant diversity. While many methodologies have been developed and much relevant information generated over the past few decades, much of this lies in unpublished reports and manuscripts, not easily accessible to plant conservation practitioners.

In response to a request from the Parties to the CBD, an on-line toolkit has been developed by BGCI and is available in all 6 UN languages. This provides a platform for sharing information, methodologies and experiences developed by GPPC members. A wide range of tools and resources are directly accessible or linked to via the toolkit.

A range of other tools and resources and case studies are being developed by plant conservation practitioners around the world but greater efforts are still needed to make these available in appropriate formats where they are needed.

This is a cross-cutting target, applicable to all other GSPC targets. It is likely that progress will be varied across targets, with some aspects of the GSPC more likely to be constrained by lack of progress in Target 3 than others.

Progress towards the target

Global initiatives: A Toolkit for the GSPC

A toolkit to assist national and regional implementation of the GSPC was initially called for by the Parties to the CBD at COP7 (2004). This request was reiterated at COP 9 (2008) and at SBSTTA 14 (2010) the Parties specified that the GSPC toolkit should be developed as online version in all UN languages by 2012. In 2010, **BGCI** was tasked by the CBD Secretariat to develop the toolkit; an initial workshop was held and an on-line survey was carried out in 2011. The GSPC toolkit was developed with input from GPPC members and presented in draft format at SBSTTA 16 in 2011. Following approval by SBSTTA, the toolkit was translated into the 6 UN languages and formally launched in May 2012.

The toolkit[32] includes background information on the GSPC, support for national implementation and technical information on how to implement each of the 16 targets of the GSPC. It includes a searchable database of tools and resources and links to useful videos and websites. It presently includes over 200 downloadable documents and links to over 500 websites.

Sibbaldia Horticultural Journal

A key element in ensuring the conservation of threatened plant species is understanding how to propagate and grow such species. This horticultural expertise is often in the hands of dedicated staff working in botanic gardens and arboreta around the world, but is often not published. In an attempt to provide a platform for the sharing of essential horticultural information, the **RBGE** publishes the journal SIBBALDIA[33]. This unique journal publishes a broad range of practical knowledge and experience in botanic garden cultivation built up over many decades.

Conserving Crop Wild Relatives

The Crop Wild Relatives SG of the IUCN Species Survival Commission has prepared an important background document on '*Conservation and sustainable use of plant genetic resources for food and agriculture: a toolkit for national strategy development*' which targets the conservation of CWR (and landrace) diversity at the national level.

Progress at the national level

GPPC members and other organisations around the world publish and contribute to the publication of a wide range of best management practices, manuals and other publications related to plant conservation. Botanic gardens are particularly involved in developing propagation protocols for

[32] www.plants2020.net

[33] http://www.rbge.org.uk/about-us/publications/publications-catalogue/journals/sibbaldia-horticultural-journal

threatened species – often developed through partnership programmes that also contribute to capacity building (Target 15).

Some specific examples are provided below:

- The development of propagation protocols for critically endangered fern species *Asplenium dielpallidum, Asplenium diellaciniatum, Asplenium dielmanni.* By **Tallinn Botanic Garden**, Estonia

- The Phoenix Project: developing germination and cultivation protocols for some of Malaga's threatened, vulnerable and endangered endemic species – **Jardín Botánico-Histórico La Concepción** (Malaga, Spain)

- **The Conservatoire et Jardin botaniques de la Ville de Genève** (CJBG) maintains on on-line list of all species of the African continent, including information on their taxonomy, biology and distribution.

- In Mexico, the **Jardín Botánico Francisco Javier Clavijero** has developed protocols for the conservation and sustainable use of the endangered cactus *Dioon edule.* This includes propagation protocols and studies on reintroduction and population structure. This experience has provided the framework for the development of an action plan for the protection and conservation of cycads in Mexico and contributed to the generation of the global action plan for cycads in collaboration with IUCN.

Case Study: using new technologies to support research

The Conservatoire et Jardin botaniques de la Ville de Genève (CJBG) developed in 2012 a smartphone application that facilitates the work of field botanists. All data being loaded, the application allows the user to not only identify all plant species in Switzerland (>3,200 species), with keys, descriptions, photos, maps of distributions, etc.., but also sends comments directly to the floristic database of Info Flora, the Swiss centre for collecting information on wild plants.

Case Study: Australia's Virtual Herbarium (AVH) - Sharing Information

In Australia, State and National herbaria hold c. 6.5 million databased records of plants and fungi from throughout Australia and its region. These records comprise an invaluable resource for the community, research scientists and government. They provide core and vital information on what grows where, how common or rare the plants are, and how their distributions have changed and are changing over time.

Previously, these records were only available to a few scientists, and only after laborious work. With the advent of the Australia's Virtual Herbarium (AVH), all of these valuable records are now freely available to enthusiastic amateurs, research scientists and government agencies over the internet, along with sophisticated discovery, visualisation and analysis tools.

The Australia's Virtual Herbarium (AVH) is built on the national technical information infrastructure of the Atlas of Living Australia (ALA). This shared infrastructure enables sharing of plant data, applications and services between plant-related and general biodiversity projects.

Case study: Developing a Field Data Collection Protocol in Brazil

In order to reach GSPC target 3, and the associated Aichi Target 19, CNCFlora (Brazil Plant Red List Authority) has proposed the development of a "field data collection protocol", following IUCN standards, with the objective of expanding and validating information regarding Brazilian plant species. The protocol would be of nationwide usage, integrating several institutions (such as universities, museums, botanical gardens and herbaria). Furthermore, the protocol could be used as a capacity-building tool for analysts, technicians, researchers and students. Thus, they would also act as multipliers for data gathering, being able to contribute to the improvement of analysis and extinction risk assessments. The protocol will consist of a series of options used to develop the species profiles during the data analysis carried out by CNCFlora, and also include options regarding threats and conservation actions, following the standards listed by IUCN. This way, a more complete data set can be obtained, which would be of great value for understanding Brazilian plant diversity and would also refine the threat assessments of species nationwide. As a direct consequence of this, an increased efficiency would be achieved for any process that made usage of this data set (such as the selection of priority species for conservation).

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

Target 4 overview

This target focuses on conservation of plant species through the conservation and/or restoration of the landscapes, or ecological regions, in which they exist. This target is achieved mainly by actions taken to implement Aichi Targets 5, 11 and 15.

The draft background technical document prepared for GBO4 notes that 55% of terrestrial ecosystems have at least 10% coverage by protected areas and 7% have at least 75%. However, 7% of terrestrial ecosystems have less than 1% coverage.

While it is difficult for botanists and conservationists to achieve the GSPC's ecosystem targets, especially Targets 4 and 6, there are areas, particularly related to the restoration part of this target, where botanical and horticultural expertise is particularly relevant.

The establishment of the Ecological Restoration Alliance of Botanic Gardens has brought together a number of partners to share experiences and raise awareness of the role of botanic gardens in

supporting ecological restoration. The Alliance focuses on the use of native species in restoration and draws on the horticultural and propagation skills of botanic gardens.

A number of GPPC members are also contributing to this target through the provision of high quality, genetically appropriate seeds and seedlings of native species for use in restoration projects.

It is considered that although progress is being made towards this target, it is unlikely to be achieved by 2020.

Progress towards the target

The Ecological Restoration Alliance of Botanic Gardens

Ecosystem restoration is the process of actively managing the recovery of an ecosystem that has been degraded, damaged or destroyed. It is a conscious intervention based on traditional or local knowledge and scientific understanding[34]. Its goal is to restore ecosystems to be resilient and self-sustaining with respect to their structure and functional properties. Botanic gardens hold a huge amount of valuable knowledge for ecological restoration and have recently come together to form the Ecological Restoration Alliance of Botanic Gardens (ERA) coordinated by BGCI.

Members of the Alliance have agreed to support efforts to scale up the restoration of damaged, degraded and destroyed ecosystems around the world, with the goal of restoring 100 places by 2020. The ERA also aims to: (i) build expertise and restoration capacity through collaborations between gardens, large and small, as well as with partners in academia, industry and government; (ii) improve the quality and quantity of restoration research; and (iii) disseminate and advocate restoration knowledge, thus addressing global environmental problems on a broad and significant scale. As of January 2014, 16 botanic gardens had joined the Alliance. A full list of members is provided in Annex 5 and information on the 27 restoration projects presently being implemented is available on the website[35].

Supporting national implementation

A number of GPPC members are involved in other projects that support the implementation of this target at the national level. Some specific examples include:

- In the St. Louis region, **Missouri Botanic Garden**'s 2,500 acre (c.1,000 ha) Shaw Nature Reserve includes the active restoration of degraded plant communities and recreates ecosystems that once thrived in the region – tall grass prairie, dolomite limestone glades, wetlands, ponds, oak savanna, floodplain forests, and woodlands. The control and/or elimination of aggressive non-native plant

[34] As defined by the Society for Ecological Restoration

[35] www.erabg.org

species remains a critical component of the Reserve's restoration efforts, which are increasingly serving as an international model for ecological restoration.

- **Fairchild Tropical Botanic Garden** has conducted landscape scale restoration of US endangered *Jacquemontia reclinata*. Reintroduced *J. reclinata* populations have more than doubled the overall number of plants in the wild. Most of the reintroduced populations have had seedling recruitment, which is an indication that they are progressing toward becoming sustainable. The extremely dynamic nature of its coastal strand habitat subjects these populations to large impacts from stochastic environmental events like Hurricane Sandy, which impacted several populations in fall 2012. Even storms that do not directly pass over land can dramatically impact the coast causing erosion and inundation. But surprisingly some reintroduced populations positively responded to inundation; new seedlings emerged from the seed banks demonstrating remarkable resilience of the species and its ecosystem.

- **SOS – Save Our Species** is a joint initiative of **IUCN**, the Global Environment Facility and the World Bank, supported by the Fonds Français pour l'Environnement Mondial (FFEM) and the Fondation Segré as well as additional private sector donors. Its objective is to ensure the long-term survival of threatened species and their habitats. As a response to increasing threats to gymnosperms, threatened cycads and conifers were adopted as a new strategic direction for SOS funding in 2012 and 2013 leading to the support of eight "on the ground" conservation projects. The SOS projects contribute to the GSPC implementation through a wide range of activities, including but not restricted to the restoration and management of natural habitats, replanting of threatened conifers and cycads, propagating and curating *ex situ* conservation collections, creating alternative livelihoods for local communities and awareness raising at all levels. Thus the SOS initiative is contributing significantly to Targets 4, 5, 6, 7, 8 and 14 of the GSPC.

- **Kadoorie Farm and Botanic Gardens** (KFBG) have been working over the last 15 years on forest restoration in Hong Kong. Early attempts to restore the forest to avoid soil erosion and to improve water quality mainly focused on exotic species. As a result the current vegetation of Hong Kong is a mixture of exotic plantations, natural secondary forests and large areas of grassland characterized by a depauperate flora and fauna. KFBG has developed germination and propagation protocols for more than 150 native tree species and conducted tree planting and forest enrichment programs in different habitats. In a recent large scale experimental planting of more than 5,000 individuals of 12 different native tree species the growth- and survival rates are being tested under different forestry treatments such as the use of tree guards and organic/inorganic fertilizer application.

A key element in effective restoration is the availability of high quality, genetically appropriate seeds and seedlings of native species. A number of botanic gardens and other agencies have recognised this demand and are responding through the development of seed multiplication programmes. Some examples are provided below:

• Under the national leadership of the **Bureau of Land Management's** Plant Conservation Program, the interagency Native Plant Materials Development Program (NPMDP) has been working since 2001 to develop high quality, genetically appropriate seeds and seedlings of America's native plant species for restoration. Eco-regional programs have been established to collect native seed, prioritize research and guide the development of restoration seed needed within each eco-region. Wildland native seed collections are the foundation for native plant materials development. Seeds of Success teams have made over 14,000 collections of more than 4,500 species from across the United States. A portion of each collection goes into long-term conservation storage (contributing to Target 8) and the remainder is available for research and restoration. The ultimate goal of the NPMDP is to restore native plant communities that provide ecosystem services and wildlife habitat. Restoration results benefit from incorporating genetic considerations, including using the research to choose the best seed source and seed mix to maximize plant establishment and sustainability in a changing climate.

• The **Australian National Botanic Gardens** has embarked on a pioneering project in partnership with Greening Australia and the Centre for Australian National Biodiversity Research, establishing Seed Production Areas (SPAs) to provide seed for restoration of threatened grassy woodland and temperate grassland communities. This partnership pools specialist Australian plant knowledge, traditional ecological knowledge, horticultural expertise and best available science, together with practical biodiversity conservation and key environmental custodians, land managers and the public.

• **NASSTEC:** a new EU project for native seed production and use in grassland restoration. The project will focus its efforts in the next four years in promoting the use of native seeds for grassland restoration, building the capacity in local companies for large scale native seed production, carrying out demonstrative pilot projects and lobbying the relevant stakeholders to widely promote the use of native seeds in land restoration and reclamation activities, both in the public and private sector. NASSTEC involves 7 partners: 4 academic institutions – **Museo delle Scienze**, Trento, Italy as coordinator, the **RBG, Kew**, **Pavia University**, the **James Hutton institute** and 3 native seed producers. NASSTEC plans to interconnect the public and private sector through the establishment of a multidisciplinary European doctoral school with the aim of integrating knowledge in plant ecology, molecular biology, taxonomy, conservation, seed biology, breeding and horticulture. The training scheme will deliver a balanced scheme of exchange visits and secondments, a rich programme of network events, news of network achievements and research information; including the findings of the final NASSTEC conference that will take place in Kew in 2017.

Case study: Restoring arid woodlands in Pakistan's Punjab province

The extent of Pakistan's subtropical to tropical, natural dry forests has drastically diminished over the past hundred years, mainly as a result of habitat loss to agriculture and urbanisation, indiscriminate exploitation and invasion by exotics species. National reforestation strategies that still favour uniform plantations of fast growing non-native trees, do not offer the diverse range of vital ecosystem goods and

services provided by the original arid woodland vegetation. Working with local communities and governmental authorities, the **Government College University Botanic Garden** and Sustainable Development Centre (GCUBG/SDSC) and **BGCI** are implementing a restoration scheme to assist and enhance regeneration of dry forests in Pakistan's Punjab province. Over 6,100 saplings of eight woody target species were raised and planted in ten trial plots covering a total area of 6.68 ha, and monitored over a period of three years (2010-2012). With an overall 46% seedlings' survival rate, reinforcement plantings accompanied by other conservation measures including fencing, elimination of invasive plants and soil remediation, have also facilitated natural regeneration via seed, root budding and suckers from remnant species. Close collaboration and regular interaction with representatives from local communities and forestry departments generally helped consolidate ownership of the conservation efforts and engagement in the restoration trials. However, setbacks resulting from natural as well as human-induced causes including grazing by rodents, fire or removal of fences, were also experienced. Further research on the socio-economic potential associated with the restoration action to revive traditional or develop new value chains based on the natural resources of dry forests is required, to address conservation and livelihoods improvement as two complementary objectives.

Case study: Forest Restoration in the East African Uplands

Brackenhurst Botanic Garden's restoration of upland forest near Nairobi has become a model for East African habitat restoration initiatives. The forest in the region was once so extensive that it hosted leopard, buffalo and elephant, and blocked city residents' view of Mount Kilimanjaro. Less than 2% of original forest remained before work began, with the rest mostly transformed into tea and eucalyptus plantations. One hundred acres (40 hectares) of tropical rainforest have now been replanted. In just 12 years, the project has replaced exotic tree plantations with a 30-foot tall native forest that shelters lianas, orchids and a species-rich understory. The forest is now home to over 170 species of birds, 120 species of butterfly, as well as fruit bats. The project also provides livelihoods in an area of high unemployment, by training and employing local people. Plans are underway to further expand the restored area.

Case study: The French VEGETAL LOCAL® label: towards a network of local plant nurseries

The use of commercial mixtures of species of unknown geographical and genetic origin for rehabilitating degraded natural areas results in loss of biodiversity, both intraspecific and interspecific, and the introduction of invasive species.

The Federation of National Conservatoires botaniques, l'Association Française Arbres et Haies Champêtres et l'Association Plante & Cité developed the national LOCAL PLANT® label that ensures local use of mixtures of wild species that: (1) originate within the local area; (2) respect the plant communities from which the seeds were collected by using ENSCONET standards and adapting them as necessary; (3) maintaining the genetic diversity during multiplication *ex situ* .

This label has already facilitated the emergence of local or thematic projects such as the use of native plants for fixing nitrates and rehabilitating degraded soils in French Guiana (GUYAFIX ®) or like the emergence of a production chain of local plants in Champagne involving disabled workers (EDUCAFLORE®).

Target 5: At least 75% 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 5 overview

An important plant area can be defined as a site exhibiting exceptional botanical richness and/or supporting an outstanding assemblage of rare, threatened and/or endemic plant species and/or vegetation of high botanical value.

While relatively little information is available to assess global progress towards this target, a number of national and regional initiatives are on-going involving GPPC members.

Plantlife International has been instrumental in developing Guidelines to support the identification of IPAs and continues to be active in a number of countries. An on-line database of IPA sites and projects is available on Plantlife International's website[36].

IUCN is developing a global standard to identify areas of particular importance for biodiversity, the Key Biodiversity Areas (KBAs). Such areas should be a priority when expanding protected areas coverage, as it is recognised that current protected area systems have many gaps. Key Biodiversity Areas provide fundamental information to CBD Parties and others to inform a wide range of decision-makers and help achieve in the same time Target 5 of the GSPC and Target 11 of the Strategic Plan for Biodiversity 2011-2020[37] .

While a number of countries have made significant efforts to identify important areas for plant diversity, it is not clear how many of these are being effectively managed or how well these are distributed across ecological regions. It is felt unlikely that ongoing efforts are sufficient to meet the target by 2020.

Progress towards the target

Regional initiatives are on-going in the Arabian Peninsular (Bahrain, Saudi Arabia, Oman, Yemen, Kuwait, UAE, Jordan, Palestine, Lebanon, Syria, Iraq and Qatar) and in North Africa and the Middle East.

[36] http://www.plantlife.org.uk/international/wild_plants/IPA/ipa_online_database

[37] UNEP/CBD/SBSTTA/17/INF/10

In the latter case, the IUCN Centre for Mediterranean Cooperation, Plantlife International and WWF completed a desk-based study to identify Important Plant Areas in the south and east Mediterranean region with country experts from Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia. 128 preliminary IPAs were identified and mapped in 2009. Following this initiative a large proposal was developed to conserve Important Plant Areas in the Mediterranean focusing on the management of sites and raising awareness in North Africa, the Middle East, the Balkans and Turkey which should begin in 2014.

In Eastern Europe, NGO-led IPA projects have focused on involving communities in undertaking management actions on small scale within IPAs (rather than producing official management plans) and on efforts to raise awareness of the importance of these sites within the communities (see case study below).

National initiatives

A number of GPPC partners are involved in IPA work at the national level – either in their own countries, or further afield. Most of this work involves a wide range of partners. Some specific examples are provided below:

- **Fairchild Tropical Botanical Garden** researchers have played a critical role in helping the provincial government of Guangxi Zhuang Autonomous Region, China, to establish two Special Protection Zones for *Geodorum eulophioides*, a Critically Endangered ground orchid. The species currently has four extant populations globally; each has less than 35 reproductive individuals. Two of these populations are located on the banks of the Hongshui River, China, subjected to severe impacts from human activities, including the massive Hongshui River hydropower project. A Fairchild researcher is leading efforts to understand the species' basic biology and ecology, to prepare for habitat restoration and population reintroduction in the near future.

- The **Missouri Botanical Garden's** research team in Madagascar has carried out the identification and evaluation of the important remaining sites for plant diversity in Madagascar. Madagascar's surviving forests and other important plant sites are being rapidly lost, particularly as a result of slash and burn subsistence agriculture. 79 important areas for plant diversity have been identified and evaluated. The Garden has also led in the development of a series of management plans for three national parks (in total c.5 million acres / c.2 million ha) in Peru, Ecuador and Bolivia. In Peru, the work has focused on the Selva Central and, within this region, particularly on the Palcazu River watershed, which lies within the homelands of the Yanesha indigenous people. MBG is partnering with Peru's Servicio Nacional de Áreas Naturales Protegidas (SERNANP), represented in the area by the management of the Park and the management of the Yanesha Communal Reserve, to conserve the biodiversity of the National Park. Toward this end MBG is advancing the first strategic objective of the Master Plan for the Park's by working in the documentation of its biodiversity. To date, MBG has documented ca. 4,000 species of vascular plants. In Bolivia, Missouri Botanical Garden has concentrated most of its work in the vast Madidi region in northeastern Bolivia. The Madidi region includes three national parks, Madidi, Apolobamba, and Pilón Lajas, which together comprise a

wilderness area of ca. 28,000 km^2. MBG team members have thus far documented ca. 8,500 of a total 12,000 estimated plant species in the Madidi region and have identified 144 species new to science.

- **RBG Kew** is also working in Peru, where the fragile forests and systems of the coastal desert of Peru are arguably one the world's most threatened ecosystems with habitat fragmentation and destruction driven making them vulnerable to climate change. One local community (San Francisco de Asís) is feeling the impacts already and experiencing a 50% die-back of its *Prosopis* forests. The community asked for support from Kew to create a Private Conservation Area (PCA) to preserve and adapt their native forest. Kew identified the site as important for biodiversity and as an opportunity to develop large-scale restoration of ecosystem services for livelihoods. Intensive fieldwork revealed a raft of other threats including land trafficking, mining prospection, expanding agro-industry and forest depredation. The reserve creation process threw light on a number of complex issues of which the community had previously been unaware, including a mining concession, questionable land ownership transactions and inconsistencies in the delimitation of community land. These discoveries, among others, resulted in the reduction of the PCA from 20,000 hectares initially to a final 11,000 hectares. Government conservation bodies in Peru have supported the reserve establishment with unanimous community support. However, local administrative processes delayed the official approval of the reserve for over a year. Yet this has not impaired the programme – a large tree nursery is now propagating the first native threatened trees, fencing is helping livestock management and allowing regeneration with baseline monitoring plots and GIS species data putting in the foundations to forge a path of adaptation for the future.

- At the edge of the capital city a dry meadow on gravel is rented by the **University Botanic Garden Ljubljana**, for habitat protection and *in situ* plant conservation. Its area is two hectares. This meadow hasn't been fertilized for more than 50 years, and it is being mowed once per year to avoid overgrowing. It acts as a live seed bank for nearby grassland areas.

- Natural forested areas that account for more than half (57.5%) of the property of the **Vallarta Botanic Garden** (VBG) in Mexico are managed for conservation and low impact ecotourism in order to provide protection for plant species and communities. This conserves notable ecological regions and assures the protection of some of the most important areas for plant diversity, as the VBG is located in a recognized critical/endangered terrestrial ecoregion: the "Jalisco Dry Forests" of Mexico's Pacific coast, which are among the world's richest tropical dry forests and exhibit about 16% endemism.

- The **Colorado Natural Heritage Program** (which tracks more than 520 plant species in Colorado – including number and mapped locations of populations, number of individuals, as well as conducting threat and quality assessments) has established Important Plant Areas throughout Colorado. They are summarized in the Colorado Rare Plant Strategy, developed by the Colorado Rare Plant Conservation Initiative of which **Denver Botanic Gardens** is a key member.

- In 2007, **Plantlife** announced the establishment of 150 IPAs across the UK, areas nominated for their internationally important wild plant populations. Since then Plantlife has been actively raising awareness of these ecologically important habitats and encouraging their long-term protection and improvement through landscape scale conservation projects and outreach programmes. Many of these IPAS are already protected areas, with two thirds of IPAs having at least 70% of their area covered by site designations. The IPA programme is supported by national conservation organisations including the RSPB and the Wildlife Trusts, and also by UK government bodies including Natural England, Scottish Natural Heritage and Natural Resources Wales.

- The **RBGE** continues to contribute to the consultation progress led by **Plantlife** on identifying and managing Important Plant Areas (IPA's) in Scotland. Over the past year the RBGE's Centre for Middle Eastern Plants (CMEP) has also been producing a list of IPA's for Iraq and undertaking National Biodiversity Assessments in Afghanistan. Prof. Toby Pennington, as part of the Leverhulme-funded "Latin American Seasonally Dry Tropical Forest Floristic Network (DRYFLOR)" has been heavily involved with gathering baseline species data to help identify areas of highest species diversity and endemism (at a continental scale) in Latin America of highly threatened tropical dry forest. This will facilitate local network partners and in-country scientists feed these results into the conservation decision making process where possible.

- IPAs have also been identified and documented in Armenia (including a new classification of habitats) and in the Falkland Islands by Falklands conservation and partners.

Case study: Natural Networks for Places and People

Plantlife and its European partners have started an exciting new initiative to promote the conservation of Important Plant Areas using networks of volunteers. This project focuses on volunteering as a way to connect plants and people. There are now 13 networks of volunteers protecting Important Plant Areas (IPANets) in Bulgaria, Romania, Macedonia, the Netherlands and the UK[38]. Volunteers work differently on each site, depending on what each site needs and the resources available. This flexibility makes the work much more efficient to protect wild plants.

Many actions have been completed: monitoring of rare plants, clearing scrub from forest glades, restoring traditional orchards, enabling sustainable grazing, heating buildings using cut vegetation materials, designing material to raise awareness, improving site access and influencing local authorities. Many of these activities involved school children and young people. Presentations about EU environmental legislation have also been completed to hold decision makers to account in relation to these policies.

[38] http://www.plantlife.org.uk/international/wild_plants/natural_networks_for_places_and_people/

Case study: Plant micro-reserves in Bulgaria

In Bulgaria, the National Ecological Network consists of protected areas and Natura 2000 sites. Recent developments have seen a small increase in protected area coverage and at the same time a sizable increase in numbers of protected sites. This is the result of a growing network of small protected areas for plant species in Bulgaria using the plant micro-reserve model[39]. The micro-reserves were established to protect 47 rare and endangered plants located in 61 localities, which prior to this initiative were outside existing protected areas, and therefore exposed to a significant risk of extinction. Plant micro-reserves are small-sized areas (less than 20 ha) for protection and long-term monitoring of populations of endemic, rare and endangered plant species and vegetation types. Usually they are located on agricultural land or in forests, subject to commercial use, and they are under high anthropogenic pressure. Due to their small size, these sites require maintenance and restoration actions. For their legal protection, the sites are declared as 'protected sites' under the Bulgarian Protected Areas Act. In the process of creating this network of small protected areas, partnerships have been developed between scientists, public administrations, local authorities and communities, who join their efforts to conserve these rare plants.

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

Target 6 overview

Land in production covers a substantial proportion (around one third) of the earth's land surface. Increasingly, sustainable production methods are being applied in agriculture, including organic production, integrated pest management, conservation agriculture and on-farm management of plant genetic resources. Similarly, sustainable forest management practices are being more broadly applied. However, there are questions concerning the extent to which plant conservation specifications are incorporated into such schemes.

The implementation of this target is closely linked to the implementation of Aichi Target 7 and the work of the UN's Food and Agriculture Organisation (FAO)

On the whole, most GPPC members are not directly involved in the implementation of this target and lack of cross-sectoral linkages, particularly at the national level, (between agricultural, forestry and environmental agencies) makes measuring progress by GPPC members challenging.

[39] http://life.s-kay.com/

Progress towards the target

Sustainable Crop Production

FAO's has produced a Compendium for Sustainable Crop Production Intensification (SCPI). SCPI aims to increase crop production per unit area, taking into consideration all relevant factors affecting productivity and sustainability, including social, political, economic and environmental impacts. With a particular focus on environmental sustainability through an ecosystem approach, SCPI aims to maximize options for crop production intensification through the management of biodiversity and ecosystem services[40].

The Sustainable Agriculture Network[41] (SAN) is a coalition of leading conservation groups that links responsible farmers with conscientious consumers by means of the **Rainforest Alliance** Certified™ seal of approval. The SAN promotes efficient and productive agriculture, biodiversity conservation and sustainable community development by creating social and environmental standards.

By August of 2010, there were over 80,000 Rainforest Alliance Certified farms in 26 countries covering a total of over half a million hectares (approximately 1.4 million acres). As of June 2013, certification had expanded to about 2.7 million hectares in 43 countries worldwide.

The Rainforest Alliance has successfully introduced the concept of "landscape mosaics" to farm and forestry operations around the world. To meet the standards of FSC and Rainforest Alliance certification, farm and forest operations must allocate as protected reserves a portion of the land they are seeking to certify. To date, more than 11 million hectares have been set aside as reserves in Latin America.

Case study: An action plan to conserve arable 'weeds' in France

Arable weed plants have depended on the agriculture they accompany for centuries. Recent developments in agriculture however, have led to a drastic population decline in these species, mainly due to the use of herbicides and intensive and deep tillage, or vice versa, the abandonment of crops.

The action plan provides general objectives : (1) to establish a conservation network by preserving existing diversity and relocating this in agricultural environments. As part of this - ensuring all actors have the necessary management and communication skills and the required training, and ensuring the technical, economic and social acceptability of the recommended conservation measures; (2) to enhance the functional role and services provided by arable weeds in agricultural systems and mobilize local actors and promoters of projects so that the conservation of arable weeds is better integrated into the promotion of biodiversity in agricultural areas and better taken into account in public policy .

[40] http://www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/scpi-home/framework/en/
[41] http://sanstandards.org/sitio/

Case study: The Coronation Meadows project

The aims of this project in the UK are to identify one flagship wild flower meadow – a Coronation Meadow - in each county across the country and then use these meadows as source or 'donor' meadows to provide seed for the creation of new meadows at 'recipient' sites in the same county. The project identifies 'meadows' as any grassland that is maintained by traditional farming practices and allowed to develop over many years, becoming richer with wild flowers over with time. These semi-natural grasslands result from natural regeneration. Such meadows only arise through years of proper management, natural regeneration and the natural spread of flowers and wildlife from field to field.

Sustainable forestry

At the global level, the **Forest Stewardship Council**[42] (FSC) has certified 181 million ha of forests, while the **Programme for the Endorsement of Forest Certification**[43] (PEFC) has certified 258 million hectares.

The recent endorsement of China's Forest Certification Scheme (CFCS) by PEFC represents a significant milestone for safeguarding global forests given the importance of the country in the forest products value chain and its substantial forest area. There are already about 2 million hectares of forests in China CFCS-certified.

China is the second Asian country after Malaysia to successfully achieve PEFC endorsement for a national certification system, and the Indonesian Forestry Certification Cooperation (IFCC) submitted its scheme for PEFC assessment in November 2013. A range of other countries in the region, including India, Japan, Myanmar, Nepal, Philippines, South Korea and the Thailand are advancing in national system development and exploring options for eventual international recognition by PEFC.

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

Target overview

In situ conservation is generally considered to be the primary approach for conservation as it ensures that species are maintained in their natural environments, allowing evolutionary processes to continue. Moreover, for some species, which are dependent on complex relationships with other species for their survival (specialised pollinators, soil bacteria etc.), it may be the only feasible conservation method.

The exact number of globally threatened plants in the world remains to be determined through the achievement of Target 2. At this stage therefore, global progress towards this target remains impossible to measure. However, much more information is available at the national level. The approach taken by

[42] https://ic.fsc.org/index.htm
[43] http://www.pefc.org/

South Africa provides an interesting case study of how a mega-diverse country can address this target and expect to achieve it by 2020 (further details below).

Many GPPC members are involved in the *in situ* conservation of threatened species, often with a particular focus on the conservation of native species at the local level. However, as with other targets, activities also take place internationally and involve partnerships across institutions and countries.

Despite encouraging progress in some countries, overall the continuing loss of natural habitat means that the *in situ* conservation status of many species is getting worse. Furthermore, many species that occur within protected areas are not effectively conserved and are affected by factors such as invasive species, climate change and unregulated harvesting.

On the basis of the available evidence, it seems most unlikely that this target will be achieved by 2020, and this has implications for the achievement of Aichi Target 12 which focuses on the prevention of species extinction.

Progress towards the target

Examples of activities related to the *in situ* conservation of threatened species are provided below:

- **Chicago Botanic Garden's** Plants of Concern (POC) Program was initiated in 2001. The program uses volunteer citizen scientists to monitor rare plant populations in the greater Chicago region. The program, administered by the Chicago Botanic Garden, has engaged more than 650 volunteers to monitor 900 populations of 250 endangered, threatened and rare plant species. Volunteers attend a day-long monitoring workshop to learn a variety of monitoring methodologies, as well as receive one-on-one mentoring in the field to help them apply the appropriate methodology for the species and sites they choose to monitor. A data validation study conducted in 2004-2005 showed a high concordance between volunteer-collected data and professional staff-collected data on the same populations. In addition to the stewardship benefits provided by the data collected, participation helps motivate people to become more active supporters of plant conservation efforts.

- At **Denver Botanic Gardens** long-term monitoring is carried out on four rare Colorado plants for conservation purposes. This work involves statistically rigorous, annual sampling of marked individuals at multiple sites per species. The work is done in partnership with federal and private partners to whom findings are reported and management strategies for these rare species suggested. These data have contributed to the addition of *Astragalus microcymbus* to the Endangered Species Act, adjustments to development plans in *Sclerocactus glaucus* habitat, and an overall understanding of the health of native plant communities in Colorado.

- The **Tallinn Botanic Garden** in Estonia carries out research on restoration ecology of three locally endangered fern species (*Asplenium septentrionale, Polystichum aculeatum* and *Woodsia ilvensis*) in Estonia as well as on three critically endangered Hawaiian endemic fern taxa (*Diellia allid, Diellia erecta f. alexandri* and *Diellia mannii* on Kaua'I (Hawaiian Islands).

- In many countries, botanic gardens are very much involved in on-going monitoring and ecological studies for *in situ* conservation of threatened plants in their local areas. For example:

    - The **Botanic Garden "Alfredo Barrera Marín**" in Mexico protects 21 species listed in the Official Mexican Standard NOM-059- SEMARNAT-2010, 42 native species, 13 endemic species, 51 CITES listed and 8 Red List species.

    - The **Vallarta Botanic Garden** in Mexico is conserving five threatened plant species *in situ*; these species grow naturally in the forested areas of the VBG: *Dioon tomasellii, Chamaedorea pochutlensis, Cryosophila nana, Vanilla planifolia* and *Calophyllum brasiliense*.

    - The **Jardim Botânico do Faial**, Azores, is implementing a strategy for monitoring and preserving natural populations of endangered species. This includes participating in the effective management of each protected area according to the management plans developed.

    - The **City of Geneva Botanic Garden** has identified sites and priority species for the Canton of Geneva for which action plans are being developed, in collaboration with the State of Geneva. Operations to protect threatened species such *Littorella uniflora* or *Gladiolus palustris* are being conducted by propagating individuals *ex situ* and reintroducing these *in situ*.

- The **Hawaiian Plant SG**, in coordination with the Plant Extinction Prevention (PEP) programme, monitored 103 of 201 PEP species (plants with fewer than 50 individuals in the wild), collected from 49 species, surveyed 34 species, managed threats for around 48 species, and reintroduced 24 species

- Scottish Natural Heritage (SNH) supports a Scottish project officer for the Botanical Society of Britain and Ireland (BSBI) based at **RBGE.** Members of the BSBI are involved with site condition monitoring for specialised species in smaller sites. RBGE staff with SNH co-operation and support have also undertaken long-term monitoring of wild populations of threatened species eg, *Woodsia ilvensis* & *Moneses uniflora*.

- The evaluation of the conservation status of taxa subject to listing and amendment proposals to the three **CITES** Appendices normally includes data assessments on population level, with reference to distribution areas and habitats. These data can be helpful for *in situ* conservation

programs for these species. This is exemplified in the Annexes 1 and 2 of CITES PC19 Doc.14.3., related to Madagascan species of *Dalbergia* L.f.(Leguminosae) and *Diospyros* L. (Ebenaceae) Here, distribution and habitat data as well as the conservation status was assessed as the basis for potential listing proposals. In addition to these processes of data gathering and evaluation, efforts by CITES Parties to ensure sustainable use of CITES-listed species should also contribute to their survival *in situ*.

Case study: South Africa and Target 7

South Africa has done interesting work over the past few years towards measuring progress in achieving Target 7. This has involved obtaining accurate information on the locations of populations of threatened species, done by:

1) digitizing and geo-referencing over 60 000 herbarium specimens;

2) validating historic records in the field and obtaining new field data on populations from a network of 500 citizen scientists who specifically monitor the status of threatened plants in the field across South Africa as part of the Custodians of Rare and Endangered Wildflowers (CREW) Programme.

With comprehensive data on the location of threatened species, it has been possible to determine that 63% of South Africa's threatened plant species have at least one population occurring within a protected area. A conservation planning process has been conducted between 2013 and 2014 on species that do not yet have any form of protection, to identify optimal sites to conserve. Only 27 properties need to be acquired for conservation, to reach the target of 75% of threatened species conserved *in situ*. This information will inform updates for South Africa's Protected Area Expansion Strategy, and provide guidance to stewardship programmes that contract private and communal land into the protected area network, to ensure this target can be achieved by 2020.

Case study: Conservation of *Mammillaria herrerae* in Mexico.

This is one of the most popular ornamental cacti cultivated around the world. On the brink of extinction in its wild environment, this microendemic and historically looted plant faces its ultimate challenge. It was studied by the **Cadereyta Regional Botanic Garden** (CRBG), and less than 400 specimens were found remaining alive in the wild. This population was recently divided and affected by the building of a road, today in the charge of a private company. The CRBG has carried out an inventory of the species in the wild and published a paper about its fragile conservation status. Propagation protocols for the species have also been developed by CRBG. Since *Mammillaria herrerae* is an emblematic species, a global partnership for its rescue in the wild could be implemented. Its place of distribution is not officially protected. Protection of the place, reintroduction of specimens and restoration of adjacent land are immediate and imminent tasks required. In addition, it is important to note that *M. herrerae* is currently listed in the Official Mexican Standard NOM-59-SEMARNAT-2010 under the category 'Endangered' (P) and is therefore protected by the Mexican General Wildlife Law (LGVS, 2000).

Case Study: Conserving a critically endangered palm from Madagascar

Dypsis sanctaemariae is a beautiful small palm with straight, slender stems topped with clusters of deeply-notched leaves below which hang generous panicles of bright orange fruits. Until recently the plant was classified as "Critically Endangered," its only known location in a small area of swamp on Ile Sainte Marie island in Madagascar threatened by the installation of tourism infrastructure. Five years ago botanists from the **Missouri Botanical Garden** discovered a previously unknown population growing in a swamp on the Pointe à Larrée peninsula that juts out from the Malagasy mainland into the Indian Ocean. This population is also threatened, but with the support of the Prince Bernhard Fund for Nature, Garden conservationist Adolphe Lehavana is working with farmers to build an irrigation network that will enable them to grow more crops for food and reduce their reliance on harvesting the remaining *Dypsis sanctaemariae* palms for economic sustenance.

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 8 overview

Botanic gardens are the main institutions involved in the *ex situ* conservation of wild plant diversity and many have adopted Target 8 as a target, either at an individual institutional level or as a national network target.

The number of botanic gardens in existence around the world has more than doubled in recent years and their combined plant collections, as recorded in **BGCI's** PlantSearch database[44], consist of more than 170,000 species, well over one third of all known plants, including many threatened species.

A recent assessment by BGCI has identified 10,100 globally threatened species (using a combination of both the 1997 and 2013 IUCN Red Lists[45]) in botanic garden collections. Of these, 2,925 species (29%) are included on the 2013 IUCN Red List. As with Target 7, lack of information on which species are globally threatened (Target 2) constrains accurate global monitoring.

National and regional assessments can provide a more accurate assessment of progress, with 39% of threatened species in the USA and 56% in Australia/New Zealand being recorded in *ex situ* collections.

While the focus of conservation work by botanic gardens in the past has been through their living collections, there is increasing recognition that such collections do not include sufficient intra-specific genetic diversity. A growing number of botanic gardens are now establishing seed banks – with the

[44] http://www.bgci.org/plant_search.php

[45] http://www.bgci.org/worldwide/which_iucn_list/

Millennium Seed Bank of the RBG, Kew, playing a key role in this respect. According to BGCI's GardenSearch database[46], 275 botanic gardens in 66 countries now record having a seed bank.

Although significant progress is being made towards this target, and it is likely that the first part of the target (*ex situ* collections) has already been achieved by some countries, it remains challenging for mega-diverse countries. While seed banking can be readily applied for many species, not all species can be conserved this way and alternative long-term conservation methods are required. Progress towards the second part of the target (recovery and restoration) remains challenging. However, there is an increasing understanding of the importance of linking *in situ* and *ex situ* conservation and using collections for restoration activities – both at species and ecosystem levels. This is exemplified by the recent establishment of the Ecological Restoration Alliance of Botanic Gardens (see Target 4).

The achievement of this target is has an impact on the achievement of Aichi Target 12 (*preventing species extinction*).

Progress towards the target

Global monitoring

BGCI has been monitoring progress towards this target using its database of plants in cultivation and in seedbanks of botanic gardens (PlantSearch). PlantSearch presently includes over 1.2 million records, relating to more than 387,500 taxa provided by over 1,000 botanic gardens (up from 934,500 records on 269,000 taxa provided by 869 institutions in 2010).

A survey carried out in 2010 identified 23% of globally threatened species in *ex situ* collections. However, the lack of data on which species are under threat globally (Target 2) makes assessments of progress at the global level challenging. A recent analysis has identified 29% of globally threatened species (as included on the IUCN 2013 Red List) in cultivation and/or seed banks, but as mentioned above, information on which species are threatened at the global level is largely incomplete.

National and regional progress

As national and regional lists of threatened species are more widely available, BGCI has also carried out a number of regional assessments on *ex situ* conservation progress since 2010.

In the USA, a recent review found that 39% of threatened native U.S. species are now maintained in living plant and seed bank collections as an insurance policy against extinction[47]. This is up from 37% in 2010. This leaves more than 3,000 threatened species to add to collections by 2020 for the USA to meet the 75% *ex situ* target.

[46] http://www.bgci.org/garden_search.php

[47] http://www.bgci.org/usa/naca/

In Australia and New Zealand, 56% (854 of 1,519) of threatened species are safeguarded in living plant collections. However, although this is the best regional progress toward the GSPC Target 8 found so far – there is still work to be done to reach the 75% goal by 2020. Furthermore, nearly 40% of reported threatened native species are known in only one collection, which suggests that collections contain low levels of intraspecific genetic diversity[48].

Figure 4: Results of an assessment of ex situ collections in Australian and New Zealand botanic garden collections

In **Colombia**, botanic gardens have been leading conservation programs for over 45 threatened plant species including Magnolia, palms, and orchids among others. More than 290 native threatened plant species are represented in the living plant collections of Colombian botanic gardens, which have been leading studies of wild populations of Magnolias and Zamias as well as carrying out propagation trials, reintroduction processes and educational campaigns.

Quindio Botanic Garden has the biggest *ex situ* collection of palms with 182 Colombian native species. The main purpose of this National Collection of Palms is to conserve the 241 palm species that are distributed in Colombia, including the 39 threatened species. Accessions of each species are collected nationwide in order to ensure that genetic variability is represented in the collection. Duplicates of the species are also held at the National Tissue Bank of Alexander von Humboldt Institute and individuals have been donated to other botanic gardens.

In **China**, the botanic gardens of the **Chinese Academy of Sciences** (CAS) are the largest group of botanic gardens devoted to *ex situ* conservation. The ten main botanic gardens maintain living collections of over 24,500 species and infraspecific taxa. This accounts for approximately over 90% of the total *ex situ* living conservation collections of Chinese botanic gardens. Summary statistics on *ex situ* conservation in the ten main Chinese Botanic Gardens are provided in the table below. Different regional native flora are represented across China, as most botanic gardens have emphasized the collection and conservation of local or regional floras. Duplication of *ex situ* conserved plants across different gardens has been

[48] http://www.bgci.org/usa/bganz2013/

shown to provide an insurance policy against unpredictable losses. Of the *ex situ* conservation collections, 8 215 species (33%) are duplicated in at least one other botanic garden.

Table 2: Contribution of the ten main Chinese botanic gardens to ex situ *living collections for plant conservation in China, 2012* [49]

Measure	**Number of verified species**	**Number of verified Chinese Red List species** [50]
Total number of plant species conserved *ex situ* in China	24,667	1,663
Total number of native plant species conserved *ex situ* in China	ca. 19,000	1,633
Total number of plant species recorded in China	33,000	4,408
Proportion of total native plant species conserved ex situ in China	58%	37%
Proportion of conserved species unduplicated across gardens	67%	46%
Proportion of conserved species duplicated across gardens	33%	54%

On-going activities

Many botanic gardens maintain *ex situ* collections of rare and threatened species – often with a focus on the local flora. Some examples are provided below:

- The 4 botanic gardens of the **Muséum National d'Histoire Naturelle** (MNHN) in Paris are involved in the conservation and multiplication of rare and threatened plants: in particular Cycadales, orchids, aloe plants, cactuses, Euphorbiaceae and other succulent plants. The Muséum also collaborates with *ex situ* conservation programmes using local facilities in Viet Nam. The seed bank of the Muséum's Conservatoire Botanique holds 7 million seeds of more than 450 regionally threatened species.

- Partners in the **Australian Seed Bank Partnership**[51] have secured a third of Australia's flora in conservation seed banks with duplicate collections at the Millennium Seed Bank, including more than 25% of the nation's threatened plants. The ASBP's 1000 Species Project (2011-2020), a national collaboration, involves coordinating targeted seed collection of endangered, endemic or economically significant species not already represented in conservation seed banks, as well as working to enhance the provenance of existing collections.

[49] Huang, H. (2011). Plant diversity and conservation in China: planning a strategic bioresource for a sustainable future. Botanical Journal of the Linnean Society 166: 282-300.
Huang & Zhang, (2012). Current status and prospects of *ex situ* cultivation and conservation of plants in China. Biodiversity Science 20(5): 559-571.

[50] Species noted on China's Red List for plants as of national conservation concern, most not yet evaluated by the IUCN.

[51] http://www.seedpartnership.org.au/

- **Memorial University of Newfoundland Botanical Garden** (MUNBG,) in conjunction with the Limestone Barrens Species at Risk Recovery Team, continues to play a crucial role in the maintaining of *ex situ* populations of rare Newfoundland plants. The rare plants are confined primarily to the limestone barrens region of the Great Northern Peninsula, Newfoundland. This small region only comprises 1.7% of Newfoundland's surface area yet is home to 35 provincially rare plant species, three of which are endemic. Until 2011 MUNBG was focused on the recovery efforts of Long's Braya (*Braya longii*, endemic, COSEWIC status endangered), Fernald's Braya (*B. fernaldii*, endemic, COSEWIC status threatened), Low Northern Rockcress (*B. humilis*, near endemic, COSEWIC status endangered) and the Barren's willow (*Salix jejuna*, endemic, COSEWIC status endangered). Living plants of these four species are maintained, as well as seed banking of the *Braya* species. *Salix* seed have a short viability so seed banking is not an option for this genus.

- The **Missouri Botanical Garden** contributes to the achievement of Target 8 both in the U.S.A. and internationally. The Garden maintains in St. Louis, living collections of 16,381 taxa, of which 221 taxa are rare or threatened. At the Garden's Shaw Nature Reserve a native plant garden with c.700 species is maintained. It is used to promote native plant conservation and their use in sustainable ornamental horticulture, as well as to study plant conservation, cultivation and management *ex situ*. The Garden has also developed and opened a new seed bank with a focus on the conservation of regionally threatened flora. To date 29 regionally threatened species and 223 additional species are protected in this long-term *ex situ* seed storage facility.

- The **Center for Plant Conservation**[52] (CPC) is dedicated solely to preventing the extinction of U.S. native plants. The Center is a network of 39 leading botanic institutions and it operates a coordinated national program of *ex situ* conservation of rare plant material. This conservation collection includes nearly 800 of the USA's most endangered plant species. The Center ensures that material is available for restoration and recovery efforts for these species.

- The Seed Bank of the **Jardín Botánico Atlántico, Gijón**, holds 808 collections representing 413 taxa. In the Cantabrian Environment botanic collection, 434 taxa of the regional flora are preserved *ex situ*. Of the 62 plant taxa that are legally protected at the regional level (Principality of Asturias Decree 65/95), 27 (44%) are preserved in the Seed Bank and 30 (48%) in the live plant collections. All the accessions of the Seed Bank are accessible for their use by the competent administrations, and the autonomous communities where they were collected.

- The *ex situ* live collection of plants at the **Jardim Botânico do Faial** (JBF), includes 63% of the threatened plants from the Region, while the Azores Seed Bank (located at the JBF) conserves about 60% of all Azorean endemic plant species: These include one species which is listed in the Habitats Directive, 6 species protected by the Bern Convention and 13 protected by both. Since 2010, 238 new accessions were banked at the Azores Seed Bank.

[52] http://www.centerforplantconservation.org/

- The **Andalusian Seed Bank** (BGVA) currently stores 10,540 accessions corresponding to 3,210 taxa of Andalusian flora, Iberian endemics, and species with forest, ethnobotanical or economical interest. Of these, 2,410 accessions representing 359 taxa (78%) of Andalusian threatened taxa are included in the Spanish Red List 2008.

- The seed bank of the **Jardí Botànic de Sóller** includes 50% of threatened plants species from the Balearic Islands. All of these are suitable for recovery and restoration programs because the collection has been done individual by individual and a good representation of each population has been conserved. In the living collection, 75% of threatened wild plants species from the Balearic Islands are cultivated. They are well documented and can provide material for horticultural and research, propagation, education and species reintroduction programs.

- The **Norwegian Network of Botanical Gardens** is working on the implementation of Target 8. The goal for the national network is to achieve 75% of threatened Norwegian plants species in *ex situ* collections within the country by 2016. For a living *ex situ* collection in the garden, there should be at least 20 individuals of the threatened species. The number of seeds in the seed bank has increased steadily since the start in 2009, and it increased by ca. 50% during the years 2011-2013. In December 2013 the National Seed Bank of Norway contained seeds from 150 species, approximately 45 % of the plant species on the Norwegian Red List (2010). Living collections of 88 Norwegian threatened plant species are also on display in Norwegian botanic gardens. The **Norwegian Natural History Museum** is involved in recovery and restoration programmes of threatened plants and is contributing to the national Action Plans for threatened plant species. Up to 2013 this work has included eight species.

- **Fairchild Tropical Botanic Garden** holds142 rare taxa in its *ex situ* collection and over 100,000 seeds of endangered Florida species in long-term storage at the USDA-ARS National Center for Genetic Resources Preservation, in Ft. Collins, Colorado. Fairchild's collections include 45% of US listed and candidate species, 515 palms, and 34% of the world's cycad species, all threatened with extinction in the wild.

- The number of targeted species in Scotland has risen from 165 to 170. Through a targeted collection programme **RBGE**, the number of these species in cultivation at RBGE has increased from 123 to 150 species. To date 9 of these species have been reintroduced to the wild. The RBGE thus continues to meet this target for Scotland.

- ENSCOBASE[53], the database of the **ENSCONET** (European Native Seed Conservation Network) Consortium currently lists more than 48,400 seed bank accessions stored for long-term storage in 32 European seed banks. These 48,400 accessions represent 9,660 different European plant taxa from 41 European countries. Fifty-two percent of Europe's threatened flora is preserved in ENSCONET Consortium seed banks (251 out of 484 species, based on the latest IUCN Red List,

[53] http://enscobase.maich.gr

IUCN 2013). Forty- seven percent of the 1992 European Habitat Directive 92/43/EEC List (with 2004 and 2007 additions) is preserved, whereas 28% of all species listed in Botanic Gardens Conservation International's European Threatened Taxa List are preserved.

- The conservation of endangered plant species is the main challenge that **Mexican Botanic Gardens (MBG)** have accepted. 985 Mexican plant species are listed in the Official Mexican Standard NOM-059-SEMARNAT-2010. MBGs house 441 of them, divided into the following categories: 180 species in the category of special protection (Pr), 167 threatened (A), 92 endangered (P) and 2 considered as extinct in the wild (E). Furthermore, 10 MBGs propagate 937 native plant species, 187 of them included among the species listed in the Official Mexican Standard. MBGs also hold 354 species that are globally threatened (listed on the IUCN Red List) and 990 of the approximately 1,500 Mexican plant species included in the CITES Appendices, are also protected.

- Conservation activities at the **Barcelona Botanic** Garden are focused mainly on the establishment of the Catalan strategy for *ex situ* plant conservation. In that strategy an accurate list of species priorities have been established in order to optimize the available conservation capacities. The *ex situ* collections at the Catalan botanic gardens and public conservation centers are still far from preserving the total threatened plant species in Catalonia. The Seed Bank of the Botanic Garden of Barcelona keeps accessions of 2,213 species. Most of these accessions come from Catalonia, Spain and northern Morocco.

- **Italy** published in 2013 the "Guidelines for translocations of wild plant species". This is the first volume devoted to translocations specifically addressing the theme of wild plants. The "Guidelines for the Translocation of Wild Plant species" are the result of about 20 years research and practical experience, focused on the improvement of translocation techniques. Plant translocations are options with a high rate of failure, and the risk can be reduced through the application of rigorous protocols and the development of ad hoc techniques. In this book there is a synthesis of the latest knowledge in the field of plant translocations[54].

Case Study: The Millennium Seed Bank Partnership

The RBG, Kew is host to the world's largest *ex situ* collection of seeds from wild flowering plants. Kew's Millennium Seed Bank Partnership (MSBP) is a network of botanical organisations working in more than 60 countries, coordinated by Kew scientists. The MSBP has two stated outputs:

[54] http://www.minambiente.it/biblioteca/quaderni-di-conservazione-della-natura-n-38-linee-guida-la-traslocazione-di-specie

1. Banking of seed collections. By the end of MSB-2, the Partnership will have conserved 25% of the world's orthodox seed-bearing species

2. Enabling the use of seed collection for innovation, adaptation and resilience in agriculture, forestry, horticulture and habitat restoration.

Priority is given to banking seed from those species which are either endemic, threatened or have known use. By January 2014, Over 32,000 verified taxa have been stored in the MSB. Of these, at least 4,666 are threatened taxa, according to the threatened species lists available to us. It is likely that many more of our collections are from threatened species which have not yet been captured in these lists. Collections held at MSB and by partners are available for restoration, and are frequently used for this purpose.

Case Study: Conserving the flora of the Hawaiian Islands

The Hawaiian Islands have one of the highest rates of endemism in the world, and over half of all taxa are at risk of endangerment or extinction. *Ex situ* facilities and conservation agencies were surveyed to determine if existing *ex situ* capacity was sufficient to represent Hawai'i's species of conservation importance (SCI) and to identify limiting factors. SCI were defined and their representation in 23 separate *ex situ* collections quantified, the number of wild plants and populations were estimated, and the attempted *ex situ* methods were recorded. There are 724 SCI and 522 are considered 'threatened'. Of Hawai'i's threatened SCI, 379, or 73% are represented to some degree. While this achievement is close to the GSPC Target 8 for securing *ex situ* collections, sixty-four percent of these secured taxa are represented by collections from only ten percent or fewer of the wild plants. These collections are inadequate to provide appropriate material for restoration efforts. In contrast, almost 19% of the SCI *ex situ* collections are abundant enough to be used for restoration efforts, and it should not require significant further effort to surpass the 20% minimum goal of Target 8. While Hawai'i is ahead of the country's average of 39% for the flora represented *ex situ*, our work is daunting and urgent. Other findings were: at least 18 taxa are considered extinct in the wild but are represented *ex situ* and 27% of secured taxa only exist at one *ex situ* facility. This study was conducted for the Lyon Arboretum and the National Tropical Botanical Garden with support from the Hau'oli Mau Loa Foundation. The next steps will be to complete a statewide strategy for plant conservation that is aligned with the GSPC, formalize a network of conservation agencies and *ex situ* facilities and seek funding support to coordinate data management, make collections and facilitate restoration projects.

Case study: Conserving exceptional species

While numerous researchers and conservation organizations are working to conserve exceptional species (species that can't be conserved by conventional seed banking methods) on a species-by-species or regional basis, there is the need for a systematic effort to build secure, genetically diverse *ex situ* collections of endangered exceptional species on a scale comparable to that of seed banks. BGCI US, working with partner botanic gardens and organizations across the U.S., is using an important group of

exceptional species as a model for prioritizing and conserving *ex situ* species: oak trees. Acorns will not survive long-term dry storage, and other forms of *ex situ* conservation like *in vitro* propagation and cryopreservation are exceptionally challenging for most oak species because of their high tannin content. BGCI is working to identify and increase the conservation value of living collections of these threatened species. BGCI is also working with the Cincinnati Zoo and Botanical Garden's Center for Conservation and Research of Endangered Wildlife utilizing these living collections to support research into appropriate *in vitro* propagation and cryopreservation techniques.

Case Study: Assessing the representativeness of threatened plant species in *ex situ* collections

The Australian National Botanic Gardens (ANBG) maintains the largest scientifically documented collection of Australian native plants in which the collection originates from plants sourced from the wild, accompanied by herbarium specimens for taxonomic study. In order to better assess the coverage of threatened plant species held *ex situ*, the ANBG developed a new methodology to assess its living collection. The methodology will also help inform decisions about future collection of target species, as well as working with partners for recovery or restoration. This methodology is a model for documenting and assessing the national comprehensiveness and adequacy of Australia's *ex situ* collections.

Using plant records for each threatened species, the methodology compares: the number of individual plants growing in the garden, held in the seedbank or under cultivation in the nursery; the number of genotypes that the living collection holds; and the number of known wild origins of the species. Each species is mapped with its known wild geographic distribution against the provenance of the plants in the living collection, providing information for a rapid assessment, or proxy, for genetic diversity.

The methodology highlights the value of accuracy and currency of plant records. It also highlights the potential value of local and regional collaborations to coordinate efforts to collect well-represented species for recovery and restoration.

Case study : French network of regional seed banks and Conservatoires botaniques for species on the verge of extinction

The **National Conservatoires botaniques** manage a network of 9 seed banks located throughout the country which are specialized in the conservation of genetic resources of endangered species at the local level. These seed banks are associated with Conservatoires botaniques for the multiplication of seed. Each year, nearly 1,000 seed lots are harvested across the country to be stored in the seed banks,.

The French network of seed banks uses cold storage in freezers to store the seed. *In vitro* culture is also used to quickly multiply species to be reintroduced into the wild.

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 9 overview

The diversity of local crops and their wild relatives plays a significant role in the livelihoods of many smallholder farming communities in developing countries.

At the global level, the **Global Crop Diversity Trust** (CDT) has been established to ensure the conservation of crop diversity for food security worldwide. It works within the framework of the **International Treaty on Plant Genetic Resources for Food and Agriculture**, which is the key global instrument for the conservation of genetic diversity for food and agriculture.

This target is also closely linked to the Global Plan of Action for Plant Genetic Resources for Food and Agriculture of the **Commission on Genetic Resources for Food and Agriculture** of the **Food and Agriculture Organization of the UN (FAO).** In July 2011, the 13th regular session of the FAO Commission on Plant Genetic Resources for Food and Agriculture (CGRFA 13) adopted the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (PGRFA).

In 2010, FAO launched the 2nd Report on the State of the World's Plant Genetic Resources for Food and Agriculture (SoWPGR-2), providing a comprehensive overview of recent trends in PGRFA conservation and use around the world. It was based on information gathered from more than 100 countries, as well as from regional and international research and support organizations and academic programmes. This report noted that although there has been progress in securing PGRFA diversity in a larger number of international and national genebanks, much of the diversity, particularly of crop wild relatives (CWR) and underused species relevant for food and agriculture, still needs to be secured for present and future use[55].

This second part of this target is implemented through the implementation of Aichi Target 18*: traditional knowledge.*

This target has probably already been met through seed conservation for the major crops that are important globally. However the challenge is to meet this target for the many thousands of other species that are of socio-economic importance at the national or local level.

[55] http://www.fao.org/docrep/013/i1500e/i1500e_brief.pdf

Progress towards the target

Seed conservation

The Svarlbard Global Seed Vault, managed by the CDT holds more than 700,000 seed samples, originating from almost every country in the world. Ranging from unique varieties of major food staples such as maize, rice, wheat, cowpea, and sorghum to European and South and central American varieties of eggplant, lettuce, barley, and potato. In fact, the Vault already holds the most diverse collection of food crop seeds in the world.

Both the number and size of national genebanks has increased in recent years and progress has been made in broadening the range of crops and numbers of accessions held by them. Recent efforts have been focused more on conserving minor crops and wild species than on the major crop species.

On-farm and *in situ* conservation

Much important plant diversity can be found in farmers' fields as well as in unmanaged agricultural ecosystems. The SoWPGR-2 reviewed the current state of knowledge regarding the amount and distribution of landraces, CWR and other useful plants and assesses the ongoing efforts to conserve and manage them *in situ* in their natural surroundings. It indicated that more attention is now being paid to using such crop diversity within production systems as a way to reduce risk, particularly in light of changes in climate, pests and diseases. Countries reported a greater understanding of the amount and distribution of genetic diversity on-farm, and of the role of the 'informal' seed systems in maintaining such diversity. It also noted that the science behind *in situ* conservation has advanced, with the development of protocols and tools to assess and monitor PGRFA within agricultural production systems.

A new project on CWR *in situ* conservation and utilization has recently been initiated in the SADC region. The project is supported by the Secretariat of the African, Caribbean and Pacific (ACP) Group of States through its ACP-EU Co-operation Programme in Science and Technology. This 3-year project is implemented by Bioversity International together with the University of Birmingham, the University of Mauritius, the Directorate Genetic Resources in South Africa and the Ministry of Agriculture and Livestock in Zambia. The project aims to enhance the scientific capacities within the partner countries to conserve CWR and to identify potentially useful traits for use in climate change adaptation strategies. It also aims to develop exemplar national Strategic Action Plans for the conservation and use of CWR across the SADC region.

In some countries, protected areas have been established with a focus on conserving crop wild relatives. Examples include:

- In Ethiopia, wild populations of *Coffea arabica* are being conserved in the montane rainforest.
- The Sierra de Manantlan Reserve in Southwest Mexico has been established specifically for the conservation of the endemic perennial wild relative of maize, *Zea mays* and significant efforts

are continuing to identify areas of important maize genetic diversity (both landraces and wild relatives)[56]

- The Erebuni Reserve has been established in Armenia to conserve populations of cereal wild relatives (for example *Triticum araraticum, T. boeoticum, T. urartu*, *Secale vavilovii, S. montanum, Hordeum spontaneum, H. bulbosum* and *H. glaucum*).

Activities of GPPC members

Some specific examples of activities of GPPC members that contribute to this target include:

- **Bioversity International** is leading the "Bridging Agriculture and Conservation Initiative" which will provide evidence-based solutions to feed a growing population, while ensuring that biodiversity is used and conserved at the genetic, farm and landscape level.

- **MNHN, Paris** works in collaboration on wild relatives of *Musa*, bamboos, other Monocots, Euphorbiaceae and Legumes. It is also involved in comparative studies of the biological and morphological diversity of cassava in Amazonia and a project on the conservation and promotion of tropical useful plants in the greenhouse of the Muséum.

- The **Chicago Botanic Garden** is working with international collaborators in Southeast Asia to study and conserve the genetic diversity of under-utilized crops. The two focal species, jackfruit (*Artocarpus heterophyllus*) and breadfruit (*A. altilis*), are cultivated throughout the tropics and may be under threat of genetic erosion. This project aims to use field data and genetic evidence from jackfruit and breadfruit to identify their wild relatives, assess genetic diversity throughout their range, determine possible threats of genetic erosion, and working closely with international collaborators make recommendations for germplasm conservation.

- **Missouri Botanical Garden** has carried out extensive research on the sustainable use of medicinal plants in Latin America, the Himalayas, the Caucasus and Vietnam. For example, this includes documenting the altitudinal distribution of important medicinal species in Nepal, Bhutan, China and Bolivia and evaluating the actual and potential impact of climate change on these species. The Garden's **Sacred Seeds Network** initiative is also making major contributions to the achievement of this target. Through the Sacred Seeds program threatened useful plant gardens have been developed, many managed by indigenous counterparts. The Sacred Seeds network now includes 40 main garden partners, in addition to about 1,500 small partner gardens.

[56] http://www.biodiversidad.gob.mx/genes/proyectoMaices.html also see http://www.biodiversidad.gob.mx/usos/maices/razas2012.html and http://www.biodiversidad.gob.mx/usos/maices/teocintle2012.html)

- **Fairchild Tropical Botanic Garden's** Tropical Fruit Program is centered at the Fairchild Farm Genetic Facility where living genetic collections of tropical fruit species from the Americas, Africa and Asia are maintained. These collections serve to conserve clones long-term and are a source for applied horticulture research and distribution to local, national and international communities. Collections include avocados, mangos, mamey, mamey sapote, sapodilla, jackfruit, canistel, caimito, and lychee.

- Many botanic gardens, such as the **Jardí Botànic De Sóller** in Spain, conserve seeds of old varieties of crops from their local areas. Fruits crops are also conserved in the living plant collections of many gardens.

- The **National Tropical Botanic Garden** in Hawaii, is home to the Breadfruit Institute which manages the largest and most extensive collection of breadfruit species and varieties in the world. Its collections include some varieties that no longer exist in their native lands. The collection contains approximately 120 varieties from 34 islands in the Pacific, as well as Indonesia, the Philippines, the Seychelles and Honduras. The Institute is also taking a leading role in ethnobotanical research documenting traditional uses and cultural practices involving breadfruit.

Case study: Adapting agriculture to climate change

The **Millennium Seed Bank** in collaboration with the **Global Crop Diversity Trust** is engaged in a project called 'Adapting agriculture to climate change'. The main objective of this project is to collect, protect and prepare the wild relatives of the world's most important food crops, in a form that plant breeders can readily use to produce varieties adapted to future climatic conditions that farmers in the developing world will soon be encountering. The project focuses on the wild relatives of 29 crops which are of major importance to food security, covered by Annex 1 of the International Treaty of Plant Genetic Resources for Food and Agriculture.

Case study: Fruit and nut forest conservation in Kyrgyzstan

The unique fruit and nut forests of Central Asia have declined by at least 80% over the last 50 years and are still under threat from grazing, hay making, over harvesting, illegal tree cutting and firewood collection. **Fauna and Flora International** (FFI) and their partners are helping the local forest service and communities to plan together to protect and manage the forests. Through seminars, events and publications they are raising awareness of the global importance of the forests and the conservation

issues, as well as developing practical solutions to address threats, such as solar cookers and heaters[57]. They are also supporting grassroots initiatives to engage school children in setting up nurseries to grow threatened trees for planting in the forest. A particular focus is conserving the Endangered Niedzwetzky apple, one of the trees identified in The Red List of Trees of Central Asia. The aim is to increase knowledge and protection of the areas where it occurs and build capacity among the local forest service, protected area staff and local communities to protect and reinforce the populations by propagation in nurseries for subsequent planting. During 2010 and 2011, well over a thousand saplings were planted in the forest, which are now being cared for and monitored.

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

Target 10 overview

Alien species that become invasive are considered to be a main direct driver of biodiversity loss across the globe. In addition, alien species have been estimated to cost our economies hundreds of billions of dollars each year.

The removal of invasive alien species is a key management activity for effective conservation. However experience has shown that preventing new invasions of harmful species is more cost-effective than waiting until they have become a threat. However, increasing global trade and the multiple pathways of introduction represent a major challenge to preventing new invasions. Applying preventative measures requires action at both international and national levels including the coordination of agencies working in the areas of plant health, transport, trade, tourism, protected areas, wildlife management and water supply.

Activities related to this target are on-going, both with respect to preventing new invasions and in managing areas already affected, but the evidence suggests that progress is insufficient to meet the target.

Implementation of this target is closely linked to Aichi Target 9 (*Invasive alien species prevented and controlled*) and Target 11 (*Protected areas are effectively and equitably managed*).

[57] See also the report: Gardening the wild – Growing the mind: Fostering Kyrgyzstan's botanical community to advance public outreach and environmental awareness (http://www.bgci.org/files/Worldwide/Regional/bgci_conservingeden.pdf)

Progress towards the target

Activities by GPPC members

A number of GPPC members are involved in important activities related to the control of invasive alien species. For example:

- **Plantlife** in the UK has published a report: "*Here today, here tomorrow? Horizon scanning for invasive non-native plants*" which provides details of a Rapid Risk Assessment screening process developed to identify potentially invasive non-native plants in the UK.

- In New York City, **NYBG** restoration specialists are actively managing invasive species in the 50-acre Thain Family Forest and re-establishing populations of native plants decimated by anthropogenic disturbances.

- **Chicago Botanic Garden** is developing internet-based decision support tools for land managers dealing with invasive species. Such tools integrate monitoring, management objectives, and actions with predicted outcomes determined through the monitoring efforts—ultimately uniting scientific research with conservation practice. Developed after years of collaborative work, the tools promote cooperative learning and facilitate more rapid, adaptive management among land managers who would otherwise be dealing with a common problem on their own and learning more slowly. The tools are currently being used by National Wildlife Refuge managers throughout the Great Plains to more effectively control Kentucky blue grass and smooth brome grass that have invaded prairies. The tools are also being used by land managers at the Minnesota Department of Natural Resources and The Nature Conservancy. The tool is being adapted for application in the Midwest and Northeast to help managers remove reed canary grass and Phragmites from wetlands.

- PhragNet: A Cooperative Learning Network for Phragmites Management – **Chicago Botanic Garden** manages a collaborative network for adaptive management of the invasive wetland plant *Phragmites australis* (common reed). Participants from throughout the United States and parts of Canada have implemented a standardized monitoring protocol in *Phragmites*-impacted areas slated for control and restoration. Hundreds of soil and leaf-tissue samples have been sent to the Garden for ongoing nutrient and genetic analyses (respectively). The goal of this cooperative effort is to "learn while doing," harnessing the collective efforts of wetland managers distributed over a broad geographic area to identify best practices for controlling Phragmites and re-establishing diverse native vegetation.

- The **City of Geneva Botanic Garden** alerted national authorities of the arrival of *Ambrosia artemisiifolia* (Asteraceae) in the early 2000s in Switzerland. Since then, they have participated in a group monitoring invasive plants in the canton. At the national level, they have participated in the development of a black list adopted by the Swiss government.

- The **MNHN**, Paris is participating in a research consortium on population genetics of invasive alien species with *Ambrosia* as model. It has also established lists of invasive plant species in France for the regional environmental management committees and participates in programs to fight against *Ludwigia* spp.

Case study: Sharing information, and policy, on potentially invasive alien plants in Botanic Gardens

Botanic gardens hold large and diverse collections of plants, the majority of which are exotic, and many of which may be new to cultivation. It is vital that botanic gardens take steps to ensure that future problem taxa do not 'escape' from their collections and establish outside the garden.

To address this issue, European botanic gardens have developed an invasive species initiative which aims to:

- Compile lists of known or potentially invasive plants from a garden, local or regional level to highlight cultivated taxa of concern across Europe.
- Identify emerging problem taxa in the large, and diverse, botanic collections, especially in an era of climatic change, so as to alert collection holders to their potential risk in terms of invasiveness.
- Foster vigilance through sharing early recognition of these newly problematic, or potentially problematic, taxa.
- Ensure responsible, pro-active policies in botanic gardens and other plant collections, and apply these in a coherent manner across Europe.
- Encourage gardens to engage with the public by informing them of the risks of introducing certain species into the wild, and how to recognise these species

A similar initiative has been developed in the USA, involving the signatories of the Saint Louis Voluntary Codes of Conduct through the Center for Plant Conservation:
http://www.centerforplantconservation.org/invasives/CodesN.asp

Case study: Establishing an International Plant Sentinel Network

The increasing globalisation of trade in plants and plant material, together with the impacts of climate change, has led to a recent increase in the introduction and spread of new and damaging plant pests and diseases. Botanic gardens and arboreta are in a unique position to help detect potential invasive threats to a country's plant health; within their collections they play host to numerous expatriate plants that can act as sentinels for potentially invasive pests. The International Plant Sentinel Network (IPSN) is being established as part of a European-funded (EUPHRESCO) project led by the UK's Food and

Environment Research Agency (FERA). The network will facilitate collaboration amongst institutions in Europe and beyond, with a focus on linking botanic gardens and arboreta, National Plant Protection Organisations and plant protection scientists. The project aims to improve the ability of garden staff to identify alien plant pathogens and diseases and to provide professional diagnostic support that can help promote early detection and rapid response to new pest incursions.

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

Target 11 overview

This target is unique in the context of the GSPC in that its implementation, monitoring and review is through linkages with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) under its Plants Committee. This target is clearly consistent with the recently adopted CITES Strategic Vision 2008-2020 (CITES Res. Conf. 16.3) which states to "*Conserve biodiversity and contribute to its sustainable use by ensuring that no species of wild fauna or flora becomes or remains subject to unsustainable exploitation through international trade, thereby contributing to the significant reduction of the rate of biodiversity loss and making a significant contribution towards achieving the relevant Aichi Biodiversity Targets*".

At the 16th meeting of the Conference of the Parties to CITES, a resolution on cooperation with the GSPC (Res. Conf. 16.5) was adopted[58]. Amongst other things, Res. Conf. 16.5 invites Parties to promote and enhance collaboration between their GSPC focal point and their CITES Authorities, through:

i) the involvement of CITES authorities in the development and implementation of the GSPC national strategies, particularly activities related to CITES-listed species; and

ii) the inclusion of CITES-GSPC-related activities in CBD National Reports.

It is clear that CITES and the GSPC can share tools, scientific results and methodologies that relate mainly to Target 11, but also have relevance to other targets such as taxonomy (Target 1) conservation assessments (Target2) and capacity building (Target 15). Intensified communication between national CITES and GSPC authorities would be an essential cornerstone for implementing joint collaborations of mutual benefit.

The list of potential CITES activities and their contribution to the objectives and targets of the GSPC (as recognised by Res. Conf. 16.5) is provided in Annex 6. In this regard, it is important to note, that the

[58] http://www.cites.org/eng/res/16/16-05.php

Resolution on Non-detriment findings (Res. Conf. 16.7) recently adopted by the CITES Conference of the Parties (Bangkok, 2013) is crucial for most of CITES' contributions to the GSPC.

The implementation of this target is linked to Aichi Target 4 - Sustainable consumption and production*: Governments, business and stakeholders at all levels have taken steps to achieve, or have implemented, plans for sustainable production and consumption…*

Progress towards the target

Activities by GPPC members

A number of GPPC members are involved in activities that support the implementation of Target 11.

Some examples are provided below:

- **TRAFFIC** with **WWF Germany** and **BfN** has finalized the CITES Non-Detriment Findings (NDF) Guidance for Perennial Plants Version 1. This 9 step process is freely available through the BfN website for all CITES Parties and other governments[59]. TRAFFIC has also designed a training workshop around the 9 step NDF process to help CITES authorities in further understanding NDFs

- A number of botanic gardens play a role as CITES rescue and propagation centres, and in this capacity provide care for endangered plants seized at national borders.

- GPPC members such as **MNHN**, Paris and **RBG Kew** act as the national CITES Scientific Authority and are also involved in providing training in plant identification to customs officers and reception of confiscated plant specimens.

- As related to timber trade of South American provenance, **TRAFFIC** has been catalyzing initiatives to control and verify the origin of timber in trade and support related improvements in forest governance – with a particular focus on trade to the European Union from Brazil, Colombia, Ecuador and Peru.

- Botanic gardens have played a role in determining the listing of species on the CITES Appendices. For example, *Yucca queretaroensis* (an agavaceae endemic to central Mexico) was added to CITES Appendix II in 2013, as a result of a proposal presented by Mexico (CoP16 Prop. 50) based on a study financed by the Mexican Scientific Authority (CONABIO) and developed by the Cadereyta Regional Botanic Garden (Querétaro, Mexico). The **Madagascar Plant SG** has contributed to the inscription of a small number of succulents and of all Madagascar *endemic rosewood a*nd ebony wood species in CITES appendix II.

[59] http://www.bfn.de/fileadmin/MDB/documents/service/skript358.pdf

- In April 2012, the Global Timber Tracking Network (GTTN) was launched to bring together scientists, policymakers and other key players to develop such tools, which can be applied both to logs and wood products. GTTN is coordinated by **Bioversity International with support** from the German Federal Ministry of Food, Agriculture and Consumer Protection, and the CGIAR Research Program on Forests, Trees and Agroforestry. In 2013 the network laid the groundwork for the collaborative development of DNA and isotope-based tools for identifying key timber species and their origins so that customs inspectors and others can confidently determine the geographic origin of logs and wood products.

Case study: Conservation and Cultivation of *Galanthus woronowii* in Georgia

The **RBG, Kew** in its role as UK CITES Scientific Authority for Plants is working with the CITES Authorities in Georgia and Microsoft Research to ensure sustainable harvest of snowdrop (*Galanthus woronowii*) bulbs for the international horticultural trade. Georgia exports some 15 million wild bulbs per year and is now beginning to export propagated bulbs. The partners have carried out field surveys to assess status of wild populations, modelled off-take/harvest, and recommended quotas and managements systems to meet CITES requirements. In addition, 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. Workshops, with the help of the UK Border Agency, were carried out to train local enforcement officials. Field surveys continue to expand the population data and research, when funding is obtained, will be carried out to determine appropriate marking techniques to track the propagated bulbs entering international trade from Georgia.

Case study: The Non-detriment Findings Guidance for Perennial Plants: the case of cycads in Viet Nam

CITES Non-Detriment Findings (NDF) Guidance for Perennial Plants has been finalized by TRAFFIC in a project supported by the German Ministry of Nature Conservation (BfN). Wild specimens of CITES Appendix II listed species may only be exported if trade is deemed to be non-detrimental to the survival of the species (i.e. is sustainable). **TRAFFIC**, with WWF Germany and BfN have developed guidance for CITES Scientific authorities to assist them in making NDFs for perennial plants[60]. TRAFFIC has also designed a training workshop around the 9 step NDF process to help CITES authorities in further understanding NDFs, and applied this in a workshop with CITES authorities in Viet Nam. The workshop examined cases of cycads, plants known to be heavily impacted by high levels of trade. Many cycads are popular in the horticultural trade and mature individuals can fetch high prices on the international market. Viet Nam has 24 cycad species, many of them highly threatened by habitat loss and unsustainable harvesting, both for domestic and international trade. Participants examined case studies

[60] This 9 step process will be freely available through the BfN website (http://www.bfn.de/fileadmin/MDB/documents/service/skript358.pdf).

of three species currently banned from trade in Viet Nam, to determine the information available for these species and whether trade would be considered detrimental or non-detrimental to the species' survival.

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

Target 12 overview

Wild plants provide a wide range of products. These products include food, fuel, fibre, timber, medicines, dyes and cosmetics amongst others. A very large number of wild plant species are used by humankind. For example, more than 50,000 medicinal and aromatic plants (MAP) species are used globally. The demand for natural products in the food, cosmetics and medicinal market sectors especially, is growing worldwide. As a result many plant species are at risk from over-collecting and habitat loss. The decline in wild plant populations has serious consequences for the livelihoods of the people these plants support.

A report published by the International Trade Centre in 2007 (based on 2005 data), provided a review of world production and marketing of organic wild collected products, but no subsequent survey has been carried out to measure progress since then. At that time, a total, of 62 million ha were registered for organic wild collection and 979 organic wild collection projects were identified. Four hundred and forty different organic products from a total of 71 countries were reported. The majority of countries (80%) were developing or emerging economies. It was also noted in the report that although organic management systems are strongly linked to environmental benefits including safeguarding biodiversity and preventing soil erosion and water contamination, the standard alone does not guarantee sustainable management of natural resources –a key focus of Target 12.

In response to this gap, the FairWild Standard was developed by TRAFFIC, WWF, IUCN and other partners, managed by the FairWild Foundation. The Standard combines the requirements of ecological sustainability of wild harvesting and social sustainability of trade, including the fair sharing of benefits throughout the supply chain. The FairWild Standard V2.0 became available in 2010 and was recognized as the best practice tool for the delivery of Target 12 of GSPC.

Previously, the lack of baseline data made measuring progress towards this target difficult, with information from industry (of foremost importance to Target 12 implementation) often disconnected from government agencies reporting on GSPC implementation. The introduction of the FairWild Standard now provides an important tool to measure progress. By the end of 2013, 12 companies that are directly involved in wild-sourcing of medicinal and aromatic plants were FairWild certified.

On the basis of presently available information, it seems unlikely that the target will be met at the global level. However there are a number of interesting initiatives taking place at the national level, involving both the public and private sectors. Implementation of this target contributes to Aichi Target 4: Sustainable consumption and production: *Governments, business and stakeholders at all levels have taken steps to achieve, or have implemented, plans for sustainable production and consumption…*

Progress towards the target

The FairWild Standard

At the global level, TRAFFIC has played a key role in the development and implementation of the FairWild Standard, a best practice tool to support the delivery of Target 12[61]. The FairWild Standard allows for traceability and transparency, as well as improving product safety. It originated from the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) which was developed between 2001 and 2006 to ensure sustainability in the wild collection system.[62] In 2008, the Fair Trade standard[63] was merged with ISSC-MAP to form the FairWild Standard version 1.0 to provide all round implementation of ecological, social and economical aspects.

The FairWild Standard is implemented as a third-party certification system, and is also used by communities and governments in their plant resource management strategies. For example, Japan's National Biodiversity Strategy the 'Environmental Paper of 2013', published by Ministry of the Environment in Japan has included the FairWild Standard as a recommended certification framework for sustainable use of natural resources in Japan. Similarly in Germany, the FairWild Standard is included in Germany's National Annual Report 2013 on CBD Implementation as a best practice ('lighthouse' project).

By the end of 2013, 12 companies that are directly involved in wild-sourcing of medicinal and aromatic plants were FairWild certified. Ingredients from 25 different species have been certified, with plant parts including roots (e.g. liquorice), leaves (e.g. raspberry), resins (frankincense) and fruits (e.g. juniper berries). FairWild-certified products are sourced from 11 countries, including Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Hungary, Kazakhstan, Poland, Spain, and the Standard has also been used for non-certification approaches in China, Czech Republic, Ecuador, Hungary, India, Lesotho, Slovenia, South Africa, and Viet Nam.

[61] The establishment of the FairWild Standard was made possible through the financial support by the German Ministry of Environment.

[62] The development the ISS-MAP was supported by the German Federal Agency for Nature Conservation (BfN), TRAFFIC, WWF, and IUCN (International Union for Conservation of Nature).

[63] The FairTtrade Standard was initiated by SIPPO (the Swiss Import Promotion Programme) in cooperation with Forum Essenzia e.V and IMO (Institute for Marketecology).

Over 1,000 collectors have benefitted from involvement in FairWild certification, with fair pricing systems being introduced and Premium funds accumulating from the contributions of trading partners (contributing to Target 13 delivery). A number of other companies are involved in handling the FairWild-certified ingredients along the trade chain – processing the ingredients and distributing them worldwide. Final products with the FairWild mark have been on the market since 2009. By 2013, three manufacturers in US and UK are trading final products with FairWild label on the US, Canadian, Japanese and many EU markets.

The FairWild Standard is available in 13 languages, together with the suite of guidance documents (including on carrying out resource assessment, development of management plans, implementing social and fair trade requirements) supporting its implementation.

Application of the FairWild Standard

The FairWild Standard Version 2.0 applies to wild plant collection operations wishing to demonstrate their commitment to sustainable collection, social responsibility and Fair Trade principles. The Standard is designed to be applicable to the wide array of geographic, ecological, cultural, economic, and trade conditions in which wild collection of plant resources occurs. The FairWild certification is based on the completed species resource assessment, species management plan, established sustainable collecting practices (including collectors trainings), transparent cost calculation along the supply chain, traceability of goods and finances and the documented fair trading practices. The on-site annual audit by the third party certification system is carried out as compulsory part of certification. Examples of certification completed in 2013 include the certification of Frankincense (*Commiphora confusa* and *Boswellia neglecta*) from a collection site in Kenya, used in the final cosmetics product by the UK manufacturer Neal's Yard Remedies, and FairWild certified lime flowers (*Tilia tomentosa*) from Bulgaria, used in the herbal teas by the UK manufacturer Pukka Herbs.

Other countries implementing the FairWild Standard include:

- In **Viet Nam**, the sustainable harvesting principles of the FairWild Standard have been implemented by TRAFFIC (supported through CEPF and KNCF funding) with local communities in Nam Xuan Lac Species and Habitat Conservation Area, Northern Viet Nam. This project influenced community harvesting practices and built the capacity of government authorities in managing plant resources, which are now viewed as a priority for sustainable use. A management plan was developed for target medicinal plant species, including a benefit-sharing mechanism, and agreed by all stakeholders for implementation.

- In **India**, the FairWild Standard is implemented in Maharashtra (Northern Western Ghats) for two species through two complementary projects. Pukka Herbs, a UK manufacturer of herbal products, has made commitments about the purchasing of the FairWild certified ingredients from the project location.

- In **Ecuador**, through the BIOCAN project, TRAFFIC and collaborators facilitated dialogue between scientists and the Waorani community towards the implementation of FairWild Standard for the Chambira palm leaves *Astrocaryum chambira* in the Yasuni National Park area. TRAFFIC produced capacity-building materials on sustainability of harvesting, both in Spanish and Waorani languages, and developed a baseline for monitoring the harvest impact on the palm's populations. The impact of sustainable harvest practices were agreed with the Waorani collectors.

National and regional activities

Other activities that contribute to Target 12 at the national and regional level include:

- Through the European Regional Development Fund supported project in Central Europe – Czech Republic, Hungary, Poland and Slovenia – **TRAFFIC** developed training materials on sustainable plant collection in the framework of capacity-building activities. Between 2011 and 2013, 935 people were trained in project target areas and training materials available online in English, Hungarian, Czech, Polish and Slovak languages.[64] The online toolkit on wild collection is in preparation and will be launched in early 2014.

- In 2013, **TRAFFIC** with partners launched the implementation of an Environmental Governance Programme (EGP) project in **China**, focusing on the improvement of sourcing practice of Traditional Chinese Medicine (TCM) manufacturers in Hunan and Zhejiang provinces. Three targeted manufacturers and four traders of TCM have been identified and have committed to sustainable sourcing management. Five of the target companies have committed to improve their sourcing practice by signing a sustainable development declaration at the project launch meeting in November 2013. The steps for improvement the sourcing practices are being developed to be implemented over the duration of project (till March 2015). Selected target species will include *Magnolia officinalis* and *Japonica* spp. FairWild certification is not available in China to date, with the EGP project looking into the feasibility of it.

Case study: Medicinal root trade, plant conservation and local livelihoods in Morocco

In April 2013, the **Global Diversity Foundation** launched a 3-year project with its partner **High Atlas Foundation** among Amazigh (Berber) indigenous communities of the Moroccan High Atlas. The project addresses livelihood improvement and threats to the sustainable harvesting of medicinal roots. The project focuses on wild-crafted medicinal roots that are intensively harvested in two rural townships of the High Atlas mountains - Ait M'hamed rural commune in Azilal province and Imegdale rural commune in Al Haouz province. The harvested roots are sold in the markets of Marrakech, and some of them are exported. The sustainable harvesting of vulnerable plant resources in the unique and biodiverse High

[64] http://www.traditionalandwild.eu/en/training-materials

Atlas montane ecosystem is essential in maintaining its delicate ecological integrity. This helps to ensure the subsistence of millions of herbal remedy users, and sustains commercial trade that contributes to the livelihoods of thousands of collectors, vendors and traditional practitioners. The project also addresses poverty alleviation in Morocco by encouraging rural peoples to benefit economically from wild-crafting, domestication and value-adding activities.

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

Target 13 overview

The preservation, protection and promotion of the traditional knowledge, innovations and practices of local and indigenous communities is of key importance, particularly for developing counties. Their rich endowment of traditional knowledge and biodiversity plays a critical role in their health care, food security, culture, religion, identity, environment, sustainable development and trade.

There is today a growing appreciation of the value of traditional knowledge. This knowledge is valuable not only to those who depend on it in their daily lives, but to modern industry and agriculture as well. Many widely used products, such as plant-based medicines and cosmetics, are derived from traditional knowledge. Other valuable products based on traditional knowledge include agricultural and non-wood forest products as well as handicrafts.

Although a wide range of initiatives to conserve traditional knowledge have been developed at national and local levels, progress towards this target is difficult to measure as baselines have not been quantified. In many ways, this is an 'enabling' target, supporting the achievement of other targets.

Implementation of this target is closely linked to Aichi Target 18 (*traditional knowledge respected…*).

Progress towards the target

Global initiatives

In May 2013, the **Missouri Botanical Garden** hosted an international workshop on the need for a global program on the conservation of useful plants and traditional knowledge. The workshop was attended by a series of international experts who issued a call to action which urged the development of a global

program on the conservation of useful plants and associated knowledge to address the loss of essential knowledge about plants and their uses, especially at the level of local communities. The participants concluded that there was also a great urgency to address the vital importance of traditional knowledge about plants, their utility, management, and conservation. This unique, often ancient, and detailed knowledge is typically held and maintained by local and indigenous communities. Among the actions recommended, there was a call to:

- Assist local peoples in the preservation of their traditional knowledge in a culturally appropriate manner.
- Facilitate capacity building and training opportunities in ethnobotany, particularly in countries and regions with significant gaps in such resources.
- Support and encourage biocultural knowledge transmission and custodianship.
- Develop the appropriate facilities, methodologies, and techniques to support culturally sensitive curation of biocultural collections (artifacts, herbarium vouchers, produces, living collections, etc.) and associated traditional knowledge.
- Elaborate and disseminate educational materials and resources in appropriate languages that support and promote the study and use of traditional knowledge, and insure their inclusion in educational curricula.

At the global level, it is also relevant to note the resolutions and initiatives recently adopted by CITES on livelihoods; which together recognize and aim to address the need to adjust the implementation of CITES in order to consider the needs and problems of rural, local and indigenous communities.

Activities of GPPC members

Other activities of GPPC members that are related to the implementation of this target include:

- The **Global Diversity Foundation** (GDF) promotes and sustains cultural, biological and agricultural diversity around the world through the development and use of applied research, training and social action. GDF has regional programmes in Mesoamerica, Southeast Asia and North Africa.
- **MNHN**, Paris, carries out research in ethnobotany and traditional knowledge in the framework of a research program related to forest products and handicraft in French Guyana, including the creation of an association to promote and develop the utilization of plants which are traditionally used in French Guyana
- In Micronesia, **New York Botanical Garden** scientists are collaborating with local researchers to document the plants of selected islands and their traditional uses with the goal of identifying key habitats for conservation and producing a checklist of vascular plants, an ethnobotanical manual, and a primary healthcare manual based on traditional plant medicines.

- As part of their cooperation programs with the South, the **Conservatoire et Jardin botaniques de la Ville de Genève** (CJBG) has published a book on medicinal plants used in the market of Asunción in Paraguay. This book provides, among others, tips on how to grow these plants.

- Researchers at the **Andalusian Seed bank** in Spain are involved in the Spanish Inventory of Traditional Knowledge (SITK). In Spain, the legal framework for this strategy is provided by the 42/2007 law of Natural Heritage and Biodiversity, which includes as a main goal the need to create the Spanish Inventory of Traditional Knowledge (SITK). The team is actively participating in the recovery of traditional knowledge associated with plant biodiversity through historical documentation. In 2012 the first volume of "Agricultural and forest Flora of al-Andalus" was published.

- In Northern Brazil, the RBG, Kew has been working with the Yanomami Association Hutukara and the Instituto Socioambiental to support autonomous research and inter-generational knowledge transfer of traditional medicines among indigenous communities.

Case study: Repatriation of local and indigenous knowledge

Repatriation of local and indigenous knowledge is a major research focus of the **Missouri Botanical Garden's** William L. Brown Center for Economic Botany in Bolivia, Peru and Madagascar. During the period included in this review, traditional knowledge has been inventoried in joint research with indigenous counterparts in those countries. Results from communities in Peru (Awajun, Lamas, Arazaeri, Zapitaeri, Urarina, Cocama, Ese Eja), Bolivia (Chacobo, Lecos, Yuracare) and Madagascar have been published in local language books, as requested by communities. Previous studies translated from foreign languages (English, German) into Spanish and French have been repatriated in book form and online. Authorship of this traditional knowledge remains with the local communities.

Case Study: Booderee Botanic Gardens

In Australia, the Booderee Botanic Gardens, is an Aboriginal-owned botanic garden. The Botanic Gardens focuses on the Aboriginal use of plants and includes a dedicated Koori Garden and education shelter, where visitors can learn about bush tucker and medicinal uses of plants and the long association that Koori people have with the area and the plants of south eastern Australia.

Since the early days of the gardens development, local indigenous people from the Wreck Bay Aboriginal Community have worked on the site, a tradition now well into its third generation. The curator of the Booderee Botanic Gardens was taught about traditional plant use by his family, passed down by word of mouth from his grandfather, uncles and aunts. He is now passing on his knowledge to his own children.

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

Target 14 overview

Plants are often under-represented in the conservation debate and neglected in efforts to engage the public in environmental action. Furthermore, increasing urbanization and population movements are resulting in a growing disconnect between people and nature, a trend that is especially notable amongst the young. Plant conservation targets will only be achieved if changes are made at all levels of society, from policy makers through to the general public. For this reason, communication, education and public awareness programmes are essential in underpinning the GSPC.

The world's botanic gardens, which together receive an estimated 250 million visitors per year, are a gateway to information on plant diversity. Almost all botanic gardens provide education programmes and many focus specifically on educating children. The continuous public awareness opportunities offered by botanic gardens are an important complement to such specific education programmes, but unfortunately there are no global statistics on how many people are reached through these activities.

In recent years there has been a spectacular growth of new botanic gardens that have a strong focus on public education. A striking example is provided by the Gardens by the Bay in Singapore which won the building for the year award in 2012 and attracts over 2.5 million visitors every year, representing an impressive commitment by the government of Singapore towards raising awareness about plants.

It is also recognized that engaging the public in new and innovative ways is key to raising awareness of plant conservation issues. One example is the increasing popularity of citizen-science projects focused around plant monitoring. Examples of such programmes include Project BudBurst in the USA, Vigie-Nature in France and the Phenology Recording System of the New Zealand Plant Conservation Network.

Although some of these initiatives are reaching large numbers of people, there is still little evidence that this is having any policy impact with plant conservation *per se* generally not being reflected in national biodiversity strategies. There is also a worrying lack of plant science being taught through the formal education system in schools and universities (see also Target 15).

Implementation of this target makes an important contribution to Aichi Target 1 (*Awareness increased*) and in the framework of the GSPC is considered cross-cutting and applicable to all other targets.

Progress towards the target

Lack of baseline information makes measuring progress towards this target difficult. Issues to be addressed include the over-emphasis on animals and neglect of plants in environmental education programmes and a need for increased teacher-training relative to plant science (linked to Target 15).

Much of the progress that is being made is due to activities that take place in the informal education sector – although some such activities are closely linked to and support national curricula.

GPPC activities on Target 14

Examples of activities by GPPC members that address this target are provided below.

- The environmental education programme at the **Cadereyta Regional Botanic Garden** (CRBG) in Mexico involves every participant in a comprehensive lesson, through guided tours and specific activities for selected groups. An educational programme for elementary school children has been in place since 2010 with the number of participants being: 2011: 3,125; 2012: 3,874; 2013: 4,419. The aim is to help local people appreciate plant diversity and increase their awareness and concern about its importance and how to conserve it. Capacity building is a key feature of all the educational activities and workshops.

- Members of the **Australian Seed Bank Partnership** actively raise awareness and understanding of the importance of plant diversity through their botanic garden education programs and visitor activities. Australia's eight capital city botanic gardens and 150 regional botanic gardens attract an estimated 13 million visits per year.

- Australian herbaria and botanic gardens play an important role in increasing awareness of the importance of plant diversity. Many herbaria in Australia maintain a high rate of species discovery (up to 10% of the world total of new species in some years), and such discoveries are promoted through websites, media programs and communication strategies. Herbaria and botanic gardens are well placed to showcase the fact that discovery of new species is an ongoing and exciting activity, particularly in megadiverse countries such as Australia

- At the **RBG, Kew**, the importance of plant diversity is incorporated into communication and education work through festivals, guided tours, family activities, adult education and schools programmes. From 2011-2013, a total of 4,771 guided tours were run involving 46,651 members of the public. Kew also organised hands-on activities and learning sessions for families, engaging with 10,000 participants and focusing on plant diversity, science and conservation. During this time, over 230,000 school children participated in school programmes run at Kew and at Kew's country site - Wakehurst Place in Sussex. All programmes included the importance of plants through lessons such as Adapting Agriculture to Climate Change, Crop Wild Relatives and Tropical Rainforests. **Kew's** website The Great Plant Hunt[65] received over 150,000 unique visitors. The site encourages children to participate in nature walks, in and around their school grounds. Training teachers is an effective way to reach large numbers of children and, from 2011-2014, Kew ran courses for over 1,000 teachers, all of who returned to their classrooms and used the skills and knowledge acquired to teach 30,000 school children in the importance of plant diversity.

[65] www.greatplanthunt.org

- In the last two years, **Denver Botanic Gardens'** conservation staff have reached more than 6,500 people through public and professional outreach activities including native plant society meeting presentations, scientific mentoring of K-12 students, and participating in regional bioblitzes.

- From 2010-2013, more than 50,000 adults, 25,000 families with children, and 13,000 seniors and people with special needs participated in the **Missouri Botanical Garden's** public classes, ranging from gardening, landscaping and green living to outdoor skills, wellness, and nature study. In the same period, through its *Center for Nature-Inspired Learning*, an average of 100,000 local students and teachers were reached each year via on-site classes, labs, and workshops, as well as community outreach programming.

- Care for the Rare is a project developed by **BGCI (US)**, in partnership with the **United States Botanic Garden** to provide free, easy-to-use interpretation resources that any botanic garden can use to clearly communicate conservation stories of threatened plants in their collections. So far, signs have been developed for 40 rare and threatened species[66].

- The International "Fascination of Plants Day" was launched in 2012 by the **European Plant Science Organisation** (EPSO)[67]. The aim is get as many people as possible around the world fascinated by plants and enthused about the importance of plant science for agriculture, in sustainably producing food, as well as for horticulture, forestry, and all of the non-food products such as paper, timber, chemicals, energy, and pharmaceuticals. Fascination of Plants Day takes place on May 18th each year, coinciding with Plant Conservation Day, which was first started in 2001 by the Association of Zoological Horticulture in the USA.

- Project Budburst[68], led by **Chicago Botanic Garden**, is a network of people across the United States who monitor plants as the seasons change. It is a national field campaign designed to engage the public in the collection of important ecological data based on the timing of leafing, flowering, and fruiting of plants. The data are being collected in a consistent manner across the country so that scientists can use the data to learn more about the responsiveness of individual plant species to changes in climate locally, regionally, and nationally. Thousands of people from all 50 states have participated.

- Wildflower Europe is a European project to raise awareness of wild flowers and their importance in our natural and cultural heritage. Conservation partners in **Bulgaria** (Bulgarian biodiversity foundation), **Croatia** (Stari Grad municipality), **Romania** (Fundatia Adept), **Slovenia** (Tourizem Bohinj) and the **UK** (Plantlife and Wild North) are organising a series of flower festivals on Important Plant Areas and also running a mass participation public art project to

[66] http://www.bgci.org/usa/carefortherare

[67] http://www.plantday12.eu/home.htm

[68] http://www.budburst.org/

create a Patchwork meadow – the public submits hand crafted squares that are joined in one large artwork that tours the country.

- **Plantlife** in the UK is running a number of outreach projects focusing on the UK's Celtic Rainforest' (Atlantic woodlands in England, Wales and Scotland). The project focusing on lichens and bryophytes; engaging people through the community, from the youngest school children who look to 'Make the Small Things Count', to aspiring lichenologists who are being trained to help with long term monitoring of key threatened species.

Case study: Vigie-Nature, France

Vigie-Nature is a set of participatory science programs led by **MNHN**, Paris open to all who are interested in nature, from beginners to experts[69]. Based on simple and rigorous protocols, it allows everyone to contribute to research and to discover the biodiversity that surrounds us. The programs consist of participatory science following common species (flora and fauna) at the national level, through networks of volunteer observers. Among these programmes, Vigie Flore aims to assess changes in the abundance of the most common plant species in France in order to understand the impact of human activities on species communities. Coordination at the national level is based on a scientific team including leaders in France and across Europe to study the impacts of global change on biodiversity and the development of indicators. Since 2009, 2008 Vigie florists have been involved in monitoring flowering plants and sampling 2,314 plots. 2,068 plant species have been studied within habitats of France and Corsica, belonging to 740 genera and 179 botanical families.

Les Sauvages de ma rue : Les Sauvages de ma rue is a program of citizen science run by the **Tela Botanica** association and the **Centre d'Ecologie et de Sciences de la Conservation**, MNHN and part of the biodiversity observatories Vigie-Nature[70]. The Les Sauvages de ma rue project helps urban people to recognize plant species that grow in their immediate environment. Even if they have no knowledge in botany, through the use of simple tools at their disposal, they can make the list of species that grow in their streets and send their data to researchers.

Case study: The Fairchild Challenge

The Fairchild Challenge is a unique school-based environmental education competition run by **Fairchild Tropical Botanic Garden** whereby students are engaged and actively involved in environmental education and stewardship[71]. Through repeated exposure to highly experiential and inquiry-based environmental education, the Fairchild Challenge is influencing and empowering a diverse generation of scientists, researchers, educated voters, policy makers, and environmentally-minded citizens. The

[69] http://vigienature.mnhn.fr/

[70] http://sauvagesdemarue.mnhn.fr/

[71] http://www.fairchildgarden.org/education/TheFairchildChallenge/

program encourages students to actively learn, explore and devise creative and effective responses to some of the most pressing environmental issues of our time.

Case study: A botanic garden education network

A specific Education group has been established within the network Jardins botaniques de France et des pays francophones. Its role is to liaise at an international level with the BGCI education network and establish synergies with existing educations networks in the country. It also organises education seminars and workshops and staff training. It also aims to inform, communicate, exchange, and develop specific tools for better communication within the network and participates in the development of thematic datasheets. The group has organised a census of educational activities in the member gardens of JBF in Francophone countries and has prepared a list of the 83 exhibitions performed in botanic gardens[72].

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

Target 15 overview

The scope of the GSPC goes beyond traditional plant conservation activities to include sustainable use, as well as working with local and indigenous communities. The achievement of the 16 targets will require considerable capacity-building, particularly to address the need for conservation practitioners trained in a range of disciplines. Such capacity is also important to address current and future grand challenges and issues facing society, including climate change mitigation, food security, land management and habitat restoration.

A recent study carried out by BGCI (US) and partners in the United States, showed that Government agencies are losing botanical capacity as staff botanists retire and positions are not refilled, either because positions are eliminated, replaced by individuals without equivalent botanical training, or because there is an inability to find appropriately qualified new candidates to fill them. Botanical education and training likewise appears to be on the decline, with many botany departments at universities being subsumed into more general or interdisciplinary departments, and subsequently losing resident expertise as professors retire and are replaced by individuals without botanical expertise.

For example the study revealed that in 1988, 72% of the nation's top 50 most funded universities offered advanced degree programs in botany. Today, more than half of these universities have

[72] http://www.bgci.org/files/JBF/pdf/groupe_education/mediations%20maj%2012%20mars%202014.pdf

http://www.bgci.org/files/JBF/pdf/groupe_education/expositions%20maj%2012%20mars%202014.pdf

eliminated their botany programs and many, if not all, related courses. Similarly, botany degrees are no longer offered in the UK[73].

Recognising the widening gaps in capacity, organizations in the private sector (e.g. botanic gardens and other non-profit conservation organizations, as well as for-profit businesses and self-employed individuals) are stepping in, providing botanical training, expertise and infrastructure where it otherwise would not exist.

Progress towards Target 15 is considered key for the successful implementation of the GSPC. However available information suggests that progress is not only insufficient to meet the target, but that capacity building opportunities are actually declining in some areas / countries. If this is the case, this will have a significant impact on the ability of Parties to meet their commitments on biodiversity conservation, and especially to meet Aichi Target 19 (*Knowledge improved, shared and applied*).

Progress towards the target

Capacity building and the GPPC

Capacity building and training for plant conservation is a major activity for many GPPC members, especially those that have large international programmes. Such capacity building can be divided into four main types of activity:

1. Short courses
2. Specialised diploma / certificate courses
3. Graduate courses
4. Postgraduate research and training

Examples of these activities are provided below:

- **Denver Botanic Gardens'** Center for Global Initiatives, which was established in 2012, strives to build botanical capacity across international borders through training, advising, and collaboration. On-going collaborations include projects in South Sudan, Madagascar, Mongolia, Argentina, Mexico and Haiti.

- The **Missouri Botanical Garden** undertakes significant international contributions towards the achievement of this target. This includes its on-going International Professional Development Fellowships and training courses in conservation and sustainable development. During the Mid-term review period the garden has provided: 98 fellowships (59 in Peru and Bolivia and 39 at the Garden); ethnobotanical training courses in Georgia (25 trainees), Peru (30 trainees), Bolivia (25 trainees) and Madagascar (10 trainees); courses for undergraduate students, teachers, park

[73] http://www.bgci.org/usa/bcap/

guards, and government officials: Peru: 319 students; Bolivia: 1,708 students; Ecuador: 136 students; and community- level training: Peru: 3,053 people; Ecuador: 202 people; Vietnam: 2,000 people.

- **Andalusian Seed Bank** researchers are involved in university level training for several Masters courses at the University of Córdoba. These Masters' objectives include Biodiversity, Conservation and Management of Wildlife and Natural Heritage. Goals and targets of the GSPC are explained in these classes.

- The **City of Geneva Botanic Garden** (CJBG) has an agreement with the University of Geneva that puts it in charge of the teaching of systematic botany. An option "Systematics and Biodiversity" in the Master in Biology was created in 2011. The CJBG can accept not only national students, but also students from the South, including Madagascar in the context of the studies carried out by the institution.

- **NYBG** Graduate student interns are trained in biodiversity research, conservation and documentation both on site and in locations all over the world. Recent off-site training courses have been held including Brazil, Vietnam, Micronesia, Ghana, Colombia and South Africa.

- **Bioversity International** has produced a range of training materials relevant to the conservation of plant genetic resources for food and agriculture. Many of the training packages include lecture support notes, exercises, notes for trainers, further reading, references, links and slides. Some materials are available in different languages.

- The **RBGE** has been delivering a wide range of bespoke and formal training courses to build capacity in horticulture, plant science and taxonomy within many countries. To date courses have taken place in Edinburgh, Oman, Italy, Turkey, Lao PDR, and Thailand.

- The ***Sud Expert Plant Developpement Durable*** SEP2D is a French initiative for capacity building for knowledge development, conservation and sustainable use of plant resources. The first phase was completed in June 2012. A new program was developed in 2013 covering the same geographical areas (Western and Central Africa, the Indian Ocean and South-East Asia), and the same fields of activity (research, support for collections, training, seminars), but with a focus on more applied topics related to the conservation and sustainable use of biodiversity. SEP2D is due to be launched in September 2014.

- **The RBG Kew** focuses on building capacity needed to safeguard plant diversity and ensure its sustainable use through knowledge transfer and partnerships with diverse organisations around the world. A programme of specialist training is offered in various aspects of plant science, conservation and horticulture. Course length and location varies according to need. Courses are run at Kew or at partner Institution anywhere in the world and range from 0.5 to 8 weeks duration. During 2011-13, eleven courses were run at Kew providing 29 weeks training for 150 people from 53 countries. Fifteen regional courses were run in 13 countries, providing 18 weeks

training for 307 people from 44 countries. Joint fund raising provided scholarships for course attendance and funds for 'appropriate facilities' including laboratory and horticulture equipment, plus providing the technical expertise to design new facilities including seed banks and herbaria.

- **Bangor University** in Wales, UK has recently announced a new one-year MSc course in Plant Conservation. The course has a particular focus on applied plant conservation and will make extensive use of the university botanic garden (**Treborth Botanic Garden**) for lectures, seminars and practical classes.

- **IUCN** Red List training - IUCN has developed new and revitalized training materials to facilitate the understanding and application of IUCN's Red List methodology. IUCN has also developed a Red List Trainer certificate course aimed at people with good Red List experience who would like to become IUCN Red List Trainers. By expanding the global network of Red List trainers, IUCN is able to increase the number of workshops held around the world and broaden the range of languages for training. Furthermore, in an effort to improve the availability of Red List training around the world, IUCN, in collaboration with The Nature Conservancy (TNC), has developed the online IUCN Red List Training course. The course is currently only available in English, but there are plans to make it available in French and Spanish.

Case study: Chicago Botanic Garden's Science Career Continuum (SSC)

In order to address the need to build capacity for plant conservation in the United States, the Chicago Botanic Garden has created a continuum of conservation education opportunities engaging students from middle school through graduate school. The SSC starts with the programs Science First and College First that provide hands on learning opportunities for middle and high school students interested in botany and environmental science. The program focuses on students from underrepresented groups. For undergraduates, the Garden is an NSF-REU (National Science Foundation Research Experiences for Undergraduates) site providing research opportunities for students in plant conservation. Next, the Conservation and Land Management Intern Program directly address the needs of federal agencies who are lacking botanical capacity by placing over 100 post-graduate interns on public lands each year to conduct stewardship activities. Lastly, the graduate program in partnership with Northwestern University is training MS and PhD students in Plant Biology and Conservation. Collectively these programs have provided plant conservation education and opportunities to over 1,500 students.

Case study: Plant conservation capacity in South Africa

South Africa has relatively good capacity to implement the GSPC in comparison to many other megadiverse countries. There is a strong network of botanists involved in conservation, ranging from professionals based at research institutions and conservation agencies to many citizens / amateurs who actively contribute towards plant conservation via the Custodians of Rare and Endangered Wildflowers (CREW) Programme. South African plant conservation capacity is being further strengthened by an initiative of the South African government to create jobs in the biodiversity sector, the Groen Sebenza

programme. As part of this programme 800 young South Africans are being employed by 50 conservation institutions. Many of these positions relate to plant conservation for example, more than 50 interns (comprising both matriculants and graduates) are currently being employed in South Africa's national botanical gardens. Another example is young community members from rural parts of South Africa are being trained as para-taxonomists, and para-ecologists to document and monitor threatened plants.

Case study: Himalayan Seed Bank (HSB) in Nepal

Started in 2010, the Himalayan Seed Bank (HSB) Project is part of the scientific activities undertaken by the Stations at High Altitude for Research on the Environment (SHARE) project of Ev-K2-CNR organization (Bergamo, Italy), the University of Pavia and the Lombardy Seed Bank (LSB). This project, co-funded by the Municipality of Milan (funds for international cooperation for biodiversity conservation), involves different Nepalese institutions led by the Nepal Academy of Science and Technology and aims to collect and preserve *ex situ* the high mountain plants of Nepal. Seed-banking projects targeting alpine species are a valid option for the survival of these plants, and the possibility to develop these activities in the country of origin of the genetic resources providing financial and capacity building support[74].

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

Target 16 overview

Networks supporting plant conservation activities provide the means to share experiences, exchange data, encourage professional development and build the capacity of the plant conservation community.

At the global level, the establishment of the GPPC has made a good start at bringing together the plant conservation community, however greater efforts are needed to engage other sectors, such as agriculture, industry, education, forestry, Indigenous and Local Communities etc. This indicates significant challenge for science communicators.

At the national level, there is still a lack of cross-sectoral networks, with limited institutional integration and a lack of mainstreaming of plant conservation work. However, where national responses to the GSPC have been developed, this has helped provide a focus for networking amongst the stakeholders, as can be seen from the example provided by South Africa.

[74] http://www.evk2cnr.org/cms/en/share/pilot-projects/ABC/Nepal?filter0=seed-bank

Most GPPC members are involved in a range of national and/or international networks, many of which have a thematic base. However, some Partners have particular geographic partnerships, which may be long-term and cover a number of thematic areas.

This target is cross-cutting and applies to all GSPC targets.

Progress towards the target

Several countries that have developed national responses to the GSPC have started by holding national stakeholder workshops in order to identify the relevant individuals and organisations involved in delivering plant conservation targets. Success in building strong national networks involving all these key players is often pivotal in successful implementation of the GSPC. Indeed, the lack of national networks, and the failure to mobilise all the relevant stakeholders is often cited as one of the reasons for failing to meet the targets.

At the regional level, the **Red Latino Americana de Botánica** has been very active in capacity building, education, conservation and sustainable use of plants throughout Central and South America. Similarly, good progress has been made in Australia and New Zealand through the **New Zealand Plant Conservation Network** and the **Australian Network for Plant Conservation** (see case study below).

Networks also exist around individual targets, or groups of targets. For example botanic gardens are well networked nationally, regionally and globally with a particular focus on Targets 8 and 14.

Examples of partnerships and networks in which GPPC members are involved include:

- The **ENSCONET** (European Native Seed Conservation Network) Consortium is led by the RBG, Kew's Millennium Seed Bank since its formal establishment on 2010. It is a network of 30 seed banks and other organisations with an interest in conservation and seed banking of Europe's native flora from 17 European countries. The Consortium's main aims are to further improve quality, co-ordination and integration of European seed conservation practice, policy and research for native plant species. ENSCONET Consortium members exchange information, equipment and staff, share data, and to collaborate at the European level. Various activities are taking place in the four main areas: collecting; curation; data management; and Research and Network. The main constraints for the ENSCONET Consortium are due to changed thematic emphasis in the individual member institutes. There is also a general shortage of funding for seed conservation activities, and related to that, a relatively high staff turnover rate.

- The **RBG, Kew's Millennium Seed Bank Partnership** is the largest *ex situ* wild plant conservation project in the world. The overall aims of the Partnership to conserve seeds (25% of the world's orthodox seed bearing plants), have also shifted over time to meet the challenges of the modern era. Further aims now include a focus on enabling the use of seed collection for innovation, adaptation and resilience in agriculture, forestry, and habitat restoration. To date, the Partnership has worked with a network of 173 partners in over 80 countries. The aims of the

Partnership are only possible with a strong, connected network including seed conservationists, practitioners, botanic gardens, scientific institutions and universities. Up to now (Jan 2014), the network has banked over 11% of the world's wild plant species.

- The **City of Geneva Botanic Gardens** (CJBG currently occupies the presidency of the CETAF (Consortium of European Taxonomic Facilites). The Gardens also participate in the GPPC, and in the European Consortium of Botanic Gardens. They are also active in committees of botanical gardens associations in Switzerland (*Hortus Botanicus Helveticus*), and in France (*Jardins botaniques de France et des Pays Francophones*), and participate in GBIF Switzerland, and in the Swiss Forum Biodiversité of the Swiss Academy of Sciences. They chair the board of the foundation Flora Info.

- The **Denver Botanic Gardens** co-leads the Colorado Rare Plant Conservation Initiative, plant professionals dedicated to the conservation of our rarest plants. Internationally the garden is collaborating with the M. S. Swaminathan Botanical Garden in India to develop a master plan for the Garden.

- The **Juan Carlos I Botanical Garden** in Spain is the coordinator of the Education network and Seed Bank network of the **Asociación Iberomacaronésica de Jardines Botánicos** (AIMJB). It is also is the coordinator of the Red Española de Bancos de Germoplasma (Spanish Seed Bank network).

- A **Norwegian network** consisting of the six main botanic gardens in Norway was established in 2008. This was an important starting point for establishing collaboration and capacity building among the botanic gardens on the conservation of threatened plants. The network is very important for the small gardens to be able to contribute, and to build competence, on the issue of plant conservation. During network meetings once or twice a year experiences and frustrations are shared. All gardens try to include the importance of plant diversity and the need for its conservation into their communication, education and public awareness programs and hence work continuously to implement Target 14. One of the main achievements of the network is the setup of a National Seed Bank at the Natural History Museum, Oslo.

- The **Missouri Botanical Garden's** approach to plant conservation is essentially one of establishing, developing and supporting collaborative partnerships. Within the limits of available resources, the Garden seeks to support and facilitate international and national networks and networking amongst institutions and organizations involved in plant conservation. The Garden is an active institutional member of a wide range of international and national organizations and networks involved in plant conservation, including the Global Partnership for Plant Conservation, Botanic Gardens Conservation International, the CBD's Consortium of Scientific Partners and is a major partner in the development of the Encyclopaedia of Life (EOL), the Global Plants Initiative (GPI) and the Biodiversity Heritage Library (BHL).

- **Xishuangbanna Tropical Botanic Garden**, in the south of Yunnan, China, is the headquarters of the newly formed Chinese Union of Botanic Gardens (CUBG). One aim of this network is to provide training for botanic garden professionals and to enhance the conservation impact of botanic gardens in China. The first training course concentrated on 'environmental education research techniques'. By training a cohort of education professionals the network hopes to have increased the capacity of botanic gardens in China to implement effective education programmes.

- **The Council of Heads of Australasian Herbaria (CHAH)** is an effective partnership between all major herbaria in Australia and New Zealand. CHAH's collaborative framework is illustrated by its major projects, Australia's Virtual Herbarium (AVH) and the Australian Plant Census (APC). The AVH brings together records from more than 6 million specimens held in Australian herbaria; it has provided the model and impetus to develop the Atlas of Living Australia (ALA). The APC is a continent-wide agreed checklist of all Australian vascular plants. It has led to development and near-completion of the ALA-supported National Species Lists, which in addition to the vascular plants, provide checklists for all bryophytes, lichens, algae and fungi of Australia. New Zealand herbaria became full members of CHAH in 2011, significantly strengthening existing regional ties between the two countries.

- In Australia, **Bush Blitz** is a continent-wide species initiative to discover and document the plants and animals within Australia's national system of conservation reserves. Bush Blitz includes several major biological expeditions each year throughout Australia, discovering new species, making new distribution records of species and reporting on these. The initiative is a public-private partnership which brings together scientists, teachers, reserve managers, landholders and indigenous communities to increase our knowledge and understanding of the taxonomy and distribution of Australia's biodiversity and better inform management decisions. The Bush Blitz model promotes multidisciplinary and cross-sectoral interactions amongst organisations, supporting GSPC objectives to document and understand plant diversity.

- In the UK, after the adoption of the amended GSPC in 2010, Plant Link (the network of plant conservation organisations in the UK) created a document called 'Wild Plant Horizons'. This document, supported by government agencies and Plant Link partners, highlighted successes of GSPC implementation in the UK to date, set out the challenges for the future and specific activities that should be implemented between 2011 and 2020. Progress on these activities in the UK will be published during 2014.

Case study: The Australian Seed Bank Partnership

The Australian Seed Bank Partnership (ASBP) was established to actively support the implementation of Australia's Biodiversity Conservation Strategy 2010-2030 and contribute to achieving the targets of the GSPC. The ASBP is taking a coordinated approach to building a national safety net for Australia's plant

species through *ex situ* conservation; providing options for future use of these plants. In 2012-13, the ASBP facilitated collections of 155 species not previously represented in Australia's conservation seed banks; nearly half (49.7%) were threatened species, listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act 1999) or state legislation. More than half of the collections were from endemic taxa. In addition, collections of 19 threatened species susceptible to *Phytophthora cinnamomi* were added to conservation seed banks.

The ASBP involves 12 member organisations and is governed by The Council of Heads of Australian Botanic Gardens Inc. with support from the Australian Government through the provision of a national coordinator and hosting of the secretariat through the Australian National Botanic Gardens. The members of the ASBP contribute to international efforts through their participation in the Millennium Seed Bank Partnership at Kew. . The ASBP also works with Associates on a project by project basis including Plant Health Australia and Myrtle Rust Transition to Management Group (Target 10), Australian Grains Genebank (Target 9) and the Atlas of Living Australia (Target 3).

Case Study: Bristol Community Plant Collection (UK)

The Bristol Community Plant Collection was initially established as a pilot project to look at the feasibility of growing a dispersed collection of the genus *Calendula* using community groups and schools throughout Bristol, UK and managed by **Bristol Zoo Gardens**. The aims were to provide training and equipment to groups to facilitate the successful growth, pollination and collection of seed from the plant. Success would indicate that it was feasible to establish a National Plant Collection as awarded by Plant Heritage Conservation Committee and also create a new 'model' that could be adopted by other Botanic Gardens to engage the public in assisting in conservation. The evaluation carried out before and after the pilot project showed an increase in knowledge in *Calendula* and a desire to continue with the project next year. Additionally, a number of unexpected outcomes were noted in individuals and groups such as an interest in conservation, horticulture, a desire to improve their own environment and community cohesion. Emotionally, some individuals also expressed an increase in confidence and self-worth. In 2013, the project was the first to be awarded with a 'Dispersed National Plant Collection' status and is currently preparing to repeat the project in 2014. The Zoo is now exploring the possibility of setting up a 2nd plant collection, dealing with UK native annual plants.

Case study: A botanic garden charter in France

Jardins botaniques de France et des pays francophones has developed a charter aiming at improving the standards and professionalism of botanic gardens in the network. The purpose of the charter is not only to define the roles and missions of botanical gardens but also serves as a strategic tool for strengthening the orientations of the Francophone botanic gardens network. The criteria contained in the charter aims to ensure the pertinence of actions in the field of research, conservation, education and awareness and the strength of the information for the dissemination of knowledge and data. So far 27 gardens of the network have obtained their accreditation among which 2 are in Switzerland and 1 in Monaco.

Section 3: Summary of progress towards the GSPC targets

The table below provides an assessment of progress made towards each of the GSPC targets and compares this with the assessment of progress towards corresponding components of the Aichi Biodiversity Targets. It aims to provide summary information on whether or not we are on track to achieve the targets by 2020. The assessment uses a five-point scale:

5. - On track to exceed target, i.e. we are doing even better and expect to achieve the target before 2020;

4. - On track to achieve target, i.e. if we continue our efforts we expect to achieve the target by 2020;

3 - Progress towards target but at an insufficient rate, i.e. unless we step up our efforts we will have missed the target in 2020;

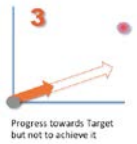
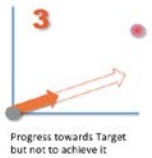
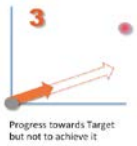
2. - No significant change, i.e. we are neither moving towards the target nor away from it;

1. - Moving away from target, i.e. things are getting worse rather than better.

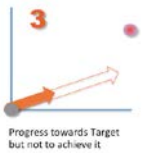
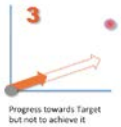
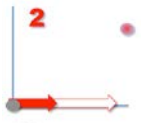
This assessment is based on the information provided for the mid-term review of the GSPC, largely by GPPC members and the level of confidence, based on the available evidence, is indicated for each target. The assessment is subject to change as additional information becomes available, including from national reports to the CBD and additional updated NBSAPs.

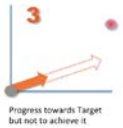
GSPC Target	Current status (and level of confidence for ranking)	Comments	Related Aichi Target and element	Progress towards relevant Aichi Target element[75]
Target 1. An online flora of all known plants	 (high)	The establishment of the World Flora Online Consortium is a major step towards this target. Good progress has been made at the national level in many countries, including several mega-diverse countries. Concerns about declining taxonomic capacity may be one constraint to the achievement of this target.	**Target 19: Knowledge improved, shared and applied** Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved	
Target 2. An assessment of the conservation status of all known plants as far as possible, to guide conservation action	 (high)	In recent years there has been significant progress at the global level, with IUCN on track to achieve its target of 38,500 plants on the Red List by 2020. Initiatives are being put in place to maintain this level of activity. Progress at the national level is varied, but encouraging in some mega-	**Target 19: Knowledge improved, shared and applied** Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the	

[75] As indicated in the draft technical background documents prepared for GBO4

		diverse countries.	consequences of its loss, are improved	
Target 3 : Information, research and associated outputs and methods necessary to implement the Strategy developed and shared	 (medium)	An on-line toolkit has been developed and is available in all UN languages. However, much relevant 'how to' information continues to lie in unpublished reports, not easily accessible to plant conservation practitioners.	**Target 19: Knowledge improved, shared and applied** Biodiversity knowledge, science base and technologies are widely shared and transferred, and applied	
Target 4. At least 15 per cent of each ecological region or vegetation type secured through effective management and/or restoration	 (high)	This target is achieved mainly by actions taken to implement Aichi Targets 11 and 15. A greater focus on the use of native species in restoration is encouraging. A report on Aichi Target 11 notes that 55% of terrestrial ecosystems have at least 10% coverage by protected areas and 7% have at least 75%.	**Target 11: Protected areas:** At least 17% of terrestrial and inland waters areas protected. Protected areas are ecologically representative Protected areas are effectively and equitably managed	
Target 5: At least 75 % 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	 (high)	While a number of countries have made significant efforts to identify important areas for plant diversity, it is not clear how many of these are being effectively managed or how well these are distributed across ecological regions.	**Target 11: Protected areas:** Areas of particular importance for biodiversity and ecosystem services protected	
Target 6: At least 75 per cent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity	 (medium)	Increasingly, sustainable production methods are being applied in agriculture,. Similarly, sustainable forest management practices are being more broadly applied. However, there are questions concerning the extent to which plant conservation specifications are incorporated into such schemes	**Target 7: Sustainable agriculture, aquaculture and forestry** Areas under agriculture are managed sustainably, ensuring conservation of biodiversity Areas under forestry are managed sustainably, ensuring conservation of biodiversity	
Target 7: At least 75 per cent of known threatened plant species conserved *in situ*		Despite encouraging progress in some countries, overall the continuing loss of natural habitat means that the *in situ* conservation status of many species is	**Target 12 Extinction prevented** Extinction of known threatened species has	

	 (medium)	getting worse. Furthermore, many species that occur within protected areas are not effectively conserved and are affected by factors such as invasive species, climate change and unregulated harvesting.	been prevented. The conservation status of those species most in decline has improved and sustained *(NB plants have generally not been included in the Target 12 assessments)*	 
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	 (high)	At the global level, 29% of the species listed on the 2013 IUCN Red List are known to be in *ex situ* collections and higher percentages are recorded at the regional and national levels. The first part of the target (*ex situ* collections) has already been achieved by some countries, but it remains challenging for mega-diverse countries.	**Target 12 Extinction prevented** Extinction of known threatened species has been prevented The conservation status of those species most in decline has improved and sustained (*NB plants have generally not been included in the Target 12 assessments)*	 
Target 9: 70 % 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	 (low)	This target has probably already been met for the major crops that are important globally. However the challenge is to meet this target for the many thousands of other species that are of socio-economic importance at the national or local level.	**Target 13: Genetic diversity maintained** The genetic diversity of cultivated plants is maintained The genetic diversity of wild relatives is maintained The genetic diversity of socio-economically as well as culturally valuable species is maintained	  Not evaluated
Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded	 (medium)	Increasing global trade and the multiple pathways of introduction represent a major challenge to preventing new invasions. Although some encouraging activities are on-going in managing areas already affected, the evidence suggests that progress is insufficient to meet the target.	**Target 9: Invasive alien species prevented and controlled** Introduction and establishment of IAS are prevented.	

Target 11 No species of wild flora endangered by international trade	 (High)	This target is implemented through the action of CITES and a resolution on Cooperation with the GSPC was adopted in 2013 by CITES COP 16. Significant progress has been made in developing Guidelines for determining Non-Detriment Findings for perennial species and these are now starting to be applied.	**Target 4: Sustainable consumption and production** Governments, business and stakeholders at all levels have taken steps to achieve, or have implemented, plans for sustainable production and consumption…	
Target 12: All wild harvested plant-based products sourced sustainably	 (low)	The introduction of the FairWild Standard provides a necessary tool to measure future progress towards this target. Although there are a number of interesting initiatives taking place at the national level, involving both the public and private sectors, it is unlikely that the target will be met at the global level.	**Target 4: Sustainable consumption and production** Governments, business and stakeholders at all levels have taken steps to achieve, or have implemented, plans for sustainable production and consumption…	
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	 (low)	Although a wide range of initiatives to conserve traditional knowledge have been developed at national and local levels, progress towards this target is difficult to measure as baselines have not been quantified. This target can be considered an 'enabling' target, supporting the achievement of other targets.	**Target 18: Traditional knowledge respected** Traditional knowledge, innovations and practices of indigenous and local communities are respected	
Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes	 (high)	Plants are often neglected in the conservation debate. However, progress is being made, particularly due to increasing participation in citizen science programmes, which are often focused on plants.	**Target 1: Awareness increased** People are aware of the values of biodiversity People are aware of the steps they can take to conserve and sustainably use biodiversity	 
Target 15: The number of trained people working with appropriate facilities sufficient according	 (medium)	The broad scope of the GSPC requires considerable capacity building across a range of disciplines. There is a worrying decline in the teaching of botany at	**Target 19: Knowledge improved, shared and applied** Knowledge, the science base and technologies	

to national needs, to achieve the targets of this Strategy		University level and much capacity building is being undertaken within the informal education sector.	relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved	
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	 (medium)	At the global level, the establishment of the GPPC has made a good start at bringing together the plant conservation community, however greater efforts are needed to engage other sectors,	**Target 19: Knowledge improved, shared and applied** Biodiversity knowledge, science base and technologies are widely shared and transferred, and applied	

Acknowledgements

This report is based largely on information provided by members of the Global Partnership for Plant Conservation, with contributions from other plant conservation practitioners from around the world. We particularly acknowledge the contributions from the following institutions and individuals:

- **Associação Ibero-Macaronésica de Jardins Botânicos – Portugal (**Maria Dalila Espírito Santo and colleagues from Portuguese Botanic Gardens).
- **Australian National Botanic Gardens - Australian GSPC Focal Point** (Judy West)
- **Australian Seed Bank Partnership** (Lucy A. Sutherland).
- **Botanic Garden of Barcelona**, Spain (Josep M. Montserrat Martí)
- **Botanic Gardens Conservation International** (BGCI) (Abby Hird, Meirion Jones, Sara Oldfield, Stephen Blackmore).
- **Bristol Zoo Gardens,** UK (Eddie Mole).
- **Cadereyta Regional Botanic Garden**, México (Beatriz Maruri Aguilar, Emiliano Sánchez Martínez, Maria Magdalena Hernández Martínez,).
- **Chicago Botanic Garden**, USA (Kayri Havens)
- **Colombian Botanic Gardens Network** (Alberto Gómez-Mejía, Carolina Sofrony-Esmeral).
- **Comisión Nacional de Áreas Naturales Protegidas, SEMARNAT,** Mexico (Mariana Bellot Rojas, Oscar Manuel Ramírez Flores)
- **Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO),** Mexico (Hesiquio Benítez Díaz, Francesca Acevedo, Caroline Burgeff, Ana Angelica Cervantes Maldonado, Sandra Janet Solís Jerónimo)
- **Conservatoire et Jardin botaniques de la Ville de Genève** (CJBG) (Pierre-André Loizeau).
- **Denver Botanic Gardens**, USA (Jennifer Ramp Neale)
- **ECOSUR - Botanic Garden "Alfredo Barrera Marín**", México (Cecilia Elizondo, Dalia Hoil Villalobos).
- **Fairchild Tropical Botanic Garden**, USA (Joyce Maschinski).
- **Fédération des Conservatoires botaniques nationaux,** France (Philippe Bardin)
- **Instituto de Ecologia AC,(INECOL)** Mexico (M. Luisa Martinez, Sergio Zamudio Ruiz)
- **International Union for Conservation of Nature** (IUCN) — **The Species Survival Commission** (SSC) (Oliver Hasinger with input from the IUCN Species Survival Commission (SSC) plant Specialist Groups).
- **Joint Nature Conservation Committee**, UK (Christine Cheffings)
- **Jardim Botânico da Madeira** (José Augusto Carvalho, Francisco Manuel Fernandes).
- **Jardín Botánico Gaspar Xuárez sj (JBGXSJ)** México (Diana Perazzolo).
- **Ljubljana University Botanic Gardens**, Slovenia (Jože Bavcon).
- **Memorial University of Newfoundland Botanical Garden**, Canada (Todd Boland, Madonna Bishop).

- **Mexican Association of Botanic Gardens** (MABG) (Cecilia Elizondo, Emiliano Sánchez Martínez, Beatriz Maruri Aguilar, María Magdalena Hernández Martínez).
- **Missouri Botanical Garden** (Peter Wyse Jackson).
- **Muséum National d'Histoire Naturelle,** France (Maïté Delmas, Antoine Lombard, Frédéric Hendoux, Nathalie Machon).
- **New York Botanical Garden,** USA (Todd Forrest, Barbara M. Thiers).
- **Norwegian network for botanical gardens** (Vibekke Vange).
- **PlantLife International** (Elizabeth Radford).
- **Royal Botanic Garden Edinburgh** (Peter Wilkie).
- **Royal Botanic Gardens Kew,** UK (Natasha Ali, Alan Paton, Eimear Nic Lughadha, Iain Darbyshire, SP Bachman, Oliver Whaley, William Milliken, Clare Trivedi, Kenwin Lui, Michael Way, Jonas Mueller, Noel McGough, Julia Willison, Colin Clubbe, Kate Gold).
- **South African National Biodiversity Institute** (SANBI) (Domitilla Raimondo, Christopher Willis, John Donaldson).
- **Spanish Network of Botanic Gardens** (AIMJB) (Álvaro Bueno Sánchez and colleagues from Spanish Botanic Gardens).
- **Tallinn Botanic Garden**, Estonia (Ruth Aguraiuja).
- **TRAFFIC** (Anastasiya Timoshyna).
- **Universidad Nacional Autónoma de México** (UNAM), Mexico (Eliana Ceccon)
- **Vallarta Botanical Gardens A.C**. (VBG) – México (Alan Heinze).
- **Vilnius University Botanical Garden**, Lithuania (Silva Žilinskaitė).
- **Xishuangbanna Tropical Botanical Garden** (XTBG), China (Richard Corlett).

Annex 1: Members of the Global Partnership for Plant Conservation

- Asociación Latinoamericana y del Caribe de Jardines Botánicos
- Australian Seed Bank Partnership
- BioNET International
- Bioversity International
- Botanic Gardens Conservation International (BGCI)
- Botanical Garden of Tver State University (Russia)
- Botanischer Garten und Botanisches Museum
- Canadian Botanical Conservation Network
- Center for Plant Conservation
- Chicago Botanic Garden
- Conservatoire et Jardin botaniques de la Ville de Genève
- Chinese Academy of Sciences – Botanic Garden Network
- Denver Botanic Garden
- The Earthwatch Institute
- The European Botanic Garden Consortium
- Fauna and Flora International (FFI)
- Food and Agriculture Organization of the United Nations (FAO)
- Global Diversity Foundation
- Global Biodiversity Information Facility (GBIF)
- IUCN - International Union for the Conservation of Nature - Species Survival Commission
- Jardí Botànic de la Universitat de València
- Joint Nature Conservation Committee (JNCC)
- King's Park and Botanic Gardens, Australia
- Missouri Botanical Garden, St Louis, U.S.A
- Muséum National d'Histoire Naturelle, Paris, France
- National Botanical Institute, South Africa (SANBI)
- National Botanic Gardens Ireland, Glasnevin
- New York Botanical Garden
- New Zealand Plant Conservation Network
- The University of Oxford Botanic Garden
- People and Plants International (PPI)
- Plantlife International and Planta Europa
- PRONAPLAMED, University of Costa Rica, Costa Rica
- Red Latinoamericana de Botanica
- Rede Brasileira de Jardins Botanicos (RBJB)

- Red Nacional de Jardines Botánicos de Colombia
- Royal Botanical Gardens (Hamilton & Burlington, Canada)
- Royal Botanic Garden, Edinburgh, U.K
- Royal Botanic Gardens Kew, U.K.
- Smithsonian Institution Natural History Museum, Washington D.C., U.S.A
- Society for Ecological Restoration
- Society for Economic Botany
- South African National Biodiversity Institute, South Africa (SANBI)
- Species2000
- TRAFFIC
- UNEP World Conservation Monitoring Centre (UNEP-WCMC)
- UNESCO CHAIR Jardín Botánico Viera y Clavijo, Spain
- World Agroforestry Centre, ICRAF
- WWF International (WWF)
- Wuhan Botanic Garden Botanical Institute

Annex 2: The contribution to selected GSPC targets of conservation actions mentioned in a sub-set of the 5th National Reports.

	Mention of "GSPC" in Report	GSPC Target 1	GSPC Target 2	GSPC Target 5	GSPC Target 6	GSPC Target 7	GSPC Target 8	GSPC Target 9	GSPC Target 12	GSPC Target 13
Australia	Yes	x	x	x	x	x	x	x	x	x
Azerbaijan			x	x		x	x	x		
China	Yes	x	x	x	x	x	x	x	x	x
Cuba	Yes	x	x	x	x	x	x	x	x	x
Finland		x	x	x	x	x	x	x	x	x
Hungary			x		x	x	x	x		x
India			x	x		x	x	x	x	
Iraq		x	x	x		x	x	x		x
Italy	Yes	x	x		x	x	x	x		
Japan			x		x		x	x		x
Liberia			x	x	x	x		x		
Madagascar	Yes	x	x	x	x	x	x		x	x
Malaysia		x			x	x	x	x	x	x
Myanmar	Yes	x	x	x	x	x	x	x	x	
Namibia	Yes	x	x	x		x	x	x	x	x
Nauru			x	x		x	x			
Nepal						x	x	x		x
Netherlands			x		x		x	x	x	
New Zealand		x	x	x		x	x	x	x	x
Pakistan	Yes	x		x	x	x		x	x	
Palau			x			x	x			
Rwanda		x	x	x		x		x		
Solomon Islands				x		x		x		
South Africa		x	x		x	x	x		x	x
South Korea		x	x			x	x	x		x
Sweden		x		x	x	x	x	x		x
Switzerland		x	x	x	x	x	x	x		
Tanzania							x	x		x
Tonga			x				x	x		
UK	Yes	x	x	x	x	x	x	x	x	x

Annex 3: Summary of national progress towards the GSPC targets:

Central America / Caribbean

Matrix of GSPC implementation by country.

Country	Objective I			Objective II							Objective III			Objective IV	Objective V	
	TARGETS															
	Knowledge			Conservation							Sustainable use			Education and Public Awareness	Capacity Building	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Costa Rica	3	1	3	3	3	2	3	1	1	3	3	2	2	3	3	2
Cuba	3	3	2	3	3	2	1	1	1	3	3	2	3	3	2	3
Guatemala	3	2	2	3	3	1	1	2	2	3	3	2	3	3	3	3
Honduras	3	1	2	3	3	1	3	1	1	1	3	1	1	2	2	2
Mexico	3	1	2	2	3	1	1	2	1	3	2	1	1	2	2	2
Panama	3	1	2	2	3	1	2	1	1	2	3	2	1	1	2	1
Dominican Republic	3	1	2	3	3	1	3	1	1	3	3	1	1	3	2	2
Puerto Rico	3	3	1	2	2	1	1	1	1	1	NI	1	1	2	1	2
Total (Average or mode)	24	12	16	21	23	10	14	6	9	19	21	12	13	19	17	17
Reds	0	5	1	0	0	6	4	6	7	2	0	4	5	1	1	1
Yellows	0	1	6	3	1	2	1	2	1	1	1	4	1	3	5	5
Greens	8	2	1	5	7	0	3	0	0	5	6	0	2	4	2	2

3	Activities are developed at a good pace, 65-100 %
2	Activities are developed at a slow pace, 30- 65 %
1	Activities are not being developed. 0-30 %

10

South East Asia

COUNTRIES' PROGRESS TOWARDS ACHIEVING GLOBAL STRATEGY FOR PLANT CONSERVATION*

	Obj 1 - Knowledge			Obj 2 - Conservation							Obj 3 – Sustainable use			Obj 4 - Education	Obj 5 -Capacity	
COUNTRY	Target 1	Target 2	Target 3	Target 4	Target 5	Target 6	Target 7	Target 8	Target 9	Target 10	Target 11	Target 12	Target 13	Target 14	Target 15	Target 16
Cambodia																
Indonesia									N/A							
Lao PDR																
Malaysia																
Myanmar																
Philippines																
Singapore						N/A			N/A			N/A	N/A			
Thailand																
Vietnam																
China																
Timor Leste																
Good progress: 65-100%	2	3	1	5	2	1	6	2	0	1	4	0	2	5	2	2
Average progress: 30-65%	5	3	5	3	5	2	1	1	5	5	4	4	2	4	4	4
Little progress towards target: <30%	3	4	4	2	3	5	3	7	3	4	2	4	5	1	3	4

*The countries' progress towards achieving the objectives and targets of the Global Strategy for Plant Conservation are subjective assessments of the participants and require validation.

Southern and Eastern Africa

Country	Do we have the necessary Information?	Are protected areas working for plant conservation?	Are plant resources being used sustainably?	Are linkages with agric. sector in place?	Is indigenous knowledge being preserved?	Challenges
Botswana	Some information available but may need updating	Insufficient protected areas	Lack of capacity to monitor	Yes generally	Yes to some extent	
Ethiopia	Information available	Generally yes, but there is a lack of inventories	Land races are being lost due to improved variety introduction	Linkages are weak	No	Genetic erosion, population growth, invasive species
Kenya	Information is available	Generally yes	Little baseline information	Limited linkages	A number of initiatives on-going	
Lesotho	Information is limited and some is outdated	No inventories of protected areas	Generally not, but some successes e.g. *Pelargonium sidoides*	Some coordination	Little work being done	Lack of resources and capacity. Fragmented legislation
Mozambique	Information lacking	Little information on threatened species	Main problem is illegal logging	Yes		Lack of capacity, habitat loss
Namibia	Plant checklist and red list available. Info available for in situ and ex situ conservation	Yes to a large extent. Some IPAs and veg. zones not covered	Mainly yes. Some concerns re. deforestation	Yes but could be improved	Yes, but no centralised system to hold all information	Habitat loss and over-harvesting
Swaziland	Information needs updating	Lack of information	No - especially medicinal plants	No formalised linkages	Some information is preserved	Lack of priority at govt. level. Unsustainable harvesting
Tanzania	Information available but scattered and needs updating	In some cases	Some monitoring is being carried out	Some linkages in place for specific activities	Documentation is fragmented	Changing political priorities, lack of resources, weak enforcement of legislation
Uganda	Regional and national floras available. Some info. on ex situ conservation	No deliberate focus on plants. Preliminary identification of IPAs	Some attempts, but not comprehensive	No	Good efforts with databases	Lack of coordination, linkages, partnerships. Lack of resources
Zambia	Information exists but some needs updating	No monitoring tools in place to check	No - main problem is charcoal production and medicinal plants	Yes some linkages are in place	To some extent	Lack of botanical capacity

Annex 4: Members of the World Flora Online Consortium (January 2014)

- Australian Biological Resources Study, AUSTRALIA
- Botanischer Garten und Botanisches Museum Berlin-Dahlem, Zentraleinrichtung der Freien Universität Berlin, GERMANY
- Conservatoire et Jardin botaniques de la Ville de Genève, SWITZERLAND
- Flora Iberica Project, Madrid, SPAIN
- Flora of North America Association, U.S.A
- Global Biodiversity Information Facility, DENMARK
- Institute of Botany, Academy of Sciences Czech Republic, CZECH REPUBLIC
- Beijing Chinese Academy of Sciences – Institute of Botany, PEOPLE'S REPUBLIC OF CHINA
- Instituto de Botánica Darwinion, Buenos Aires, ARGENTINA
- Instituto de Pesquisas, Jardim Botânico do Rio de Janeiro, BRAZIL
- Kunming Institute of Botany, Chinese Academy of Sciences, PEOPLE'S REPUBLIC OF CHINA
- Missouri Botanical Garden, U.S.A.
- Muséum National d'Histoire Naturelle, Paris, FRANCE
- New York Botanical Garden, USA
- Royal Botanic Garden Edinburgh, UNITED KINGDOM
- Royal Botanic Gardens Kew, UNITED KINGDOM
- South African National Biodiversity Institute, SOUTH AFRICA
- Smithsonian – National Museum of Natural History, U.S.A.
- Tsitsin Main Botanical Garden, Russian Academy of Sciences, Moscow, RUSSIA
- UNESCO Chair for the Conservation of Biodiversity in Macaronesia and the West of Africa, Las Palmas de Gran Canaria, SPAIN

The following organizations and institutions have also indicated that they will join the international collaborative effort to prepare the World Flora Online but have not signed the MOU.

- Alexander von Humboldt Biological Resources Research Institute, Colombia
- Botanical Survey of India (BSI)
- Encyclopedia of Life (EOL)
- Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Thailand
- Forest Research Institute, Malaysia
- Institut de Recherché pour le Développement, New Caledonia
- Komarov Botanical Institute, Russian Academy of Sciences, St Petersburg, Russia
- Museo Botánico, Córdoba, Argentina
- National Herbarium, Addis Ababa University, Ethiopia
- Species Plantarum Programme (SPP)

Annex 5: Members of the Ecological Restoration Alliance

The following institutions are members of the Ecological Restoration Alliance:

- Royal Botanic Gardens, Kew, UK
- Royal Botanic Garden Edinburgh, UK
- Missouri Botanical Garden, USA
- Brackenhurst Botanic Garden, Kenya
- Kings Park and Botanic Garden, Australia
- National Tropical Botanical Garden, USA
- Rio de Janeiro Botanic Garden, Brazil
- Instituto de Ecología, A.C. “Francisco Javier Clavijero Botanic Garden”, Mexico
- Royal Botanical Gardens, Canada
- The Eden Project, UK
- South China Botanical Garden, China
- Royal Botanic Garden, Jordan
- Korea National Arboretum, Korea
- Paignton Zoo Environmental Park, UK
- Chicago Botanical Garden, USA
- Royal Botanic Gardens Sydney, Australia

Annex 6: Potential contribution of CITES to the GSPC targets

(CITES Resolution Conf 16-5)

GSPC's Objective	GSPC's Target [1]	CITES's potential contribution
(I) Plant diversity is well understood, documented and recognized	1. An online flora of all known plants.	CITES checklists available online.
	2. An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action.	– CITES Appendices. – Supporting statements for proposals to amend the Appendices. – NDFs. – Periodic Review results. – Review of Significant Trade results.
	3. Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared.	
(II) Plant diversity is urgently and effectively conserved	4. At least 15 % of each ecological region or vegetation type secured through effective management and/or restoration.	Not directly applicable as CITES works at species level.
	5. At least 75 % 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.	
	6. At least 75 % of production lands in each sector managed sustainably, consistent with the conservation of plant diversity.	
	7. At least 75 % of known threatened plant species conserved *in-situ*.	– Inclusion of species/populations in CITES Appendices. – Identification of the location/habitat of Appendix I species. – Efforts by CITES Parties to ensure sustainable use of CITES-listed species: NDFs and national quotas. – Implementation of Resolution Conf. 13.9 on *Encouraging cooperation between Parties with* ex situ *breeding operations and those with* in situ *conservation programmes*. – CITES Certificate of Scientific Exchange.
	8. At least 75 % of threatened plant species in *ex-situ* collections, preferably in the country of origin, and at least 20 % available for recovery and restoration programmes.	
	9. 70 % 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.	Not directly applicable.
	10. Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded.	Not directly applicable. Nevertheless, CITES Parties have recognized the link between trade and alien invasive species in Resolution Conf. 13.10 (Rev. CoP14) on *Trade in alien invasive species*.
(III) Plant diversity is used in a sustainable and equitable manner	11. No species of wild flora endangered by international trade.	All CITES activities contribute directly to this Target, and CITES is recognized as having a leadership role in implementing this Target.
	12. All wild-harvested plant-based products sourced sustainably.	– NDFs, national quotas, Review of Significant Trade, and Periodic Review of the Appendices. – Annotations to the Appendices enable regulation of certain target commodities.
	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.	– NDFs. – Resolution Conf. 10.19 (Rev. CoP14) on *Traditional medicines*. – CITES Standing Committee Working Group on CITES and Livelihoods.
(IV) Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on earth is promoted	14. The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.	CITES tools, such as: – Training courses, workshops results and technical reports. – CITES Virtual College – CITES website – CITES Identification Manual and Web pages. – Training materials, including PowerPoint presentations and CD-ROMs. – Capacity-building work of the Secretariat.
(V) The capacities and public engagement necessary to implement the Strategy have been developed	15. The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.	
	16. Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.	– CITES Parties and Plants Committee. – Regional Directories.