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PLANT CONSERVATION REPORT 2020:

A review of progress towards the Global Strategy for Plant Conservation 2011-2020

Convention on Biological Diversity

United Nations Decade on Biodiversity 2011-2020

BOTANIC GARDENS CONSERVATION INTERNATIONAL

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PLANT CONSERVATION REPORT 2020:

A review of progress towards the Global Strategy for Plant Conservation 2011-2020

A contribution to the fifth edition
of the Global Biodiversity Outlook (GBO-5).

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Ian Harvey-Brown

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FOREWORD

The adoption of a Global Strategy for Plant Conservation (GSPC) in 2002 and its subsequent renewal in 2010 were significant milestones for the Convention on Biological Diversity. Not only did this strategy, its objectives and targets provide a valuable framework to guide plant conservation worldwide, it also played a critical role in mobilizing the plant and botanical community at global and national levels to develop new priority plant conservation actions. In addition, many countries responded by developing national plant conservation strategies or incorporated new plant-focused initiatives into their national biodiversity strategies and action plans.

This report is celebrating and highlighting almost 20 years of targeted action towards the implementation of the five goals of the Global Plant Conservation Strategy: developing knowledge of the plant world, ensuring effective conservation of the plant diversity and promoting its use in a sustainable and equitable manner, organizing education and awareness and reinforcing the capacities and the public engagement necessary to implement the strategy.

This report reviews progress to this ambitious action plan of the GSPC with its 16 outcome oriented 2020 targets and its contribution to many areas of concern highlighted in the Strategic Plan for Biodiversity and to the U.N. Sustainable Development Goals for 2030.

In 2004, a Global Partnership for Plant Conservation (GPPC) was launched to support CBD Parties on the achievement of the strategy. Today the GPPC includes over 60 of the world's leading botanical and plant conservation organisations, networks and institutions. The GPPC was pleased to continue its support for the CBD and the GSPC by leading in the development of this Plant Conservation Report. We acknowledge in particular the support given by Botanic Gardens Conservation International (BGCI) that led the efforts to compile and review progress on the achievement of the GSPC and its targets, drawing on both the reports by Parties to the Convention and the individual efforts of members of the GPPC. BGCI has also provided a secretariat for the GPPC since its establishment and led in the development of an online GSPC toolkit. We would also like to acknowledge the work of the many scientists and organisations that have contributed to providing data and case studies included in this Report and to particularly recognize the contribution of those Parties that have provided a contribution to the GSPC in their 6th National Reports.

When the GSPC was launched in 2002 it was recognized that plants are essential for the functioning of the planet and vitally important to support human livelihoods. Securing a rich and healthy plant diversity in functioning ecosystems is fundamental to the achievement of a sustainable future for humankind where the ecosystem services that plants provide are crucial to our survival.

Over the almost two decades since the GSPC was launched considerable progress has been made. This has been achieved not only by individual Parties but also by a wide range of organisations and institutions, notably too by the botanic garden community worldwide, working individually and collectively and guided by the principles and priorities of the GSPC.

Notable progress has been made with many targets, including the development of an online and accessible digital world Flora of all known plants; the establishment of networks of areas important for plant diversity, *in situ* and *ex situ* conservation of the genetic diversity of crop species and their wild relatives; the sustainable use of plant species; actions for individual species conservation (including Red Listing) and in building new public awareness of the vulnerability and conservation importance of plant diversity. New capacity and networks now flourish at national, regional and international levels. New directions in plant conservation have made significant steps forward, such as in conservation genetics, species recovery and ecological restoration. While we can be proud, with some justification, that most of the GSPC targets have made significant progress, we must acknowledge that only Target 1 (World Flora Online) is likely to be achieved by 2020 and for fifteen other targets we will miss the mark. Nevertheless, it is clear that without having the guiding framework that the GSPC provided, much less progress would have been made. It is clear therefore that this CBD initiative can be regarded as having been a considerable success.

As we near the end of 2020, and the culmination of the Decade on Biodiversity, we are mindful that many significant tasks in plant conservation remain to be addressed. We can acknowledge that much progress has been made, but much more remains to be done. We anticipate that within the proposed Global Biodiversity Framework (GBF), currently under negotiation and due to be adopted at the next Conference of the Parties (May, 2021, Kunming, China), many goals and objectives related to plant conservation will be incorporated. With this aim in mind, at the request of a CBD Liaison Group meeting held in Cape Town South Africa, in August 2018, the GPPC undertook to develop an outline for the elements and components of a post-2020 strategy for plant conservation. This would form part of and contribute to the 2050 Biodiversity Vision and new 2030 biodiversity targets. The work in developing such contributory framework for plants in the GBF has gone forward since then. We hope that the Convention on Biological Diversity will acknowledge the continuing importance and urgent need for these special efforts on plant conservation post-2020 and support the continued development of such a framework. The GPPC and the broad botanical and plant conservation community worldwide stands ready to rise to new challenges that this will present to secure the future of the world's plant diversity.

Peter Wyse Jackson and Maïté Delmas
Co-chairs, Global Partnership for Plant Conservation

FOREWORD

Plants are critical to sustaining all life on Earth as they maintain environmental balance and ensure ecosystem stability. Through photosynthesis, plants are at the base of most of the trophic chains that sustain life across the planet. As a consequence, our lives totally depend on plants and the ecosystem goods and services they provide. These services include food, medicine, clean water, climate amelioration, rich and productive landscapes, fabrics, building materials, energy and a healthy atmosphere. However, under the current crisis of global biodiversity loss, where one third of assessed plant species is threatened at some level, it is urgent to effectively address the challenges that plant diversity and natural habitats are facing.

In 2002 the Sixth Conference of the Parties (COP-6) adopted the Global Strategy for Plant Conservation (GSPC), providing 16 global targets which have served to unite the international botanical community towards a common goal. In 2010, COP-10 adopted a consolidated GSPC update in alignment and support of the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets.

I am very pleased to see in the Plant Conservation Report (2011-2020) how the GSPC has contributed to significant achievements for the conservation, restoration, re-introduction and sustainable use of plants at global, regional and national scales. This has been the result of innovative actions, programs and partnerships led by a myriad of key institutions, acting like real champions. In fact, countries like Brazil, China, Colombia, Indonesia, Mexico, Philippines and South Africa have developed national responses to the GSPC, and some others are implementing the GSPC through their NBSAPs. In Mexico, for example, the National Strategy for Plant Conservation was developed in coordination with relevant stakeholders, and guides, through a Steering Committee, actions for generation and systematization of knowledge, conservation, restoration and sustainable use of the Mexican flora.

Globally, the GSPC has increased our understanding of the vital importance of plant diversity for our wellbeing. However, many issues still remain to be addressed to ensure its effective implementation. These include capacity building, full involvement of all sectors that depend on plant diversity, SMART indicators and resource mobilization. We need to continue and reinforce such efforts beyond 2020, building on successful experiences and lessons learned.

As the Global Partnership on Plant Conservation noted during SBSTTA-23, the most important lessons to be drawn from the last two decades were that progress was made when targets were measurable and supported by a focused and committed community.

Considering the importance of plants for people in relation to sustainable use, ecosystem services and the impacts of climate change, and the enormous challenges posed by the global biodiversity crisis, it is crucial to ensure effective conservation measures. There is also a need to develop productive diversification using native species and varieties and improved agroecological practices, reduce pollution and support community-based forestry and the fair and legal trade of agriculture, timber and non-timber products. For this aim, stakeholders such as botanical gardens, herbaria, seed banks, academia and relevant organizations of the UN System, working together with governments at all levels, Indigenous Peoples and Local Communities, NGOs and private sector, are key to increasing plant knowledge (including traditional knowledge) and implementing *in situ* and *ex situ* conservation, restoration and sustainable use.

The Plant Conservation Report 2011-2020 provides the basis to redefine objectives and targets of the GSPC for the period 2021-2030, closely embedded with the Post 2020 Global Biodiversity Framework to be adopted at CBD COP15 in China. A continued GSPC is essential to achieve successful plant conservation, restoration and sustainable use, linked to poverty alleviation, food security and economic development. Our future depends on it.

Hesiquio Benítez-Díaz
CBD SBSTTA Chair

EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND TO THE GSPC

The Global Strategy for Plant Conservation (GSPC) with its 16 outcome-oriented targets aimed at achieving a series of measurable goals by 2010, was originally adopted by the Conference of the Parties to the Convention on Biological Diversity at its sixth meeting (COP-6) in 2002. The GSPC targets were updated in 2010 and a set of revised targets for 2020 were agreed at COP-10 in 2010, with a decision that implementation of the GSPC should be pursued as part of the broader framework of the Strategic Plan for Biodiversity 2011-2020.

In agreeing to the development of a specific strategy for plant conservation in the framework of the CBD, Parties acknowledged and recognised the special importance of plants as the basis of all life on earth and providing the building blocks of all terrestrial ecosystems.

The GSPC has played a pivotal role in ensuring significant progress in plant conservation in recent years. Implementation has stimulated collaboration and synergies and provided an entry point for governments, as well as many smaller, non-governmental organisations into plant conservation and the implementation of the CBD. The GSPC has also encouraged the development of target-specific support groups and champions, which are linked together through the Global Partnership for Plant Conservation (GPPC), which was established in 2004.

PROGRESS TOWARDS THE GSPC'S OBJECTIVES

Several new initiatives have been developed specifically to address the targets of the GSPC. These include the establishment of the World Flora Online Consortium, bringing together over 40 institutions to prepare a World Flora on-line (Target 1) and the Global Tree Assessment, which aims to have completed Red List assessments for all the world's tree species by 2020 as a major contribution to Target 2. The impressive progress that has been made in generating and sharing information on the world's plant diversity makes a significant contribution to Aichi Target 19.

Clear, measurable targets, new information, tools and the sharing of experiences has helped many countries to make good progress in conserving threatened and socio-economically important plants through both *in situ*, *ex situ* and integrated approaches. Mechanisms and indicators to track progress have been put in place and such species-based programmes contribute to the achievement of Aichi Target 12. At the habitat-level much research has been carried out on the scientific basis for achieving long-term sustainable ecological restoration, and an increasing number of such programmes are now including a mix of appropriate native species and providing support for the implementation of Aichi Targets 11 and 15.

A range of initiatives, such as the launch of the FairWild Standard provide valuable tools to measure progress towards Target 12. The FairWild Standard is being used by a growing number of companies for products sourced in countries around the world. Implementation, monitoring and review of Target 11 (international trade) of the GSPC is through linkages with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) under its Plants Committee. This represents an important area of cooperation between the CBD and CITES and contributes to the achievement of Aichi Target 4. Capacity building, education and public awareness programmes focused on plants are reaching ever larger numbers of people, especially through the increasing participation of the public in plant-based citizen science programmes and through the use of social media, thus contributing to the achievement of Aichi Target 1.

At the national level, a number of countries have developed responses to the GSPC, including many of the world's most biodiverse countries. These countries collectively include more than 50% of the world's plant species within their borders. Other countries are implementing the GSPC – explicitly or implicitly - through their National Biodiversity Strategies and Action Plans (NBSAPs). While reporting on progress towards the GSPC targets is voluntary, 61 countries (38%) of those countries that had submitted 6th National Reports to the CBD by May 2020, provided an indication of national progress towards the GSPC, with the majority reporting against the global targets. Most countries report at least some progress towards all the targets, with Targets 1, 2 and 14 (e-floras, red listing and public awareness of plant diversity) being most likely to be achieved at the national level.

THE FUTURE OF THE GSPC

Implementation of the GSPC has resulted in some significant successes in plant conservation, but has also presented a number of challenges. These are particularly notable in relation to reporting and data management. Due to lack of alignment between the GSPC and Aichi targets, national CBD reports rarely capture the progress that has been made in plant conservation, while mechanisms to feedback data from global datasets to national partners are not well developed.

Strong support for a continued GSPC beyond 2020 has been expressed by a number of Parties and organisations, with agreement that this should be firmly embedded within the framework of the post-2020 biodiversity framework. Future targets will need to be SMART and have well identified indicators and means of measuring progress and it will be important to recognise inter-dependencies between targets and use data generated for one target to support the implementation of other targets.

At the national level, good progress has been associated with having dedicated champions for each target driving the work forward, as well as active NGOs and public support through citizen science programmes with dedicated plant conservation volunteers. Some specific areas of importance for a future GSPC include:

- Ecological restoration – focussing on the use of appropriate native plant species in order ensure resilience and diversity in restored areas so that they can provide the required ecosystem services;
- Species recovery plans, as a prerequisite for successful conservation;
- Plant conservation and sustainable use clearly supporting poverty alleviation and economic development, including in urban areas;
- Compliance with the Nagoya Protocol, but facilitating access to plants for conservation, science and sustainability.

Pulsatilla alpina in the Alps, southern Carinthia (Barbara Knickman)

INTRODUCTION

The Global Strategy for Plant Conservation (GSPC) with its 16 outcome-oriented targets aimed at achieving a series of measurable goals by 2010, was adopted by the Conference of the Parties to the Convention on Biological Diversity at its sixth meeting (COP-6) in 2002.

The Strategy developed from a call from the botanical community to enhance measures to ensure the protection of plants, as the basis of all life on earth and the building blocks of all terrestrial ecosystems. A wide range of stakeholders, including CBD Parties and representatives of the botanical community were engaged in developing the Strategy, which acknowledged the need to support all aspects of plant conservation, from information generation and sharing, through conservation and sustainable use of wild plants and crop genetic resources, to capacity building, education and public awareness.

The Strategy was updated in 2010 and a set of revised targets for 2020 were adopted at COP-10 in 2010 (Annex 1). The major steps in the development of the GSPC are outlined in Table 1.

This review of progress in the implementation of the GSPC builds on earlier assessments of progress and challenges for its implementation. A mid-term review of progress was undertaken in 2014, combining data from national plant conservation strategies, 5th National CBD reports, National Biodiversity Strategies and Action Plans, submissions from members of the Global Partnership for Plant Conservation and information published on the GSPC Toolkit (www.plants2020.net). This review was published as a companion to the fourth edition of the Global Biodiversity Outlook (Sharrock *et al.*, 2014) and concluded that progress was being made towards the achievement of most of the sixteen targets of the GSPC but that in most cases it was not sufficient to achieve the targets by 2020.

Further data on progress towards the targets was collected in 2016 for the first meeting of the Convention's Subsidiary Body on Implementation (CBD 2016a).

This report draws on the progress reports carried out in 2014 and 2016, as well as recent information provided by members of the Global Partnership for Plant Conservation (GPPC)[1], particularly that presented at a GPPC conference held in South Africa in August 2018 and information submitted by Parties to the CBD Secretariat in 6th National CBD Reports.

Date	Activity
1999	Establishment of the Gran Canaria Group and its Gran Canaria Declaration
2000	Decision at CBD COP-5 to consider establishment of a Global Strategy for Plant Conservation at COP-6
2002	Adoption of the GSPC at COP-6 marking the first adoption of targets for biodiversity conservation by the international community.
2004	Establishment of the Global Partnership for Plant Conservation (GPPC) at COP-7 to support national implementation of the GSPC. The GPPC now includes over 50 institutions, organizations and networks with national, regional and international programmes in plant conservation.
2010	GSPC targets updated for 2020, taking into account progress that had been made (SCBD, 2009) and adopted at COP-10, with a decision that implementation of the GSPC should be pursued as part of the broader framework of the Strategic Plan for Biodiversity 2011-2020.

Table 1: An overview of the development of the GSPC.

[1]Asociación Latinoamericana y del Caribe de Jardines Botánicos; Australian Seed Bank Partnership; Bioversity International; Botanic Gardens Conservation International (BGCI); Botanical Garden of Tver State University (Russia); Botanischer Garten und Botanisches Museum, Berlin, Germany; Canadian Botanical Conservation Network; Cadereyta Regional Botanical Garden (CRBG), Mexico; Centre for Plant Conservation; Chicago Botanic Garden, USA; China Wild Plant Conservation Association; Council of the Heads of Australian Botanic Gardens; Conservatoire et Jardin botaniques de la Ville de Genève, Switzerland; Core Facility Botanical Garden of the University of Vienna, Austria; Chinese Academy of Sciences – Botanic Garden Network; Denver Botanic Gardens, USA; 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); Indonesian Institute of Sciences - Bogor Botanic Gardens (LIPI); Instituto de Pesquisas Jardim Botânico do Rio de Janeiro; IUCN - The World Conservation Union - Species Survival Commission; Jardín Botánico Medellín, Colombia; Jardí Botànic de la Universitat de València, Spain; Jardín Botánico Viera y Clavijo, Spain; Joint Nature Conservation Committee (JNCC), UK; King's Park and Botanic Gardens, Australia; Mexican Association of Botanic Gardens (MABG) C. A.; Missouri Botanical Garden, St Louis, U.S.A; Muséum National d'Histoire Naturelle, Paris, France; National Botanic Gardens Ireland, Glasnevin; National Tropical Botanical Garden, Hawaii; New York Botanical Garden, USA; New Zealand Plant Conservation Network; Nezahat Gökyiğit Botanic Garden, Istanbul, Turkey; The University of Oxford Botanic Garden, UK; People and Plants International (PPI); Plantlife International and Planta Europa; Plant Conservation and Reseach Foundation, Bangladesh; PRONAPLAMED, University of Costa Rica, Costa Rica; Red Latinoamericana de Botanica; Rede Brasileira de Jardins Botanicos (RBJB), Brazil; 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.; Royal Botanic Gardens Victoria, Australia; 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; The Morton Arboretum, Chicago, USA; TRAFFIC; UNEP World Conservation Monitoring Centre (UNEP-WCMC); Whitney R. Harris World Ecology Center, St Louis, USA; World Agroforestry Centre, ICRAF; World Flora Online Consortium; WWF International (WWF); Wuhan Botanic Garden Botanical Institute, China.

SOME OVERALL SUCCESSES OF THE GSPC

In adopting the GSPC, the Parties to the CBD acknowledged the special importance of plants in supporting all life on earth and the fact that existing process and strategies in place at the time were not adequate to provide the protection they needed. The development of the Strategy, through a consultative, participative process involving both CBD Parties and the botanical community, allowed consensus to be built around the key issues and priorities and implementation has helped to broaden the base of plant conservation activities world-wide. The adoption of the GSPC marked the first time outcome-oriented targets for biodiversity conservation had been adopted at the international level, and in this respect, provided a pilot in target-setting for the CBD, leading to the subsequent development and adoption of the Aichi targets (Annex 2). The GSPC targets have provided clear, stable, long-term goals, that have been adopted at global, regional, national and local level, and by a wide range of stakeholders. Efforts to achieve the targets have required action by a broad range of stakeholders across sectors, stimulating collaboration and synergies, as well as implementation at both national and international levels.

NTBG Conservation Biologist working in the field (National Tropical Botanical Garden)

BGCI

While it is unlikely that the targets will be fully achieved by 2020, it is clear that greater progress has been made in plant conservation and sustainable use than would have been achieved without the Strategy. Furthermore, it has provided an entry point for many smaller and non-governmental organisations into plant conservation and the implementation of the CBD and has resulted in the development of a broad-based, multi-stakeholder, united community, committed to ensuring the conservation and sustainable use of plant diversity into the future.

A number of new global initiatives have been developed specifically to address the targets of the GSPC and new information, tools and resources are now available to support plant conservation worldwide. The impressive progress that has been made in generating and sharing information on the world's plant diversity makes a significant contribution to Aichi Target 19, and demonstrates the value of clear, unequivocal targets. Mechanisms and indicators to track progress in species conservation *in situ* and *ex situ* have also been put in place and much research has focused on the scientific basis for achieving long-term sustainable ecological restoration.

Significant progress has been made at both national and international levels in achieving the targets of the GSPC, and this progress is described in more detail in the following chapters of this report. A table providing an overview of progress in achieving each target at global and national levels is provided in Annex 1.

NATIONAL IMPLEMENTATION OF THE GSPC

In 2010, at the 10th Conference of the Parties to the CBD (COP-10), the sixteen outcome-oriented targets that constitute the GSPC were updated, taking into account the progress that had been made until then (SCBD, 2009). In doing so it was decided that implementation of the GSPC should be pursued as part of the broader framework of the Strategic Plan for Biodiversity 2011-2020. It was also reiterated that the outcome-oriented global targets for 2011-2020 should be viewed as a flexible framework within which national and/or regional targets might be developed, according to national priorities and capacities.

To date, a number of countries have developed national responses to the GSPC, including several mega-diverse countries (e.g. Brazil, China, Colombia, Indonesia, Mexico, Philippines and South Africa). It is notable that these biodiverse countries collectively include more than 50% of the world's plants within their borders. Other countries are implementing the GSPC – explicitly or implicitly - through their National Biodiversity Strategies and Action Plans (NBSAPs), while at the regional level, Europe developed its Plant Conservation Strategy through Planta Europa, a consortium of organisations dedicated to the implementation of the strategy.

Reporting on progress towards the GSPC targets forms a voluntary part of 6th National Reports to the CBD. An analysis of reports received to date (May, 2020) shows that of the 162 National Reports received, 61 (38%) have reported to some extent on the GSPC. In reporting on the GSPC, countries were asked to rate progress at the national level towards each global target as:

- On track to achieve target at national level (Green in Figure 1)
- Progress towards target at national level but at an insufficient rate (Yellow in Figure 1)
- No significant change at national level (Red in Figure 1).

Figure 1 below provides an overview of progress at the national level towards each target of the GSPC as reported through 6th National Reports.

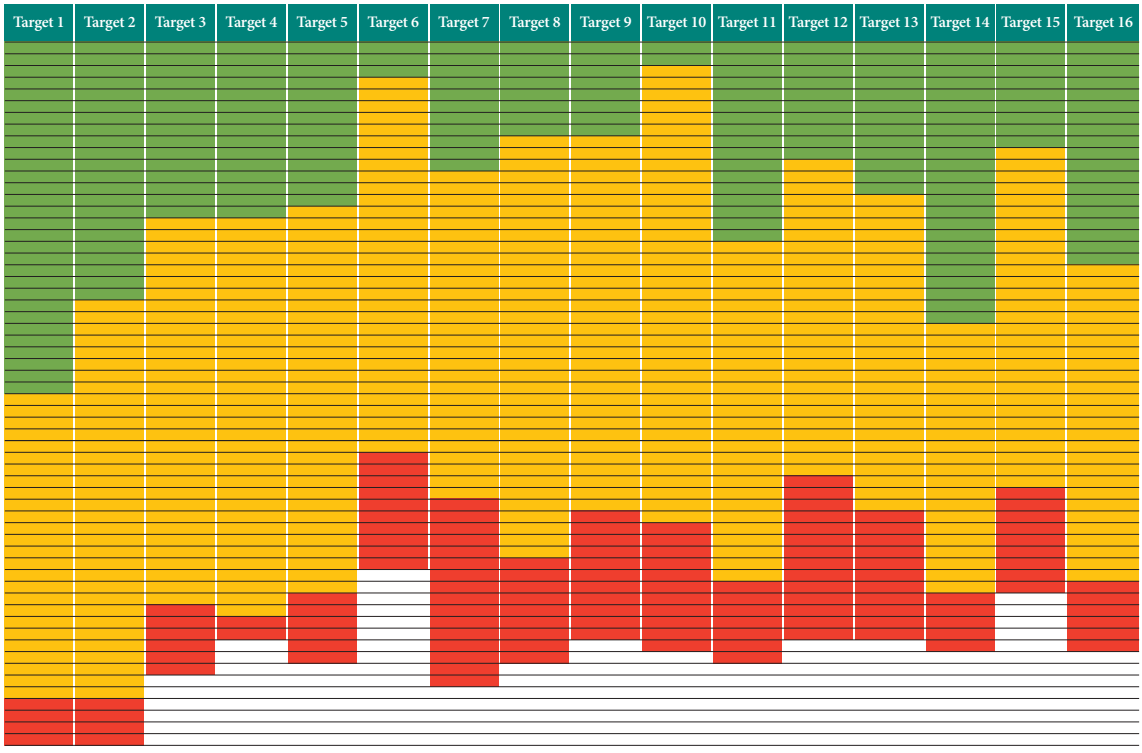


Figure 1. National progress towards each of the GSPC targets as reported in 6th National Reports.

Progress towards the targets of the GSPC is variable both between targets and between countries. However, most countries report at least some progress towards most of the targets, with Targets 1, 2 and 14 (e-floras, red listing and public awareness of plant diversity) being most likely to be achieved at the national level, while Targets 7 (*in situ* conservation) and 12 (sustainable use), being those where least progress has been made. It is encouraging to note that the majority of the countries that have reported, have made notable progress towards achieving at least 12 of the 16 targets.

GSPC TARGETS AND THEIR RELATIONSHIP WITH NATIONAL BIODIVERSITY TARGETS

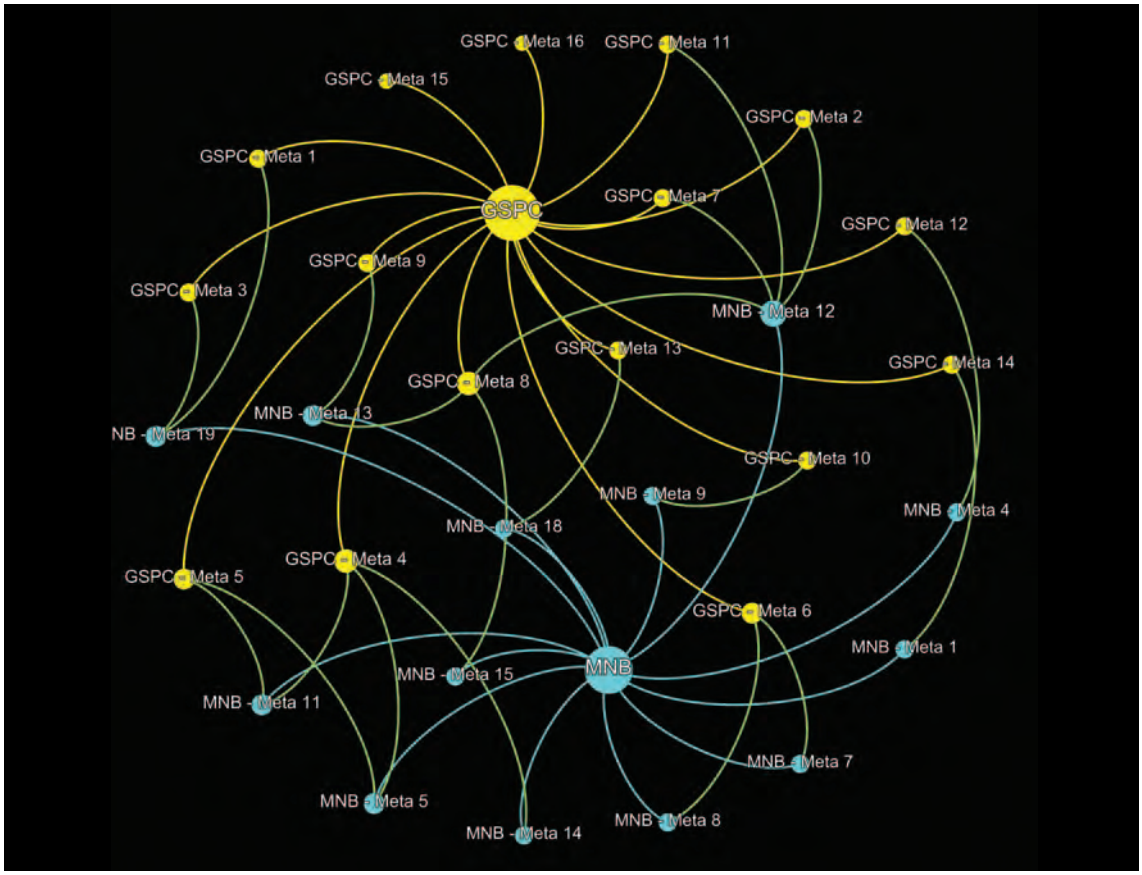


Figure 2: The relationship between Brazil's National Biodiversity Targets and the GSPC targets (Dalcin and Wyse Jackson, 2018)

The majority of countries that have reported on the GSPC, are reporting against the global targets. Very few countries have set specific national plant conservation targets that differ from the global targets. However, many countries have mapped their national biodiversity targets against the GSPC targets.

An example of this is provided by Brazil, where, with the exception of GSPC Targets 15 (capacity building) and 16 (networks and partnerships), all the GSPC targets match to at least one of Brazil's national biodiversity targets (Table 2).

The relationship between GSPC targets and Brazil's National Biodiversity Targets can be visualised as shown in Figure 2.

Left: The Caucasus Strategy for Plant Conservation
Right: The Costa Rican Strategy for Plant Conservation

GSPC target	National Biodiversity Targets
Target 1	Target 19
Target 2	Target 12
Target 3	Target 19
Target 4	Targets 5, 11 and 14
Target 5	Targets 5 and 11
Target 6	Targets 7 and 8
Target 7	Target 12
Target 8	Targets 12, 13 and 15
Target 9	Target 13
Target 10	Target 9
Target 11	Target 12
Target 12	Target 4
Target 13	Target 18
Target 14	Target 1
Target 15	-
Target 16	-

Table 2: Linkages between Brazil's national biodiversity targets and the GSPC targets

Other examples of a similar approach come from Argentina, Australia and Canada. In Australia, the National Biodiversity Conservation Strategy (2010-2030) provides the guiding framework for conserving Australia's biodiversity. The Strategy outlines three priorities for action that are underpinned by 10 targets. Six of the 10 targets have some alignment with the Global Strategy for Plant Conservation. In addition, a Threatened Species Strategy was launched in 2015 as the guiding policy for the Australian Government's approach to protecting and recovering the nation's threatened plants and animals. The Strategy pursues a science-based approach in support of clear actions and conservation partnerships. The Strategy sets out five-year targets to 2020 with plant specific targets.

In Canada, 11 of the GSPC targets align with the 17 biodiversity goals and targets set for 2020, while in Argentina, all GSPC targets have a relationship with one or more of Argentina's national biodiversity targets.

NATIONAL STRATEGIES FOR PLANT CONSERVATION

A limited number of countries have developed National Strategies for Plant Conservation, modelled on the GSPC, but with targets adapted to the national situation. China, South Africa, Malaysia, Ireland and Mexico are examples of this approach.

Left: The Chinese Strategy for Plant Conservation
Right: The UK Strategy for Plant Conservation


Barney Wilczak

Box 1: The Chinese Strategy for Plant Conservation

China is home to a rich diversity of plant life with its flora consisting of over 35,800 species of vascular plants. In recognition of the importance of its plant diversity, China's Strategy for Plant Conservation (CSPC) was adopted in 2008 as a joint initiative of the Chinese Academy of Sciences, the State Forestry Administration (now, National Forestry and Grassland Administration) and the State Environmental Protection Agency (now, Ministry of Ecology and Environment). The CSPC targets were established following the updated GSPC at the global level. A review of progress was carried out in 2018 (Ren *et al*., 2019) showing that by 2018, Targets 1, 2, 4, 5, and 7 of the GSPC had been achieved in China, and substantial progress had been made toward meeting Targets 3, 8, 9, 14, and 16 by 2020. Limited progress has been made so far in reaching Targets 6, 10, 11, 12, 13, and 15. China is fully committed to continuing its efforts to conserve and sustainably use its plant diversity, and in 2019, at an international forum on the GSPC, held in Dujiangyan, Sichuan Province, it launched an updated Chinese Strategy for Plant Conservation 2021-2030. See: https://mp.weixin.qq.com/s/H9Xeip3fGrpP6DV_c0otyQ.

In the case of Mexico, the National Plant Conservation Strategy includes 6 strategic goals and 33 targets with a time frame extending beyond 2020 (see Figure 3).

A Coordination Committee has been established to support the implementation of the Strategy, with a coordinator responsible for each of the 6 objectives as shown in Figure 3.

In South Africa, a response to the GSPC was first carried out in 2006, consisting of a review of progress against the global targets. As a result of this, a country-specific strategy was developed to focus attention on gap areas. A partnership between the Botanical Society of South Africa and the South African National Biodiversity Institute (SANBI) provided the foundation to produce the strategy, which was developed between 2013 and 2015, and endorsed by the Ministry of Environmental Affairs in 2016. The South African Strategy maintains the same set of 16 targets as the GSPC, but with some targets modified to suit the national situation. An alignment between the plant conservation targets and the NBSAP targets has also been carried out.

Left: The Mexican Strategy for Plant Conservation
Right: The South African Strategy for Plant Conservation

Tree nursery in Yamgambi, DRC (Piet Stoffelen)

Figure 3: The Mexican Strategy for Plant Conservation

SECTOR-SPECIFIC RESPONSES

As well as being implemented through national and international initiatives, the GSPC has also prompted the development of sector-specific responses, notably amongst the botanic garden community. A number of institutional, national and regional responses to the GSPC have emerged from within this community, with targets mirroring, or contributing to the global targets.

An example is the North American Botanic Garden Strategy for Plant Conservation, which was initiated in 2006 by many collaborating organizations, including, but not limited to, botanic gardens. Covering Canada, Mexico and the USA, other participants included representatives from non-governmental organizations, government agencies, and university researchers with expertise in plant conservation. It was intended to inspire individual and collective action, and to link the efforts of North American botanic gardens with the goals of the GSPC and to complement the Conservation Strategy for Mexican Botanic Gardens (Estrategia de Conservación para los Jardines Botánicos Mexicanos) published in 2000.

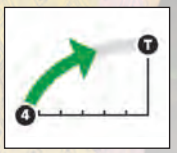
In 2015, the North American Strategy was updated and aligned with the 2011-2020 GSPC Targets. It provides relevant information and case studies illustrating the diversity of botanic gardens and plant conservation activities happening across North America (http://northamericanplants.org/).

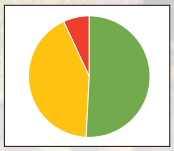
Rich local alpine flora of Shrine Pass in the Gore Range of the Southern Rockies, USA (Nicola Ripley)

PROGRESS TOWARDS THE GSPC TARGETS

Progress towards the targets of the GSPC is variable both between targets and between countries. As countries are encouraged to implement the GSPC within the broader framework of the CBD's Strategic Plan, implementation is largely at the national level. However, as the GSPC targets are set at the global level this has, in some cases, promoted global responses and a number of new initiatives and consortia have been formed around specific targets. These are highlighted in this section, together with examples of national implementation on a target by target basis

In the following section an overall assessment of progress towards each target at global and national level has been made. At the global level, this is shown by a green or



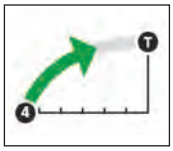


yellow arrow which indicate that progress is either on track to achieve the target (green arrow) or that progress is being made, but not at a sufficient rate to achieve the target by 2020 (yellow arrow). At the national level, progress is represented by a pie chart that shows the percentage of countries that have reported (i) being on track to achieve the target (green): (ii) making progress but not sufficient to achieve the target (yellow): or (iii) making no progress towards the target (red), as reported though 6th national reports to the CBD (see also Figure 1).

Ecological restoration plot in Hong Kong (Kadoorie Farm and Botanic Garden)

TARGET 1: AN ONLINE FLORA OF ALL KNOWN PLANTS

Global progress



A widely accessible Flora of all known plant species, (present estimates indicate that there are around 350,000 species of vascular plants (WCVP, 2020) and 20,000 species of bryophytes (The PlantList, 2013)) is a fundamental requirement for plant conservation and provides a baseline for the achievement and monitoring of other targets of the Strategy. The previous (GSPC 2010) Target 1 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 at the end of 2010, as The Plant List (http://www.theplantlist.org). Drawing from the knowledge gained in producing The Plant List, a project to create an online world Flora of all known plant species was initiated by Missouri Botanical Garden in 2012. A World Flora Online (WFO) Council has since been formed with 42 participating institutions world-wide[2].

The WFO is being developed as an open-access, web-based compendium of the world's plant species. It is 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 known plant groups and plants in unexplored regions.

At the core of the WFO is an updateable Taxonomic Backbone of scientific names and their classification that contains all Effectively Published plant names (as defined in the International Code of Nomenclature for Algae, Fungi and Plants) and differentiates between accepted

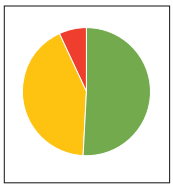
Hibiscadelphus woodii *(Ken Wood)*

names and synonyms. Such a comprehensive global consensus taxonomic hierarchy is fundamental to WFO for organizing the descriptions and images of families, genera and species. The Plant List v1.1 is the default taxonomic backbone for the WFO portal. However, this is being replaced on a family-by-family basis as newer or more widely accepted information becomes available. Updating of the taxonomic backbone will be a continuous process as the understanding of the relationships among plants continues to be refined. The data included in the taxonomic backbone include the taxonomic names (from order to family through sub-species level), accepted names and synonyms, and literature citation of the original description. All names included in the backbone are assigned a globally unique identifier that is related to other existing indices of botanical nomenclature.

A beta version of the website is presently available for searching on-line. This includes 1,325,205 names, 350,634 accepted species, 56,141 images, 437,915 descriptions, 129,179 distributions and 1,382,149 references (WFO, 2020).

The WFO portal is available online at http://www.worldfloraonline.org.

National implementation



At the national level, over half of countries providing a report, report that they are on track to achieve this target. This includes a number of mega-diverse countries, such as China, Colombia, Mexico, Peru and South Africa. Others, such as Brazil, have initiatives in place to ensure this target will be achieved within the next few years.

[2]Allen Herbarium, Landcare Research, New Zealand; Australian Biological Resources Study, Australia; Botanic Garden Meise, Belgium; Botanic Garden and Botanical Museum Berlin-Dahlem, Germany; Botanical Research Institute of Texas, USA; Conservatoire et Jardin Botaniques, Geneva, Switzerland; Core Facility Botanical Garden of the University of Vienna, Austria; Euro+Med Plantbase, Berlin, Germany; European Botanic Gardens Consortium; Flora Iberica Project, Madrid, Spain; Flora Malesiana Foundation, Leiden, Netherlands; Flora of North America Association, US & Canada; Forest Research Institute, Malaysia; Global Biodiversity Information Facility, Denmark; Institute of Botany, Academy of Sciences of the Czech Republic; Institute of Botany, Azerbaijan National Academy of Sciences, Azerbaijan; Institute of Botany, Chinese Academy of Sciences, Beijing, China; Institute of Botany, Slovak Academy of Sciences, Slovakia; Instituto de Botánica Darwinion, Buenos Aires, Argentina; Instituto de Ecología A.C. ;Veracruz, Mexico; Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Brazil; Instituto Nacional de Ciência e Tecnologia (INCT) Virtual Herbarium ;Recife, Brazil; Komarov Institute of Botany, Russian Academy of Sciences, St. Petersburg, Russia; Korea National Arboretum, Pocheon, South Korea; Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, China; Missouri Botanical Garden, St. Louis, USA; Muséum National d'Histoire Naturelle, Paris, France; National Biodiversity Institute (INBio) of Costa Rica; Santo Domingo de Heredia, Costa Rica; National Botanical Research Institute, National Herbarium of Namibia, Namibia; Natural History Museum, London, UK; Naturalis Biodiversity Center, Leiden, Netherlands; Royal Botanic Garden Edinburgh, UK; Royal Botanic Gardens Kew, UK; Smithsonian National Museum of Natural History, Washington DC, USA; South African National Biodiversity Institute, Pretoria, South Africa; Species2000/Catalogue of Life, Leiden, Netherlands; The New York Botanical Garden, NY, USA; the Nezahat Gökyiğit Botanic Garden, Istanbul, Turkey; Botany Department of Trinity College Dublin, Ireland; Tsittsin Main Botanical Garden, Moscow, Russia; UNESCO Chair in Plant Conservation and Biodiversity in Macaronesia and in Western Africa, Gran Canaria, Spain; Universidad Nacional de Colombia, Bogota, Colombia

Box 2: Achieving Target 1 at the national level: The cases of Australia, Brazil, China and Colombia,

Australia: Australia is committed to the development of open and freely accessible botanical and taxonomic data for use by the research sector and plant conservation community. Australia has taken significant steps to digitise data on its known vascular flora. Approximately half of Australia's known flora is captured online with substantial effort over the next decade dedicated to building on the existing information. A range of information sources contribute to these efforts: The Australian Plant Name Index (APNI) is a comprehensive nomenclature for Australia's native and naturalised flowering plants, conifers, ferns, mosses, hornworts and liverworts. The Australian Plant Census (APC) is a nationally agreed view of the current taxonomic classification of the Australian flora derived from evaluation of the published research documented in the Australian Plant Name Index. The Flora of Australia holds around 15,000 plant profiles, representing approximately 50% of the known Australian vascular flora. Missing family, genus and species profiles will be progressively added by Australian Biological Resources Study (ABRS) and the Australian botanical community over the coming decade. The Flora with its enhanced functionality will enable the plant conservation community to search and browse thousands of species, identify plants using interactive keys and export information for use offline (https://profiles.ala.org.au/opus/foa).

Brazil has more than 46,000 species of plants, algae and fungi, representing one of the most biodiverse countries on Earth, and playing a key role in the GSPC. To meet the GSPC goals of Target 1 and facilitate access to plant diversity, Brazil committed to preparing the List of Species of the Brazilian Flora (2008–2015) and the Brazilian Flora 2020 (2016–present), aiming to achieve GSPC Target 1. This project includes provisions to include descriptions, identification keys and illustrations for all species of plants, algae and fungi known in the country. By 2018, the Brazilian Flora 2020 included 121,989 species names and infraspecific categories, of which 90% have been checked by specialists and are available through the home page (http://floradobrasil.jbrj.gov.br). The Brazilian Flora project currently includes 770 Brazilian and foreign taxonomists affiliated to 203 institutions, representing the largest biodiversity research network in Brazil. Most of these specialists are also integrated in the network for Target 2. (The Brazil Flora Group., 2018)

China: The Flora of China (FOC) is available on-line at: www.efloras.org/flora_page.aspx?flora_id=2. The online functionality was greatly enhanced in 2014, with the addition of an Advanced Search function. Over 64,000 synonyms, misapplied names, Chinese names, and pinyin names, and data on elevations, Chinese provinces, and foreign countries are now searchable. Users can generate various databases for their own purposes based on FOC data, e.g., list of species of vascular plants occurring in both China and India, or China and Greece, etc. Since 2014 a full version of the Chinese translation of FOC has been available. This has greatly expanded the readership of FOC.

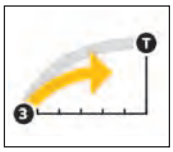
Colombia: On April 15th, 2015, Universidad Nacional de Colombia and its partners launched the most comprehensive checklist ever documented of the plants that occur in the country. The Catalogue of the Plants and Lichens of Colombia includes contributions from 180 botanists working in 20 countries over the last 13 years. For the first time, information about the 1,674 species of lichens and 26,126 plant species that have so far been documented in the country are compiled in one on-line resource. Colombia is one of the countries with the greatest botanical diversity on the planet and this inventory is fundamental to the management and conservation of Colombia's rich natural history. (Bernal *et al.*, 2015).
http://catalogoplantasdecolombia.unal.edu.co

Target 1 – issues to consider

While it is considered that Target 1 will be achieved globally by 2020, and the launch of the WorldFloraOnline website provides evidence of this, it is clear that our knowledge of the world's flora is far from complete. There are still vast regions of the world remaining to be explored, and some 2,000 new vascular plant species are being discovered and named each year. Furthermore, taxonomic revisions lead to many thousands of name changes each year. Efforts will also continue to be needed to digitize many important floristic works from various parts of the world that are currently only available in printed forms, to allow their inclusion in the World Flora Online and other online databases. The need to be able to track species through time, identify synonyms and accommodate alternative taxonomic views are all challenges that will continue and will need to be addressed in the future. Plant identification is a particular concern, with implications for the achievement of all the other species-based targets of the GSPC. Accurate identification of species is necessary for Red List assessments, targeted conservation programmes and monitoring sustainable use and trade.

TARGET 2: AN ASSESSMENT OF THE CONSERVATION STATUS OF ALL KNOWN PLANT SPECIES, AS FAR AS POSSIBLE, TO GUIDE CONSERVATION ACTION

Global progress



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.

The IUCN Red List™ presently includes assessments for 40,468 plant species, of which 16,620 (41%) are considered to be threatened with extinction or extinct (IUCN, 2020). This means that global conservation assessments are available for little more than 10% of known plant species. The sample of plants for which conservation assessments are available is not only small, but also skewed, notably because assessors tend to select species that are likely to be at risk of extinction. A solution to a potential bias towards species at high risk taken by RBG Kew, was to select a suitably large, random selection of plant species and assess their extinction risk. This representative view has revealed that one in five plant species are estimated to be in the top three 'threatened' categories of Critically Endangered, Endangered or Vulnerable. Further assessments of the sample in future years will establish an overall trend in the extinction risk index for plants (RBG Kew, 2016).

To help address the gap in conservation assessments for plants, IUCN is pursuing a range of assessment projects and engaging with national Red List efforts. Examples include:

- The Plants for People initiative focuses on assessing at least 1,500 priority plant species in each of the following groups: crop wild relatives; medicinal plants; timber trees; and palms (www.iucn.org/theme/species/our-work/iucn-red-list-threatened-species/plants-people).

- The Global Tree Assessment aims to assess the conservation status of every known tree species by the year 2020 (see Box 2).

To further address the gap in global conservation assessments for plants, Botanic Gardens Conservation International (BGCI), together with partners from the National Red List and the Royal Botanic Gardens, Kew, have assembled all currently available digital conservation assessments, including data from IUCN, into a single list of conservation assessments for plants. This list was launched in 2017 and is available on-line as the ThreatSearch database (www.bgci.org/threat_search.php). It presently includes over 340,000 assessments representing more than 180,000 taxa and is the most comprehensive database of conservation assessments for plants. ThreatSearch lists global, regional and national red list assessments for plants derived from a variety of sources and systems and includes global assessments for some 90,000 species. The results to date show that one third of the species that have been assessed are threatened at some level (Figure 4).

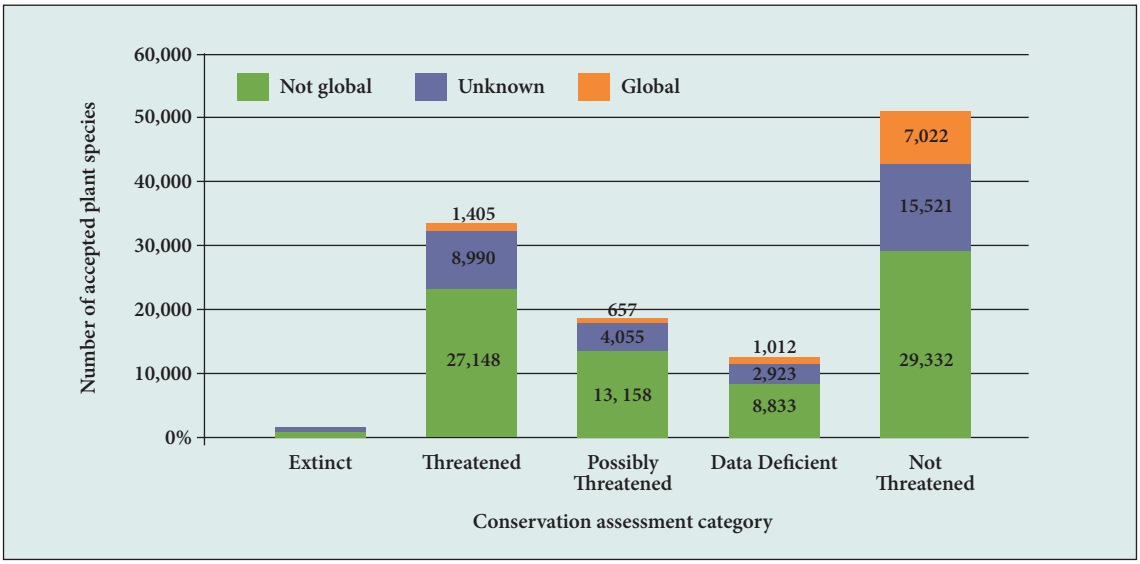


Figure 4. Breakdown of accepted plant species by threat category (extinct, threatened, possibly threatened, data deficient, and not threatened) and counts of species further split by geographical scale of assessment (global, unknown, not global). Data for the extinct category were too few to be clearly labelled on the graph (global, 460 species; unknown, 666; not global, 25). (Bachman et al., 2018)

Box 3: Global Tree Assessment

The Global Tree Assessment is an initiative led by BGCI and the IUCN/SSC Global Tree Specialist Group. It aims to provide conservation assessments of all the world's tree species by 2020. The goal of the Global Tree Assessment is to provide prioritization information to ensure that conservation efforts are directed at the right species so that no tree species becomes extinct.

The latest analysis (17/04/2020) shows that 58% of all 60,008 tree species have a conservation assessment. Around 46% of the already assessed trees are assessed as threatened to some level and 38% of all assessed trees are threatened globally. This means that at least 22% of all tree species are threatened with extinction globally.

Work is ongoing to develop an even more extensive global collaborative partnership, involving the coordinated effort of many institutions and individuals. These steps will enable the Global Tree Assessment to achieve its 2020 target.

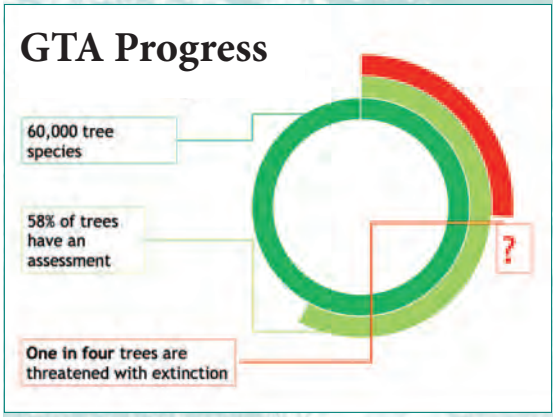
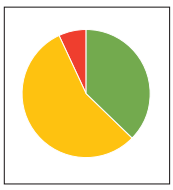


Figure 5: Progress with the Global Tree Assessment. https://www.globaltreeassessment.org/progress/ Rivers, 2020.

National implementation



Good progress with Red List conservation assessments is being made at the national level, in some cases using nationally developed instruments for assessing extinction risk (Mounce *et al.*, 2017a). For example, in Australia, a Common Assessment Method has been developed to reduce confusion and duplication of effort as state and territory governments have different legislative frameworks for the assessment and listing of threatened species. Using the Common Assessment Method, participating jurisdictions will work together to ensure that species are assessed and, where warranted, listed in only one 'nationally threatened' category, which is reflected on each of the relevant jurisdictional lists.

A unique South-South partnership involving South Africa, Brazil and Colombia has been established to share experiences and accelerate progress in Red List assessments in mega-diverse countries using the IUCN Red List™ Categories and Criteria. This has resulted in the publication of the Brazilian Red Data book – a significant contribution to the achievement of Target 2. South Africa and China, two mega-diverse countries, have already assessed the conservation status of all their floras, a huge accomplishment.

Box 4: IUCN Red Listing of Australian Eucalypts

A comprehensive review of the conservation status of Australian eucalypts (*Eucalyptus*, *Corymbia* and *Angophora*), including individual assessments of all 822 Australian species was completed in 2020. Assessments were undertaken against the IUCN Red List criteria and have been included in the global IUCN Red List of Threatened Species. Overall, 193 (23%) eucalypts qualified as threatened and 36 were considered Data Deficient. Habitat conversion to crops and pastures was the cause of decline for most threatened eucalypts. These assessments form the most comprehensive assessment of an Australian genus ever undertaken using the IUCN Criteria and will improve knowledge of the status of Australia's eucalypts including population trends, distribution and threats. The outcomes of this project will support threatened species conservation at the national level by informing future Environment Protection and Biodiversity Conservation Act (1999) listing assessments and recommended recovery actions.

Fensham *et al.*, 2020


Ian Harvey-Brown

Target 2: issues to consider

Based on an analysis of ThreatSearch data, Bachman *et al*. (2018) have concluded that between 33.1% and 39.7% of threatened plant species have already been identified in digitally available red lists. We can therefore expect to identify at least 50% of the expected globally threatened plant species by 2020 if:

- attention is given to making digitally available, those assessments of conservation status currently only available in paper form (mostly books);
- the Global Tree Assessment is successful in its target of assessing all 60,000 tree species by 2020; and
- IUCN fulfils its pledge to conclude the assessment of 38,500 plant species, hopefully prioritizing under assessed families and regions,

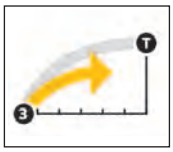
Given that conservation assessments form the baseline of knowledge for identifying and prioritising threatened species, it is essential that work towards this target continues to be given priority beyond 2020. Information from Red List assessments is critical in supporting decision making about land use planning and natural resource management. While the IUCN Red List™ Categories and Criteria provide a robust framework for this endeavour, since the proportion of plants assessed globally is still low, this approach will need to be complemented by drawing upon a wider range of assessments at national, regional and global levels.

Box 5: The need for tree red listing in Madagascar

In Madagascar, illegal logging of rosewood and ebony has been identified as a major problem by the Malagasy Government and the conservation community. Despite this, little information is available on the status or sustainability of these resources. Comprehensive and objective species assessments provide information to support sustainable forest management, strengthened national park protection, regulation of international trade in forest products, biodiversity funding decisions, ecological restoration, mitigation strategies and livelihoods development. The current lack of comprehensive conservation assessments for trees seriously compromises conservation and sustainable management of the island's natural resources at a time of urgent and growing need. In addition, further work on discovering, naming and describing many important but rare trees in Madagascar must continue, as conservation assessments need to be undertaken on species that have been documented by science. Political and economic decision-makers do not have complete and representative data for prioritising and agreeing conservation and sustainable use action, and conservation practitioners are unable to concentrate their efforts accordingly. Through the Global Tree Assessment, efforts are focused on ensuring there is a conservation assessment completed for all of its known 3,300 tree species by 2020.

TARGET 3: INFORMATION, RESEARCH AND ASSOCIATED OUTPUTS AND METHODS NECESSARY TO IMPLEMENT THE STRATEGY DEVELOPED AND SHARED

Global progress

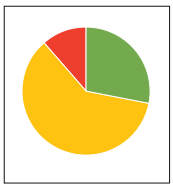


Plant conservation research, methodologies and practical techniques are fundamental to the conservation of plant diversity. While many methodologies have been developed and much relevant information generated over the past few decades, much of this lies in unpublished reports and manuscripts, not easily 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 (www.plants2020.net).

A range of other tools and resources and case studies are being developed by plant conservation practitioners around the world. For example, BGCI and partners are developing e-learning modules and Directories of Expertise in areas such as seed conservation, ecological restoration, conservation of 'exceptional' species etc. to facilitate capacity building and access to relevant expertise to support conservation activities. However, greater efforts are still needed to make information available in appropriate formats and languages, as and where they are needed.

National implementation



The majority of countries reporting on this target felt that progress is being made, but not at a sufficient rate to achieve the target by 2020. Areas that have been identified as requiring further research attention include seed storage behaviour for many species, the development of *ex situ* conservation for species that cannot be stored as seed (exceptional species) and conservation genetics

A few examples of national and regional activities that contribute to this target are provided below. Many more examples are available on the GSPC toolkit.

Collection of wild propagation material in Greece by the Balkan Botanic Garden, Kroussia (BBGK archives)

Box 6: A toolkit for crop wild relative conservation planning

An interactive toolkit, has been developed by Bioversity International and the University of Birmingham, UK, to guide national programmes on planning the conservation of crop wild relatives. The toolkit covers all the steps involved in conservation planning for crop wild relatives, and facilitates systematic thinking on the processes required for countries, organizations and projects to develop a strategy. The toolkit contains 13 modules, each corresponding to a different step in the conservation planning process. Every module consists of an introduction, methodology inclusive of an interactive flowchart, case studies demonstrating researchers' experiences, references, and additional helpful resources. The toolkit can be accessed at: www.cropwildrelatives.org/conservation-toolkit/

- **Canada: The species at risk public registry**. This registry provides information about species at risk, including species profiles, status reports, assessments, recovery status and related documents.

- **Central Asia:** A consortium of Central Asian countries that participate in a regional project is studying the flora of the Western Tien Shan, supported by the Korean Forest Service. This has contributed to the exchange of research results between countries, the development of scientific publications on rare and endemic plant species and the flora of key areas of Western Tian-Shan. In addition, the research results serve as a scientific basis for developing plans for the conservation and sustainable management of plant genetic resources and provide a basis to adopt practical measures for the restoration and rational use of various ecosystems.

- **UK:** The Royal Botanic Garden Edinburgh has developed a series of plant guides for **Nepal**. These provide scientifically accurate information – based on the authoritative knowledge of plants in the Flora of Nepal – via user-friendly, bilingual, pictorial guides for use by anyone, from villagers in remote communities to high-level decision-makers in Government, incorporating local plant names for effective communication, identification tools, and details of economic importance. These guides support livelihoods and sustainable development, enabling local communities to make informed livelihood choices and have raised awareness on the threats of invasive plants to biodiversity and the value of healthy forests in sustaining livelihoods.

- In **China**, Universities, institutes, botanical gardens, herbaria, nature reserves and other institutions have strengthened the sharing of information on plant protection and utilization, and constructed digital network platforms. For example, there were 10,200,000 items on plant diversity in the Baidu search engine in March 2018.

- An updated Botanical Society of **Britain and Ireland** Atlas of the flora is due in 2020. This aims to provide maps for both native and introduced taxa, interactive maps to display frequency and distribution at various scales and an analysis of change summarising the state of the Irish flora in 2020. https://bsbi.org/atlas-2020.

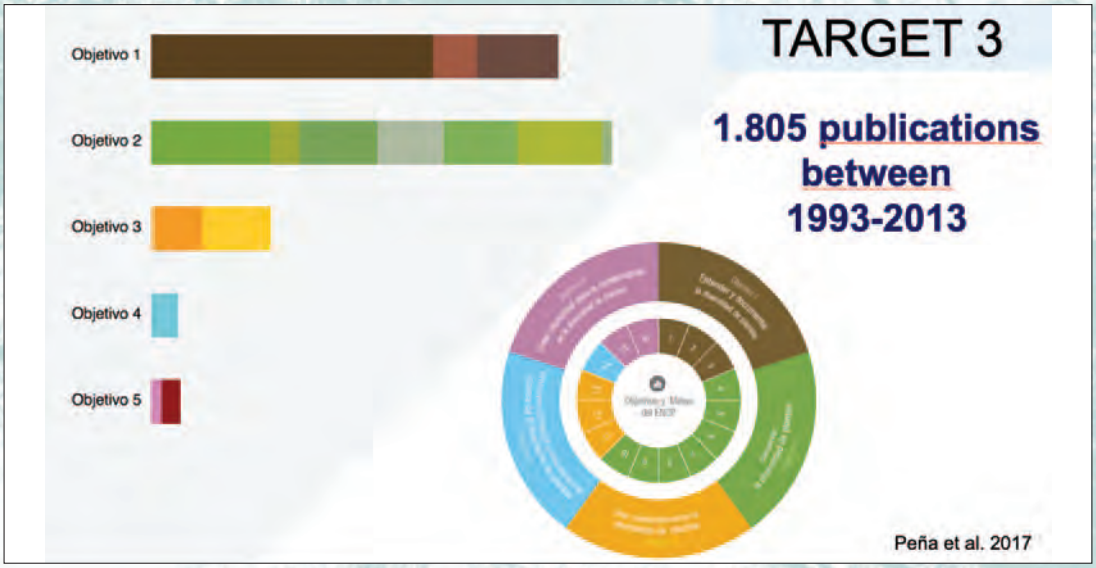
- The **Scottish** Code for Conservation Translocations has been produced by the National Species Reintroduction Forum. The Code sets out when conservation translocations may be appropriate and the types of situation in which they may cause problems to wildlife, people, and the environment. The Code is available at www.snh.gov.uk/translocation-code

- **RBG Kew** has published a book on Traditional Chinese Medicine, this is an important reference collection and identification guide for orchids and other medicinal plants globally.


Chester Zoo

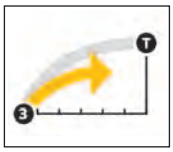
Box 7: Implementing Target 3 in Colombia

In Colombia, 1,805 publications were produced between 1993 – 2013 relating to the implementation of Colombia's Plant Conservation Strategy. These mainly related to Objectives 1 and 2 of the Strategy, but also covered Objectives 3, 4 and 5:



TARGET 4: AT LEAST 15 PER CENT OF EACH ECOLOGICAL REGION OR VEGETATION TYPE SECURED THROUGH EFFECTIVE MANAGEMENT AND/OR RESTORATION

Global progress



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 Biodiversity Targets 11 and 15.

While it is challenging for botanists and plant conservationists to implement the GSPC's ecosystem targets, especially Targets 4 and 6, there are areas, particularly related to ecological restoration, where botanical and horticultural expertise is especially 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. 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 (www.erabg.org/).

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. An example is the Australian National Botanic Gardens, which has embarked on a pioneering project in partnership with Greening Australia and the Centre for Australian National Biodiversity Research. The project aims to establish 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.

Members of the GPPC are also contributing scientifically to support recent large-scale ecosystem restoration efforts including the African Forest Landscape Restoration Initiative (AFR100) Initiative and the Great Green Wall across the African Sahel – see Box 8.

The AFR100 is a country-led effort to bring 100 million hectares of land in Africa into restoration by 2030. Currently 113% of the overall goal has been formally committed by 28 African countries (see http://www.afr100.org/).

Despite the fact that many African countries have made large commitments to AFR100, there are currently limited indigenous seeds available in national tree seed centres, limited indigenous seedlings available in nurseries and limited knowledge on how to propagate indigenous species. Members of the Ecological Restoration Alliance of Botanic Gardens (ERA) in East Africa are setting up forest restoration demonstration sites that test indigenous species performance and show that restoration results can be achieved quickly with indigenous species. They are also developing propagation protocols for indigenous species to make it easier for government, NGOs and other AFR100 implementing partners to incorporate a wider number of indigenous tree species in restoration projects.

Box 8: RBG Kew and the Great Green Wall cross-border pilot project (Burkina Faso, Mali and Niger)

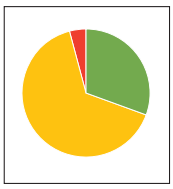
Kew's Great Green Wall cross-border pilot project aims to gather environmental and social data on land restoration to help inform larger restoration projects in the Sahara and Sahel region. As part of a larger initiative to transform 8,000km of desert land across Africa (https://www.greatgreenwall.org/about-great-green-wall), Kew is coordinating a cross border pilot project across Burkina Faso, Mali and Niger. The project aims to build a model for the restoration of large-scale agrosylvopastoral systems throughout the Sahel region. The approach taken combines the reintroduction of native trees and shrubs in a restoration framework which includes the economic and ecological rehabilitation of traditional agroforestry systems. Amongst other outputs, the project, in consultation with local communities, has developed a list of 193 useful species. Of these 55 woody and herbaceous species have been selected and propagated at community level, with over 1 million seedlings being propagated across the three countries. https://www.kew.org/science/our-science/projects/great-green-wall-cross-border-pilot-project.

Box 9: 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 incorporates more than 500 woody plants from East Africa and 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.

Brackenhurst has become a training centre for NGOs, botanic gardens and other organisations from across East Africa involved in forest restoration and has collaborated with Tooro Botanic Garden in Uganda, in the restoration of two Local Forest Reserves and one Central Forest Reserve in the Fort Portal District.

National implementation



At the national level, only two countries have reported no progress towards this target. This presumably reflects the progress that has been made by most countries in establishing protected areas. However, it is not clear to what extent different ecological regions or vegetation types are protected and the level of restoration that is on-going.

Box 10: Ecosystem restoration in Mexico

Under Objective 3 of the Mexican Strategy for Plant Conservation, Action 3.2.1 is to *Expand and strengthen the actions of rehabilitation and restoration of ecosystems under some process of degradation.* In November 2014, the first Mexican Symposium on Restoration was held. This attracted 316 participants from 43 institutions and resulted in a publication of Mexican experiences on ecosystem restoration. This publication provides information on projects which have been carried out in nine Mexican ecosystems located in 13 states, at a great variety of scales, deadlines and levels of intervention, using a range of social, experimental and practical approaches. It also resulted in the development of a protocol to evaluate restoration projects and served as an input to the development of a National Restoration Plan.

Box 11: Végétal local - Planting locally to promote biodiversity in France

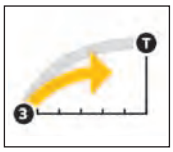
The brand 'Végétal local' was created in 2015, supported by the Federation of National Botanical Conservatories, and the AFAC (Agroforesterie and Plante & Cité). Since 2017, it has become a brand of the French Office for Biodiversity. It guarantees the geographical origin of plants and seeds (trees, shrubs and herbaceous plants), and using these local plant species during ecological restoration or landscaping projects helps to ensure the success of their ecological integration (interaction with wildlife, resistance to diseases and insect pests, etc.).

Nurseries wishing to benefit from this brand must harvest seeds or take cuttings from local species in their natural environments, where no planting has previously been carried out. The plants and seeds resulting from these harvests can be sold, after validation by the brand committee, by biogeographical regions. In metropolitan France, there are currently 11 such regions.

http://www.fcbn.fr/vegetal-local-vraies-messicoles

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

Global progress



An important plant area (IPA) 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.
Plantlife International has been instrumental in developing Guidelines to support the identification of IPAs and maintains an on-line database of IPA sites and projects. (https://www.plantlife.org.uk/international/important-plant-areas-international). IPAs have now been identified across large sections of Europe, Africa and the Middle East with 1,994 IPAs in 27 countries identified and documented to date (Figure 6).

In partnership with the Royal Botanic Gardens, Kew (RBG Kew), a Tropical Important Plant Areas (TIPAs) programme was launched in 2015 and revised criteria to identify IPAs were published in 2017. (Darbyshire *et al*., 2017). The criteria are based around a sound, scientific, global framework which acknowledges the practical problems of gathering plant and habitat data in many regions of the world, and recognises the role of peer reviewed expert opinion in the selection process. They can be applied to the conservation of all organism groups within the plant and fungal kingdoms and can work alongside the Key Biodiversity Areas Standard published by IUCN (IUCN, 2016).

RBG Kew has a target of carrying out IPA assessments with national partners in 7 Tropical Regions between 2015 and 2020 (Cameroon, Guinea, Mozambique, Uganda, Bolivia, the UK Overseas Territories in the Caribbean and West Papua). By 2020, the first phase of TIPA analysis will have been completed in these countries. This includes delimitation and mapping, with information on the component species available through the Plants of the World Online Portal. Information from this output will feed directly into conservation prioritisation for delivery of on-the-ground conservation actions by the project partners. As an example of this, the TIPA work in Guinea has resulted in the conservation status of over 170 species being assessed for the IUCN Red List™. These assessments have contributed to the designation of 22 new TIPAs and there is now Ministerial commitment to include these new TIPAs in the protected area network in Guinea. Similarly, parallel work on tree red listing in Madagascar is helping to generate the necessary data to support the conservation of Key Biodiversity Areas, many of which presently lack the basic knowledge to justify their status as KBAs.

With respect to KBAs, 1,644 such sites in 106 countries have been identified for 2,378 plant species of conservation concern. Of these, just 16% are completely covered by protected areas, and almost half (47%) are entirely outside protected areas. On average, 37% of each KBA identified for plants is covered by protected areas.

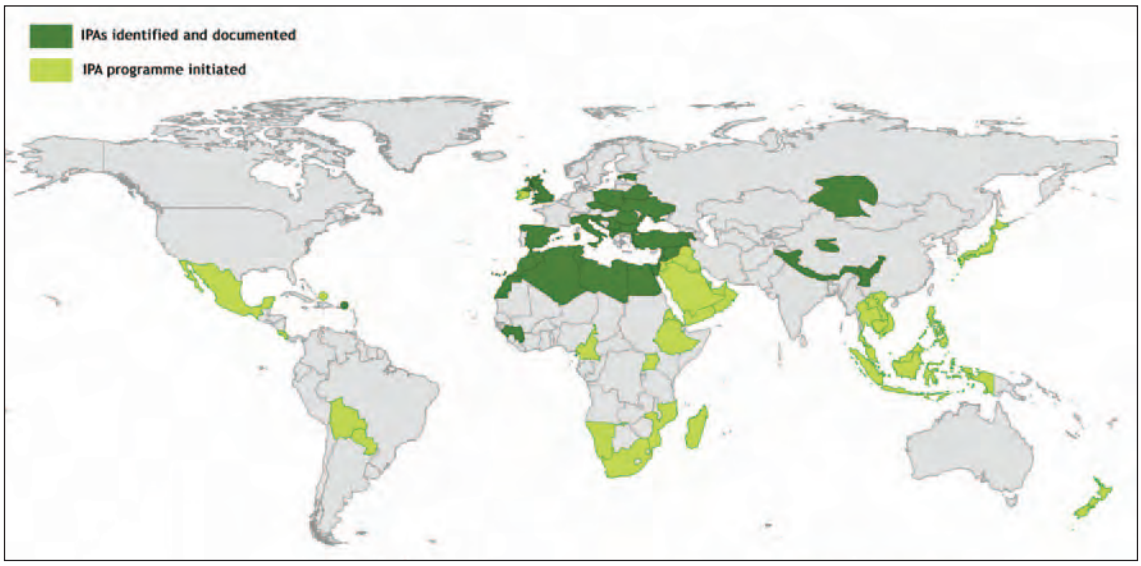
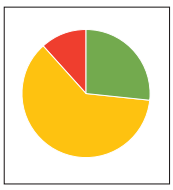


Figure 6: The Global IPA programme and partners

National implementation



In some countries, IPA networks have been integrated into national conservation planning and monitoring schemes. For example, in Belarus all IPAs are now protected by law, in Romania, IPAs have led to the recognition and protection of new critical habitats, whilst in Croatia many IPAs were included in the expanded protected area network under the Natura 2000 scheme as part of their accession to the European Union in 2013.

Important Bryophyte Areas in Ireland (Lockhart *et al.*, 2012) have been identified using a combination of PlantLife, Stewart (2004) and Green & Fitzpatrick (2008) approaches to identify 47 important bryophyte areas. Most of the areas identified were large and contained a mix of both protected and unprotected sites. 19 of the identified Important Bryophyte Areas (~40 %) are found within fully protected sites.

Box 12: 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. 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.

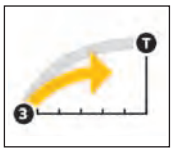
Box 13: Conserving plants of the Arabian Peninsula

RBG Edinburgh, through the Centre for Middle Eastern Plants (CEMP), has been working with local partners to ensure the conservation of plants in the Arabian Peninsula. As well as completing conservation assessments for more than 95% of the c. 850 endemic plant taxa of the Arabian Peninsula, criteria for IPA selection in Arabia have been developed with the IUCN Arabian Plant Specialist Group. Criteria for the Arabian region specifically include relict species and refugia for connectivity and climate change mitigation. They also target traditional protected areas (himas in Saudi Arabia, hamiyah in Oman) for inclusion in the network. Over 100 provisional IPA sites have been identified in Saudi Arabia, Oman & Yemen. This includes 43 sites identified in Oman as part of a project to systematically identify a network of priority sites for conservation: these are being integrated into the country's National Spatial Strategy. Similarly, 46 IPAs have been tentatively identified in Saudi Arabia, of which four have been fully assessed with assessments published, and 12-14 have been partially assessed and confirmed. CMEP continues to work with project partners in surveying and producing final assessments of these sites as IPAs.

Critically Endangered Overberg Sandstone Fynbos (R. Blackhall-Miles and B.Ram).

TARGET 6: AT LEAST 75% OF PRODUCTION LAND IN EACH SECTOR MANAGED SUSTAINABLY, CONSISTENT WITH THE CONSERVATION OF PLANT DIVERSITY

Global progress



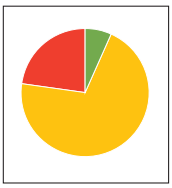
Land in production covers a substantial proportion (around one third) of the earth's land surface. Increasingly, sustainable production methods are being applied in agriculture, including organic production, integrated pest management, conservation agriculture and on-farm management of plant genetic 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 Biodiversity Target 7 and the work of the UN's Food and Agriculture Organisation (FAO). At the 2016 Conference of the Parties to the CBD, a platform on biodiversity and agricultural sectors was launched by FAO for governments, communities of practice and other stakeholders to build bridges between sectors, identify synergies, align goals and develop integrated cross-sectoral approaches to mainstreaming biodiversity in the agriculture, forestry and fisheries sectors. (CBD 2016b).

Box 14: One Planet Business for Biodiversity (OP2B))

This new initiative is a unique international cross-sectorial, action-oriented business coalition on biodiversity with a specific focus on agriculture, launched at the United Nations Climate Action Summit in New York on 23 September 2019. The coalition aims to drive transformational systemic change and catalyse action to protect and restore cultivated and natural biodiversity within the value chains. Actions are focused around three pillars: scaling up regenerative agricultural practices; boosting cultivated biodiversity and diets through product portfolios; and eliminating deforestation / enhancing the management, restoration and protection high-value natural ecosystems. The coalition currently consists of nineteen companies. Over the past months, these companies have analysed their value chains to identify the most impactful levers to protect and nurture biodiversity.

https://op2b.org/

National implementation



Only three countries reported good progress towards this target, and many noted that activities related to this target fall under Ministries of Agriculture rather than Environment. Information and data for reporting purposes were therefore less available. Significant progress has however been made in South Africa in engaging with the productive sector – see Box 15.

Box 15: Working with the productive sector in South Africa

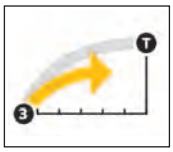
Working with the production sector through mainstreaming projects is a major focus of biodiversity conservation work in South Africa. Agriculture, specifically crop cultivation, is the most severe threat to plant diversity in South Africa threatening over 1,400 plant species. Much work has been done since 2004 to work within the agricultural sector with Biodiversity and Business Initiatives (BBIs) set up for wine, potatoes, rooibos tea, sugar, indigenous cut flowers and fruit producers. Overgrazing by livestock also poses a significant threat to plant diversity and a number of non-governmental organisations (NGOs) and biome-based mainstreaming projects have worked on initiatives with the red meat industry.

All of these agriculture-based initiatives involve developing and implementing best-practice farming guidelines to minimise the impact of farming on biodiversity, as well as providing training on a range of land management techniques. Within several of these initiatives, and driven by the broader conservation sector, incentives are provided to farm owners of high biodiversity land to formally conserve land via biodiversity stewardship programmes.

http://biodiversityadvisor.sanbi.org/planning-and-assessment/plant-conservation-strategy/target-6/

TARGET 7: AT LEAST 75 PER CENT OF KNOWN THREATENED PLANT SPECIES CONSERVED *IN SITU*

Global progress



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. *In situ* conservation is also important for those plants which have recalcitrant seeds (seeds which cannot be dried and stored at low temperatures) – such as many species from the humid tropics – and for which *ex situ* conservation is expensive and difficult (Teixido *et al.*, 2017).

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 difficult to measure.

However, rapid progress in the Global Tree Assessment (GTA) (see Target 2) has resulted in the collection of a significant amount of data related to the world's tree species. Location information (point data) of plants in the wild is essential to support threat assessments and through the GTA a dataset of tree species distribution data has been developed. A recent analysis has compared the distribution of 48,486 tree species with protected area sites, using information from the World Database of Protected Areas. This analysis has shown that 79% of all analysed tree species have at least one point in a protected area. Of the species analysed, 11,003 are threatened either nationally or globally, and of these, 71% can be found in at least one protected area. Of the 9,011 globally threatened species in the data set, 67% can be found in at least one protected area (Figure 7).

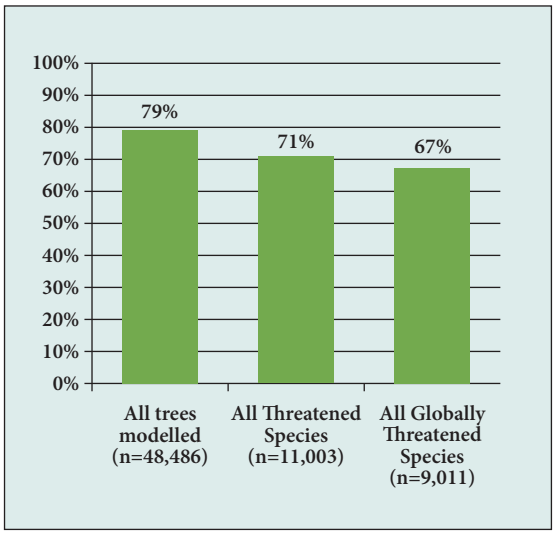
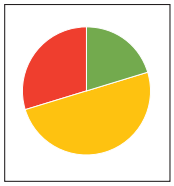


Figure 7: The percentage of tree species found in protected areas (unpublished data BGCI/UNEP_WCMC).

Further analysis of the data shows that, on average, each species is found in 20 protected areas and 31% of the points for each species occur in a protected area. However, for threatened species, 49% are found in 5 or fewer protected areas, and 9% (2,070 species) are found in only one protected area. Of the globally threatened species, 21% are found in only one protected area.

While trees make up less than 20% of all know plant species, and forested areas might be more likely to be protected than other vegetation types, the information that 71% of threatened tree species and 67% of globally threatened species are protected in some way, gives an indication of global progress towards this target.

National implementation



At the national level, a number of countries have reported little progress towards this target. However, some countries where progress towards Target 2 is more advanced, have reported good progress with this target as well. China for example reports that 90% of its threatened species are conserved *in situ* while in Australia, 92% of the country's nationally listed threatened plant species are known or likely to occur in one or more of Australia's existing or interim protected areas. This target is challenging for countries with a great diversity of plant species. Malaysia for example has reported that the current protected area system is insufficient to conserve all its threatened species, and only 21% of the Critically Endangered and Endangered Dipterocarpaceae are conserved in protected areas.

The approach taken by South Africa provides an interesting case study of how a mega-diverse country can address this target and expect to achieve it by 2020 (see Box 16).

Box 16: Implementing Target 7 in South Africa

Since 2005, the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP) has worked towards getting accurate distribution data for known locations of threatened species. Over 57,000 herbarium records have been encoded and georeferenced and a network of volunteers has been monitoring populations of threatened plants in the field as part of the Custodians of Rare and Endangered Wildflowers (CREW) programme (www.sanbi.org). Other threatened plant data sources, come from national and provincial conservation authorities, regional herbaria, and atlas and citizen science programmes are also included. Accurate distribution data is therefore available for all 2,842 threatened plant species (75,000 occurrence records from 43 sources). Mapping the location of threatened species against protected areas has shown that 67% of threatened plants are protected *in situ* through the protected area programme. Priority sites for the protection of unprotected threatened plants have also been identified and these sites are being targeted for protected area expansion. Between 2013 and 2018, 16 priority sites have been secured for conservation. Since 2008, 66 previously unprotected threatened species are now protected. As part of this process, important plant areas have been identified and these are being used in land use decision making.

Box 17. Community based *in situ* conservation in Madagascar

Missouri Botanical Garden (MBG) has been supporting plant conservation in Madagascar for many years. During this time, it has developed strong links with local communities to support conservation in 13 sites across the country. These sites cover a wide diversity of ecosystems and together protect over 570,000 hectares and 3,500 species (nearly 25% of Madagascar's entire flora). 52 species are known from only 1 or 2 of these sites and 402 species are known from no more than 5 sites. Through working with local communities, approximately 30,000 people from over 40 local communities are now engaged in conserving these species and habitats. Success has been achieved by MBG's novel approach, which includes having a permanent site-based team; supporting local community leadership and ownership of the land; developing a shared, coherent vision for the sites; defining actions through participatory research; building trust with the local communities and other stakeholders; and, importantly, through entrepreneurial, incentive-based methods, investing in improving local livelihoods.

Suzanne Sharrock

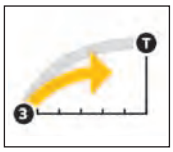
Target 7 – issues to consider

Target 7 is one of the most important targets for preventing plant species extinctions, but 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.

Progress towards this target, as with Target 8, is closely linked with progress in Target 2 (conservation assessments). Lack of progress towards Target 2 constrains progress towards this target.

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

Global progress



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 (both living collections and seedbanks), as recorded in BGCI's PlantSearch database (www.bgci.org/plant_search.php), consist of well over 100,000 species equating to around 30% of all known plants. A recent study (Mounce *et al.*, 2017b) revealed that botanic garden collections include some 41% of known threatened plant species,

The analysis of the combined global botanic garden plant collections did however show that they are disproportionately temperate, with 93% of species held in the Northern Hemisphere. Consequently, an estimated 76% of species absent from living collections are tropical in origin. Furthermore, phylogenetic bias has resulted in over 50% of vascular genera, but barely 5% of non-vascular genera, being conserved *ex situ*. (Figure. 8: Mounce *et al.*, 2017b).

Multiple accessions of threatened species across the network will buffer against loss of threatened species, and provide genetic diversity for ecological restoration efforts. However, 11% of globally threatened species are currently held in just one institution. Furthermore, over half of endemic threatened species are not held *ex situ* within their country of origin, implying reduced availability for ecological or species restoration.

Across the plant kingdom, only gymnosperms meet the target threshold, with 89% of threatened species being held *ex situ*. As noted by Mounce *et al.*, (2017b) gymnosperms are a successful *ex situ* conservation story:

- they are the least speciose of the major plant lineages, rendering the percentage-based GSPC Target 8 more feasible;
- there is a specific international conifer conservation programme;
- like most botanic gardens, they are broadly temperate;
- they have horticultural value as evergreen collections.

In stark contrast, the bryophytes, which have the poorest overall conservation assessment rate of 12.2%, are similarly impoverished with respect to *ex situ* conservation, such that only 2.6% of threatened bryophytes are documented in the botanic garden network.

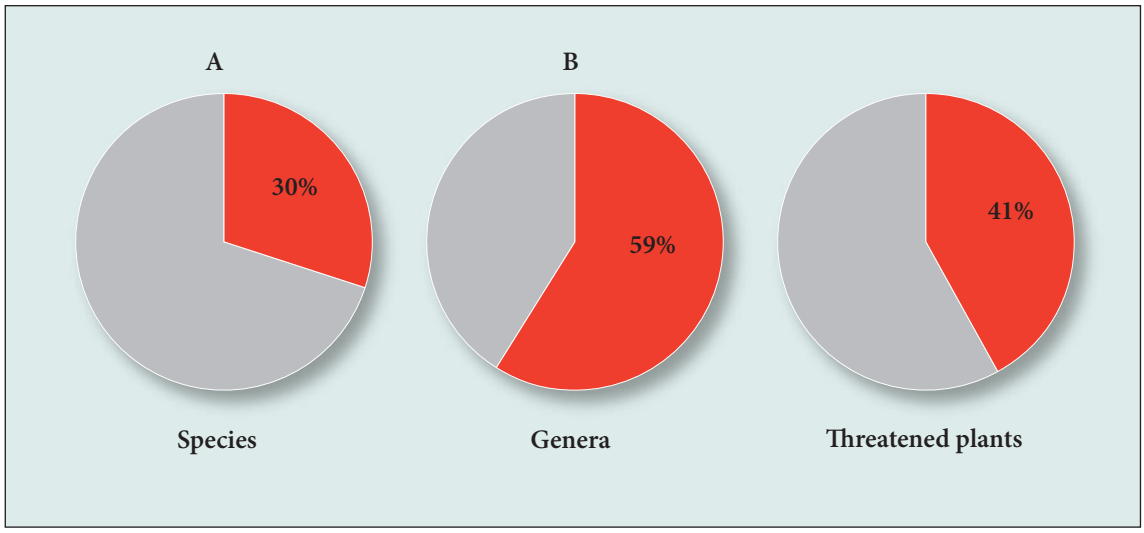


Figure 8: Percentage of species, genera and threatened plants held in the world's botanic garden collections

Surveys of *ex situ* collections of a range of other plant families show variable progress in achieving the 75% target – see Table 3:

Plant group	Threatened taxa in *ex situ* collections
Oaks	47%
Maples	61%
Zelkova	100%
Rhododendron	72%
Conifers	81%
Betulaceae	75%
"Theatened trees"	26%
Ebonies	25%
Magnolias	45%
Orchids	38%
Theaceae	51%
Fraxinus	91%
European Trees	81%

Table 3: Percentage of threatened taxa in ex situ *collections for a range of plant taxonomic groups. Pale green bars indicate those with 75% or more conserved. (BGCI: https://www.bgci.org/our-work/plant-conservation/conservation-prioritisation/ex-situ-surveys/).*

Box 18: The Millennium Seed Bank Partnership (MSBP)

Part of the Royal Botanic Gardens, Kew in the UK, this is the largest and most diverse wild plant species seedbank in the world, working in partnership with a global network across more than 80 countries. Thanks to the efforts of the MSBP, in 2009 Britain became the first country in the world to have preserved its botanical heritage, with seeds from all the UK's bankable native plant species stored at the MSB. With a target to store, across the partnership, 25% of the bankable species by 2020, the MSBP presently holds more than 92,500 seed collections in the bank; representing over 40,000 species, from almost 5,800 genera and more than 360 families. That is at least one collection each of around 12.5% of those seed-bearing species estimated to have orthodox, bankable seeds (https://www.kew.org/wakehurst/whats-at-wakehurst/millennium-seed-bank).

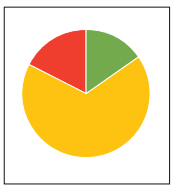
While the focus of conservation work by botanic gardens in the past has been through their living collections, there is increasing recognition that such collections do not include sufficient intra-specific genetic diversity and are therefore of limited use in restoration work. A growing number of botanic gardens are therefore now establishing seed banks to support their conservation work. Properly curated seed banks allow large quantities of seed to be maintained in a small space over a long period of time. This allows greater intra-specific diversity to be collected and made available to support restoration and reintroduction projects. Over 370 botanical institutions in 74 countries around the world now collect and bank seed of wild species (O'Donnell and Sharrock, 2017) and BGCI has established the Global Seed Conservation Challenge to promote and support seed banks in botanic gardens. (www.bgci.org/plant-conservation/seed conservation/). Notable examples of botanic garden seed banks are the Millennium Seed Bank Partnership (MSBP) of the Royal Botanic Gardens, Kew, in the UK (see Box 18), and the Germplasm Bank of Wild Species (GBOWS) in China.

On a geographic basis, oceanic islands harbour disproportionally large numbers of endemic species, many of which are under significant threat of extinction. In a survey carried out in 2010, it was estimated that between 3,500 and 6,800 of the estimated 70,000 insular endemic plant species worldwide might be highly threatened (CR+EN) and between 2,000 and 2,800 of them in critical danger of extinction (CR) (Caujapé-Castells *et al*., 2010). While there has been no systematic survey to assess how many of these threatened species are conserved in *ex situ* conservation programmes, increasing efforts to conserve and seed-bank such species are on-going in a number of island communities, including Hawaii, Mauritius, and the Azores. For example, in Hawaii, extensive work has been undertaken in recent years and 95% of all 724 species of conservation concern are now protected *ex situ* (75% in seed banks, 10% in tissue culture, 10% in living collections).

At the European level, a consortium of native seed banks (ENSCONET)[3] has been established and a recent review indicated that 62.7% of European threatened species are conserved *ex situ* in seed banks. However, the review also noted that the infraspecific diversity of threatened species stored in ENSCONET seed banks needs to be increased to meet research and conservation objectives. A priority setting exercise has been completed to ensure that Target 8 is achieved across Europe by 2020 (Rivière *et al*, 2018).

[3]ENSCONET members: Royal Botanic Gardens, Kew (UK), National and Kapodistrian University, Athens (Greece), Institute of Botany, Slovak Academy of Sciences, Bratislava (Slovakia), Budapest Zoo & Botanical Garden (Hungary), Mediterranean Agronoic Institute Chania (Crete), IMGEMA - Jardín Botánico de Córdoba (Spain), Trinity College Dublin (Ireland), Jardín Botánico Viera y Clavijo Gran Canaria (Spain), Agricultural Research Institute (Cyprus), Universidad Politécnica de Madrid (Spain), National Botanic Garden (Belgium), Museum National d'Histoire Naturelle Paris (France), Università di Pavia/Centro Flora Autoctona della Lombardia (Italy), Università di Pisa, Orto Botanico (Italy), Jardí Botànic de Soller (Spain), Museo Tridentino di Scienze Naturali Trento (Italy), Jardí Botànic, Universitat de València (Spain), Department of Biogeography & Botanic Garden, University of Vienna (Austria), Botanical Garden Polish Academy of Sciences Warsaw (Poland), Botanischer Garten und Botanisches Museum Berlin-Dahlem (Germany), Helsingin yliopisto, Helsinki (Finland), Jardim Botânico - Fundação da Universidade de Lisboa (Lisbon), Botanical Garden, Natural History Museum, University of Oslo (Norway), Institute of Botany - Bulgarian Academy of Sciences (Bulgaria).

National implementation



At the national level, many countries, particularly those with a high level of plant diversity, find this target challenging. Many lack capacity, in terms of both facilities and expertise to store large numbers of plant species *ex situ*. These issues are compounded by the reluctance of some countries to make use of international facilities to store native plant diversity outside their national borders. Of course the situation is very variable across countries, with some mega-diverse countries such as China, Mexico and South Africa having well-established botanic garden networks that are playing a key role in achieving this target. China reports that by 2015, the botanical gardens and arboreta in China had successfully cultivated 85% (around 270 species) of the country's key protected wild plants and 40% of the 6,495 endangered plant species. Furthermore, the Chinese Germplasm Bank of Wild Species had preserved about 10,000 wild plant species as seed collections by the end of 2017. In addition, by 2017, a total of 180 plant species had been successfully reintroduced to the wild, accounting for about 5% of threatened plant species. In France, the network of Conservatoires Botaniques Nationaux is using an infra-regional approach and maintains nine seedbanks for the conservation of threatened species. The aim is to conserve representatives of the genetic diversity by harvesting several populations for each species. In Mexico, more than 52% of the country's endangered species are conserved in *ex situ* collections and 23% of these are cultivated by the national network of botanic garden. Of these, some 227 taxa (23% of threatened species) are also included in propagation programmes. In South Africa (which is part of the Millennium Seed Bank Partnership – see Box 18), 514 of the country's 2,842 threatened species have been collected and conserved; reintroduction projects are underway for 25 species and all 10 botanical gardens in South Africa are receiving support from SANBI's Threatened Species Unit to expand reintroduction work into all nine biomes. However, in countries such as Brazil and Indonesia, where the botanic garden networks are less well established, progress towards this target is slower (Brazil reports 21% of threatened species in *ex situ* collections and Indonesia 29%).

Ian Harvey-Brown

Box 19: The Australian Seed Bank Partnership

The Australian Seed Bank Partnership (the Partnership) is a national collaboration of twelve of Australia's leading botanic gardens, state environment agencies and flora-focused non-government organisations. The Partnership delivers a national program of work focussed on *ex situ* plant conservation that supports the Australian Government's priorities to protect and improve the environment. The *ex situ* conservation work being undertaken by Australia's conservation seed banks presents an important opportunity to improve the results of *in situ* conservation through refining germination and cultivation protocols and identifying appropriate storage techniques for native seeds to ensure higher rates of success in re-introduction programmes and advance the effective conservation of target species and plant communities. The Partnership is working to increase direct efforts in provenance focused native seed collecting to increase genetic representation in *ex situ* collections, to support long term conservation and restoration activities. Australia's conservation seed banks currently hold collections of more than 13,300 plant species. This includes 826 species or 61 per cent of Australia's nationally listed threatened flora species, many of these having already been accessed to support recovery and restoration programs (http://www.seedpartnership.org.au/).

Box 20: California Plant Rescue: Conserving the endemic and endangered plant diversity of the Golden State.

California Plant Rescue (CaPR) was formed in 2014 to conserve the wild species of California, primarily through *ex situ* conservation. Long before the CaPR consortium was formalized, CaPR partners had been making seed collections of both rare and common species for decades. This approach successfully conserved germplasm of some 30% of plants acknowledged by the state of California to be the rarest in the state (California Native Plant Society [CNPS] rank 1B).

Since 2014, via dedicated effort, collaborative and synergistic action, and concerted focus on rare species, seed bank holdings of the rarest plants in California have been increased by 53%, with a trajectory to securing 75% of the most threatened plant species (CNPS rank 1B) in *ex situ* collections by 2020. Excellent progress has also been made on the species accorded lower rank as at least somewhat less threatened (i.e., ranks 2, 3, 4 of the CNPS rank plant ranking system).

Since CaPR's founding in 2014, partners have also increased capacity; at Rancho Santa Ana Botanic Garden, the flagship partner in CaPR, the seed bank's freezer capacity has been increased by almost 50%, increasing germplasm storage capacity in equal measure.

Quantities permitting, the collaborative makes seeds available for research and restoration and also tests for viability periodically as resources permit. (www.caplantrescue.org/).

Target 8 – issues to consider

Species conservation initiatives traditional favour *in situ* conservation over *ex situ* and countries such as Canada report that species recovery plans rarely include *ex situ* conservation as a measure. However, the increasing loss of habitat and the impacts of climate change mean that not all species can be conserved in their natural environments. Furthermore, genetically representative *ex situ* collections provide an important source of material for research and restoration activities. There is therefore a clear need to maximise genetic diversity in collections as well as increasing the use of such collections Such use needs to be broadened beyond restoration to include species reintroductions, translocation, novel species assemblages and use in agriculture, horticulture and forestry.

Monitoring progress towards this target (as with Target 7) is limited by a lack of information on which species are threatened, so greater focus on Target 2 is urgently required at both national and global levels. In addition, over 20% of seed plant taxa either do not produce seeds that withstand storage conditions well or produce very few seeds. These "exceptional species" need alternative conservation methods, including tissue culture, cryopreservation, or maintenance in living collections.

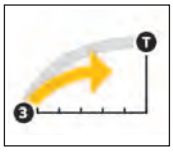
Box 21: Conserving *Buchanania barberi* a Critically Endangered and Endemic Tree from India

Buchanania barberi Gamble (family Anacardiaceae) is a small evergreen tree (15 meter) endemic to the south Western Ghats of Kerala, India. The Western Ghats is a recognized UNESCO World Heritage site and a biodiversity hotspot. *Buchanania barberi* is known from only two mature individuals with an area of occupancy < 5 km^2 and is categorized as Critically Endangered on IUCN Red List. The species is on the verge of extinction due to low seed production (the majority of its fruits are eaten by birds), no clonal propagation, low natural seed germination, lack of seedling establishment and road expansion and development activities in the area. An *ex situ* conservation project has been initiated funded by The Mohamed Bin Zayed Species Conservation Fund and run by Jawaharlal Nehru Tropical Botanic Garden and Research Institute. As a result, seeds of *B. barberi* have been collected from natural population and propagated in a greenhouse at the institute. The seedlings produced have been distributed to schools and villages to ensure a future for this rare tree.

Case study supplied by: Anurag Dhyani, Division of Conservation Biology Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India

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

Global progress



At the global level, the process of conserving Plant Genetic Resources for Food and Agriculture (PGRFA) is managed by the Food and Agriculture Organisation (FAO) of the UN, on behalf of the Commission on Genetic Resources. The 2nd State of the World's PGRFA was published in 2010 and a 2nd Global Plan of Action for PGRFA was agreed in 2011. According to the latest reports, there are some 7.4 million accessions of PGRFA stored in 1,750 genebanks around the world, of which 11 are international collections. Of the stored accessions, between 1.9-2.2 million are thought to be unique accessions. Information on material held in crop genebanks is made available through the Genesys database, which contains records for over 4 million accessions, and allows users to explore the world's crop diversity conserved in genebanks through a single website.

The bulk of crop genepool genetic diversity consists of landraces and wild relatives. Landraces are the traditional forms of crops maintained by cycles of farmer-based seed saving and planting and often have evolved local unique genetic adaptation to local agro-environments. However, landraces are one of the most severely threatened component of biodiversity (Camacho-Villa *et al.*, 2006) and we have no idea how many landraces exist. Furthermore, landrace maintainers are almost always older people and their number is dwindling each year (average age in the Scottish islands is 65). Farmers are by definition commercial, they grow what yields the highest economic return, they are not conservationists.


Luis Salazar

Seed companies, breeders and government agencies are actively promoting modern cultivar replacement of landraces and in most countries no agency has direct responsibility for their conservation. No country has a comprehensive inventory of extant landraces (A Scottish islands survey in 2003 found 30 crofters growing landraces, but a repeat survey in 2018 found just 2 (Maxted, pers. com.)).

Figure 9: Distribution of accessions held in Genesys (https://www.genesys-pgr.org/a/map)

With regard to the conservation of crop wild relatives (CWR), the material held in the crop genebanks is overwhelmingly of domesticated origin, with wild species being significantly under-represented (Figure 10).

A review of the comprehensiveness of *ex situ* conservation of CWRs related to 81 crops was carried out in 2016 (Castañeda *et al.*). This revealed that only 28% of CWRs are adequately conserved. Genepools considered of high priority for greater conservation action included those of important commodity crops for example sugarcane, sugar beet and maize, as well as important food security staples such as banana and plantain, cassava, sorghum, yams and cowpea.

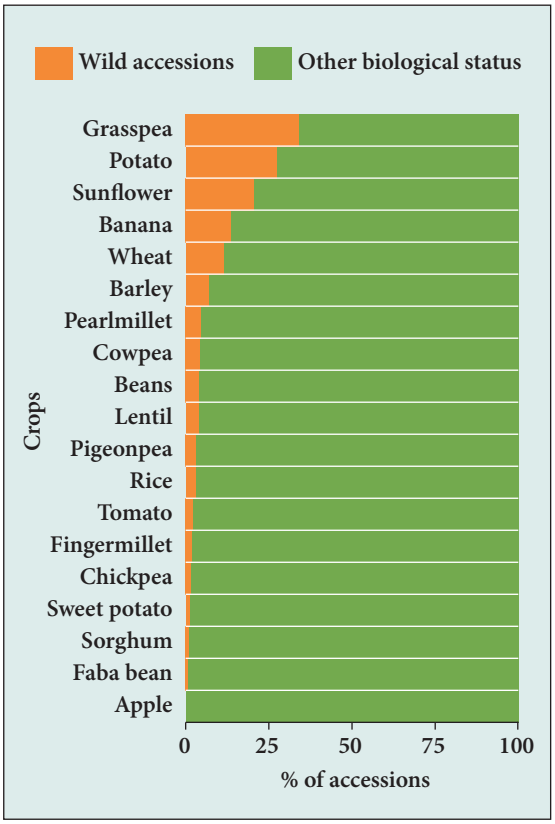


Figure 10: Status of material in crop genebanks (Castañeda-Álvarez et al., 2016)

One initiative to address the lack of CWRs in *ex situ* collections is being led by the Global Crop Diversity Trust with the Millennium Seed Bank and other partners. The project '*Adapting agriculture to climate change*' aims to collect, and conserve the wild relatives of 29 of world's most important food crops. This material will be made available in a form that plant breeders can readily use to produce varieties adapted to the future climatic conditions that farmers in the developing world are likely to encounter.

Another recent study looked at the conservation of CWRs *in situ* (Vincent *et al.*, 2019). Looking at the distribution of 1,261 CWRs from 167 major crop genepools, individual species were found to be well represented in current protected areas; only 35 (2.5%) of the studied species related to 28 crops were distributed exclusively outside of protected areas. These included seven CWRs from primary genepools, such as wild *Pennisetum glaucum* (related to pearl millet); *Prunus argentea* (related to almond) and (*Prunus sibirica*) related to apricot. The top five CWRs found to have the highest proportion of distribution in protected areas were: *Coffea costatifructa* (related to coffee), *Ficus glareosa* (related to fig), *Manihot alutacea* (related to cassava), *Beta patula* and *Beta nana* (both related to beet). If a threshold of 50% or more of CWR genetic diversity being within protected areas is considered adequate for genetic conservation, then 91% of the assessed CWR are well represented by existing protected areas. However, this existing *in situ* conservation is likely to be passive, and more active conservation is recommended for these populations to ensure their genetic diversity is conserved.

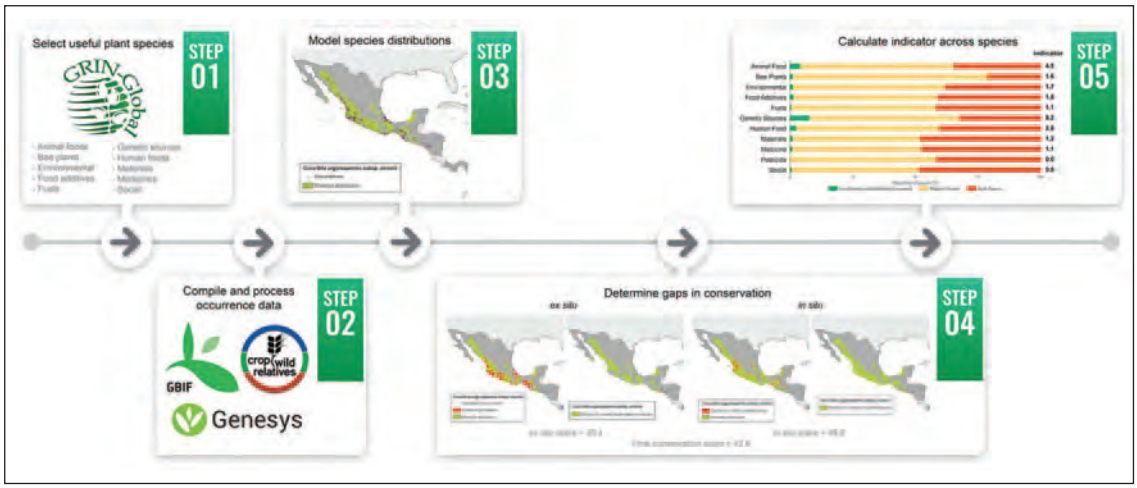
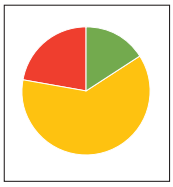


Figure 11: Steps in the development of an indicator to monitor the conservation of socioeconomically important plant species (Khoury et al., 2019).

With regard to other socioeconomically important plant species, efforts have been made to develop an indicator to monitor progress in the conservation of these species (Khoury *et al.*, 2019). The methodology aims to provide a pragmatic estimate of the comprehensiveness of conservation of the genetic diversity of useful wild plants, both *ex situ* and *in situ*. Assessing almost 7,000 taxa with the "*Comprehensiveness of conservation of useful wild plants*" indicator, it was found that they are currently highly under-conserved, with fewer than three out of every 100 taxa assessed as sufficiently conserved or of low priority for further conservation action (overall global indicator = 2.78). Indicator results at the national and regional scales as well as by species use type varied, although virtually all countries, regions, and use categories were found to require further conservation action, particularly with regard to *ex situ* conservation.

The plant and seed collections of botanic gardens were not included in the analysis above and a recent review has shown that 89% of the c. 7,000 taxa used in the analysis are found in at least one botanic garden collection, and nearly 50% are held by more than 10 collections. While further studies are required on the quality of these collections, the inclusion of this data into the indicator should give a more accurate picture of the status of *ex situ* conservation of this group of species.

National implementation



One of the major challenges with implementing Target 9 is to identify the many thousands of species that are of socio-economic importance at the national or local level as well as managing the indigenous knowledge associated with these species. At the individual crop level, a number of countries report significant efforts that are underway to conserve CWRs or other species that have a special significance in their countries. For example, Meise Botanic Garden in Belgium is working with partners in the DR Congo to support the conservation of wild coffee species, while in Cambodia, a Cardamom Genetic Conservation Area has been established. Good progress is also being made in Madagascar on the conservation of wild yam species, where a national strategy for yam conservation was recently launched. A small number of other CWR active genetic reserves have been established: *Triticum* CWR in Israel; *Zea perennis* in Mexico; *Solanum* CWR in Peru; wild coffee CWR in Ethiopia; wild celery in Germany and *Beta patula* in Madeira.

Good progress towards this target is reported by China, where in 2015, a "*National long-term development plan for the protection and utilization of crop germplasm resources (2015–2030)*" was launched. China has also completed resource investigations and *ex situ* conservation of medicinal plants and launched the "*National forest germplasm resources investigation, collection and conservation plan (2014–2025)*" in 2014. China is also carrying out an on-farm programme for the protection of genetic diversity and related native knowledge.

An Interactive Toolkit for Crop Wild Relative Conservation Planning has been developed to provide guidance to plan and implement active *in situ* and *ex situ* conservation of CWRs at national level (See Target 3, Box 3). The conservation recommendations that result from this national CWR conservation planning process are used to develop National Strategic Action Plans (NSAP) (or National Strategies) for the conservation and sustainable use of CWRs.

Box 22: National Strategic Action Plans for the conservation and sustainable utilization of CWRs (NSAP)

An NSAP is a document that sets out a coordinated, systematic and integrated approach to the *in situ* and *ex situ* conservation of a particular country's CWR diversity. It evaluates current conservation actions and establishes future CWR conservation objectives. Equally, the NSAP also addresses the use of CWRs, by promoting their value as well as evaluating their use in breeding programmes and the national (and global) demand for CWRs in crop improvement. Finally, the NSAP reviews the resources required to implement conservation and sustainable use, it attributes responsibilities and sets CWR conservation action and use in the broader environmental and agricultural policy context

(http://www.cropwildrelatives.org/conservation-toolkit/the-toolkit/national-strategic-action-plans/).

CWR checklists and inventories have been developed and documented by 26 countries, and at the regional level for the Euro-Mediterranean region, Nordic countries and North Africa.

CWR conservation strategies have been developed and documented for the following countries and regions:

- Europe
- Cyprus
- Czech Republic
- Denmark
- Finland
- Italy
- Russia
- Spain

NSAPs have been developed for Mauritius, South Africa and Zambia, but to date, Zambia is the only country this has been officially endorsed at governmental level.

Box 23: *In situ* conservation and use of Crop Wild Relatives in the Southern African Development Community (SADC) Region

This project, led by the University of Birmingham with partners in Zambia, South Africa and Mauritius, aimed to enhance the linkages between conservation and use of crop wild relatives for regional food security and to address the impacts of climate change. More specifically, the project focused on enhancing scientific capacity and developing exemplar National Strategic Action Plans. The project identified that SADC CWR are poorly conserved both *ex situ* and *in situ*. 50% of the countries' CWR are not conserved *ex situ* and of those that are conserved *ex situ*, 40% have <5 populations and 16% have only 1 population conserved. 17% of the CWRs occur exclusively outside Protected Areas and those that occur within PAs are not monitored or actively managed. As a result of the project: the capacity of over 50 participants from SADC Member States in *in situ* conservation and use of CWR has been strengthened; detailed checklists and inventories of CWR in each of the three partner countries have been developed; hotspots of priority CWR sites have been identified in each country and across the SADC region for *in situ* conservation intervention including protected area establishment; an interactive toolkit for conservation of CWR has been published and shared; three exemplar National Strategic Actions Plans (NSAP) for CWR conservation and use (Republic of Mauritius, South Africa and Zambia) have been developed; and a Regional Network of CWR Important sites within SADC region has been established.

(www.cropwildrelatives.org/resources/expertproject-database/projects/project-list/project-details/?proj=21)

Hanspeter Klasser


Luis Salazar

Box 24: Conserving medicinal plants in Morocco

The Global Diversity Foundation (GDF) has been working with local partners to enhance local livelihoods in the Moroccan High Atlas while addressing threats to plant diversity. Drawing on indigenous knowledge and practice, the project goal was to ensure that Moroccan medicinal plants are conserved, sustainably harvested and profitably cultivated, thus improving the livelihoods of thousands of collectors, vendors and traditional practitioners. *In situ* and *ex situ* conservation activities helped ensure sustainable populations of vulnerable medicinal species while also sustaining plant-dependent livelihoods. A key outcome of the project was the establishment of thriving community plant nurseries. These act not only as *ex situ* conservation zones for medicinal and aromatic plants but also provide community members with income through the distribution of fruit and nut trees and useful plants, generating opportunities to transmit local knowledge and horticultural techniques while learning about innovative approaches such as drip irrigation.

www.global-diversity.org/mediterranean/medicinal-root-trade-plants-conservation-and-livelihoods-in-morocco/

Box 25: Setting conservation priorities for the wild relatives of food crops in Indonesia

Indonesia as one of the important areas for Crop Wild Relative (CWR) diversity, but it does not yet have specific plans to conserve these resources. However, some initial CWR conservation planning steps have been taken in terms of checklist development and subsequent prioritisation. A total of 1,968 taxa have been recorded as wild relatives of food crops in Indonesia. About 571 (29%) of those taxa are national endemics and 864 (44%) are narrow regional endemics. After prioritization based on the socio-economic value of the related crops and potential utilization for plant breeding, 234 taxa were established as a priority for conservation. Ninety-five of these priority taxa are important at the national and global levels (such as wild relatives of rice, banana, mango, breadfruit, sugarcane, taro, coconut, sweet potato, melon, sorghum, citrus, and aubergine), 69 are important at the national and regional levels (such as wild relatives of tropical fruits and sugar crops), and 70 taxa are important at global level only (such as wild relatives of yam, figs, and raspberry). Those priority taxa are now the target for further CWR conservation action both of *ex situ* and *in situ* gap analyses and the establishment of a systematic conservation planning strategy for effective conservation action in Indonesia.

https://link.springer.com/article/10.1007/s10722-019-00761-1

Box 26: Capacity building for seed conservation at Kakadu National Park

Kakadu National Park includes the traditional lands of a number of Aboriginal clans and is jointly managed with Parks Australia. Since 2014, the Traditional Owners of Kakadu have been working with staff from the National Seed Bank (NSB) to collect seed from listed threatened and at risk plant species. The knowledge acquired during joint field trips on how to collect using scientific methods was put to good use in April 2018. Three agencies (NSB, Australian Grains Genebank and George Brown Darwin Botanic Gardens) coordinated by the Australian Seed Bank Partnership worked with Traditional Owners to collect the seed of crop wild relatives. The project secured 15 new seed collections from *Cajanus, Glycine, Oryza, Sorghum* and *Vigna* species. The seed bank team taught Traditional Owners how to record, process and bank collections using basic seed banking equipment that can be used anywhere in the country. Traditional Owners are now better equipped to participate in plant conservation efforts and to contribute to the mix of traditional and scientific methods that can be used to protect plant species and ensure their future use. Indigenous knowledge was essential to identifying the location and timing of field collections to ensure seed harvest for the target species. Traditional Owners also shared knowledge on the traditional management and collection of wild rice and sorghum within the National Park. This led to interesting discussions and reconsideration of how collections of some species are made. This knowledge will help to make better quality collections in the future, which ultimately ensures the future conservation of plant species at risk.

Target 9 – issues to consider

The major difficulty with this target is the scale of the task. At the national level, countries need to identify local landraces that are being used by the agricultural community, as well as socio-economically important wild plants that may be used much more widely across society – few countries have done this as yet. For many of the major crops, diversity is spread across many countries, so to achieve the target for these crops, international collaboration is required. In this respect, global conservation strategies have been developed for about 20 crops (including banana, barley, coffee, maize, potato, rice…) https://www.croptrust.org/our-work/supporting-crop-conservation/conservation-strategies/. These strategies are being used to develop a global system to ensure the secure, rational, cost-efficient, long-term conservation of each crop and its wild relatives.

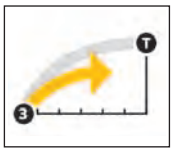
A further issue related to this target is that it spans both the agricultural and environmental sectors, and all too often at the national level, collaboration between these sectors is not strong. Greater alignment with the Global Plans of Action for Plant Genetic Resources and Forest Genetic Resources, as developed under FAO may help to bridge this gap.

Other constraints to achieving the target relate to: genebank data availability and accessibility; insufficient collaboration between *ex situ* and *in situ* practitioner; unclear institutional mandates for CWR; lack of awareness of available methodologies and tools for strategizing and priority setting; and lack of awareness of protected area managers, conservationists and policy makers of targeted conservation actions for CWRs within PAs.

Finally, the maintenance of associated indigenous and local knowledge presents a particularly significant challenge and to date there is a lack of tested methodologies and limited assessments of indigenous and local knowledge associated with plant genetic diversity.

TARGET 10: EFFECTIVE MANAGEMENT PLANS IN PLACE TO PREVENT NEW BIOLOGICAL INVASIONS AND TO MANAGE IMPORTANT AREAS FOR PLANT DIVERSITY THAT ARE INVADED

Global progress



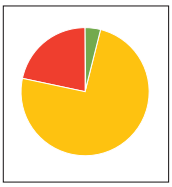
Alien species that become invasive are considered to be one of the main direct drivers of biodiversity loss across the globe. Alien species have been estimated to cost our economies hundreds of billions of dollars each year. The removal of invasive alien species is a key management activity for effective conservation. Nevertheless, 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.

While this target is best addressed at the national level, a new global initiative to develop an early warning for new and emerging tree pests is the International Plant Sentinel Network (IPSN). The IPSN has been established to facilitate collaboration between botanic gardens and arboreta, National Plant Protection Organizations (NPPOs) and plant health scientists. The monitoring and surveying of exotic plant species in collections can provide an early warning of potential plant health risks to these species should the pests and diseases being monitored be introduced to the species' native environments.

The work of the IPSN can be illustrated by a recent survey of bark beetles affecting European oak species in Californian botanic gardens and arboreta. Previous to the survey, the susceptibility of European oak species to the Polyphagous Shot Hole Borer (PSHB) (*Euwallacea whitfordiodendrus*) was unknown as the pest is not yet present in Europe. The survey in an area affected by PHSB revealed that two important European Quercus species were susceptible to attack, while other European species were less affected. Such information is essential in developing pest risk analyses and informing plant quarantine policies.

Other significant initiatives include the Honolulu Challenge, launched at the 2016 IUCN World Conservation Congress in response to a call for more action on invasive alien species. It challenges countries and organizations to commit to taking bold yet practical measures necessary to safeguard biodiversity and human well-being from the devastating impacts of invasive alien species and has gathered commitments from governments and organizations to meet the aim of the Honolulu Challenge. In its Decision XIII/13 Parties to the CBD welcomed the Honolulu Challenge on Invasive Alien Species (CBD 2016c).

National implementation



This target corresponds closely to Aichi Target 9 and progress is therefore reported in more detail in the Global Biodiversity Outlook. In GSPC reporting, very few countries have reported progress sufficient to meet this target.

Actions taken by many countries include the establishment of inventories of invasive plant species and the development of national strategies on alien invasive species. In France, a National Resource Centre has been set up with the French IUCN Committee.

Some issues that have been raised at the national level are the need for capacity building for customs and quarantine officers and enhanced public awareness.

*Goldenrod (*Solidago canadensis*) is considered highly invasive in Europe (Ewald Weber)*

*Water hyacinth (*Eichhornia crassipes*) invading a river in Borneo (Suzanne Sharrock)*

Box 27: Working for Water in South Africa

South Africa's Working for Water (WfW) scheme is an inter-sectoral, multi-disciplinary project that was launched in 1995, WfW was initially designed to tackle the proliferation of invasive alien plants, which crowd out native species, overwhelm ecosystems, impede agriculture, and exacerbate drought. Clearing these weeds is extremely labour intensive, and thus can provide jobs and economic empowerment for unskilled or marginalised communities where unemployment is highest. As of 2017, the scheme creates around 50,000 jobs every year, and has expanded its focus to target economic support for the most disenfranchised: well over half its workers are underprivileged women, and the programme has ambitious quotas for young people, disabled individuals, and those living with HIV/AIDS. WfW runs over 300 projects in all South African provinces, and is the largest single poverty relief and public works programme in the country. These projects are largely funded by the government through poverty relief funds, but funding also comes from private companies who recognise the value of clearing invasive plants for their own businesses and are willing to pay for WfW's services. For example, in the Eastern Cape, local farmers pay around 60% of WfW's costs for removing invasive species, and the forestry industry provides planning, mapping, vehicle donations and training.

(www.environment.gov.za/projectsprogrammes/wfw).

Box 28: Managing invasive species in the UK

There are 1,402 non-native plants established in the wild in Great Britain, of which 108 (8%) are stated to have a negative impact. Every year, approximately £1.7billion is spent on trying to tackle the problem of invasive non-native species. The actual cost may be far greater as the 'indirect costs', such as damage to ecosystem service provision and damage to wildlife and waterways are not accounted for. Millions of pounds are spent clearing invasive species from congested ponds and rivers with delicate rare water flowers such as starfruit (*Damasonium alisma*) being pushed to extinction. Furthermore, invasive species have been found in 30% of the UK's Important Plant Areas. In 2014, five non-native, invasive aquatic plants were banned from sale in the UK and in 2019, 36 non-native, invasive plants were banned by the European Union. Of the banned plant species, several are plants that have proved popular with gardeners in the past. The GB Invasive Non-native Species Strategy, originally published in 2008 and updated in 2015, is intended to provide a strategic framework within which the actions of government departments, their related bodies and key stakeholders can be better co-ordinated.

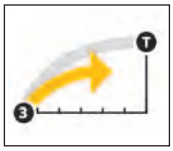
www.gov.uk/government/uploads/system/uploads/attachment_data/file/455526/gb-non-native-species-strategy-pb14324.pdf

Box 29: Invasive plants of Nepal

In a project funded by the UK's Darwin Initiative, the Royal Botanic Gardens Edinburgh is working with the Government of Nepal to develop the scientific knowledge-base and in-country capacity to tackle the increasing challenges from invasive plants in Nepal. The project aims to engage local communities in recognising, controlling and utilizing invasive plants, and restoring the infested lands. It aims to use invasive plant biomass for alternative, carbon-sensitive bioenergy sources to improve livelihoods, reduce poverty, conserve biodiversity and offset carbon. http://www.invasiveplantsnepal.org/

TARGET 11: NO SPECIES OF WILD FLORA ENDANGERED BY INTERNATIONAL TRADE

Global progress



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 consistent with the 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"*.

In 2019 at the 18th CITES meeting of the Conference of the Parties (COP), there was support for Resolution Conference 16.5 which highlights the need for Parties to submit information on national CITES work contributing to the GSPC through their National GSPC Focal Points. It is clear 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 (Target 2), wild harvested plants sourced sustainably (Target 12), and capacity building (Target 15). Intensified communication between national CITES and GSPC authorities is an essential cornerstone for implementing joint collaborations for mutual benefits.

Traditionally the plants covered by CITES have been ornamental (such as orchids and cacti) threatened by commercial collecting from the wild for gardens and greenhouses. However, more attention is now being focused on the major commercial groups of internationally traded species such as timbers and medicinal plants.

In the case of orchids, the entire family is listed on Appendix 2 of CITES but many are still collected commercially. For example, over 100 are harvested for commercial purposes in Nepal. Most are traded internationally for Ayurvedic and Chinese medicines. Nepal has introduced a quota-based system of legal harvest, yet most trade is suspected to be illegal and has led to widespread reports of population declines.

Medicinal and aromatic plants

At the international level, CITES provides an important form of trade regulation with over 800 species of medicinal and aromatic plants listed in Appendix II. In 2006–2015, 43 CITES Appendix II wild species were traded legally—some 25,000 t in total. According to importers' annual reports, the top three exporters were Mexico, Cameroon and South Africa, together representing 75% of all wild-sourced exports (kg as unit), while five countries were responsible for 77% of imports: France (26%), USA (16%), Japan (15%), Germany (11%) and Spain (7%). According to importers' data, the trade in Candelilla (*Euphorbia antisyphilitica*) and African Cherry (*Prunus africana*) accounted for 73% by volume with significant trade in aloes (*Aloe* spp.), orchids (*Dendrobium* spp.) and agarwoods (*Aquilaria* spp.). Jatamansi (*Nardostachys jatamansi*) exports from Nepal also appear to be globally significant according to data reported by exporters. There is evidence of illicit trade as exemplified by analysis of CITES-related seizures reported by European Union (EU) Member States. During 2018, 23% of all seizures reported were of medicinal plant and animal products and parts/derivatives for medicinal use—by far the largest category of all reported seizures. This included 260,562 plant-derived medicinal items, with many Appendix II-listed MAPs seized, including aloe (*Aloe maculate*), *Gastrodia elata* and *Dendrobium orchids*, and *Prunus africana*. Many of the seized products contain CITES Appendix-II listed plant species suggesting some are linked to poor compliance with, rather than intentional violation of CITES regulations. The former may be linked to a lack of understanding of CITES requirements along trade chains, and/or capacities to implement the regulations in source and transit countries.

Recognizing the particular features of trade in medicinal and aromatic plants, CITES CoP18 adopted new decisions on medicinal and aromatic plants, focussing on this important group of species and particular issues around the implementation of CITES requirements for them.

A project addressing "*CITES-listed medicinal and aromatic plants species (MAPs) and voluntary certification standards*" was implemented by TRAFFIC with the support of the German government and preliminary results were presented to the CITES Parties during the CITES Plants Committee Meeting in July 2018 (De Angelis and Timoshyna, 2020) and further presented to CITES Parties during the CITES CoP18. The aim of the project was to identify how voluntary certification standards can assist with implementation of CITES for Appendix II listed MAP species that are taken from the wild. To enable legal trade in these species the project sought to aid industry to ensure sustainable and legal trade, and to help governments with the information necessary for making evidence-based decisions about trade in CITES-listed MAPs. Questions raised at the Plants Committee in 2018 on the operationalization of such an approach, were addressed in a workshop held in January 2019 in Cambridge UK. The final report from this is to be presented at the next Plants Committee Meeting in 2020.

In Nepal, a project was launched in 2018 by TRAFFIC and the Asia Network for Sustainable Agriculture and Bioresources (ANSAB) with the Government of Nepal to develop support for legal and sustainable Jatamansi harvest by rural communities. Supported by the UK Government's Darwin Initiative it aims to promote legal and sustainable international trade in *Nardostachys jatamansi*, listed as Critically Endangered on the IUCN Red List™ and in Appendix II of CITES, it is a case study for sustainable trade.


Barney Wilczak

Timber trade

The international trade in timber is worth hundreds of billions of dollars every year and the increasing demand for luxury timber items is threatening the survival of many timber species. Following the listing of all *Dalbergia* rosewood and palisander species at COP17, additional threatened tree species (*Cedrela* spp, *Pterocarpus tinctorius*, and *Widdringtonia whytei*) were added to CITES Appendix II in 2019. COP18 therefore added 19 new tree species under CITES controls.

There are many more tree species and non-timber species that are covered under national legislations, but are not listed under CITES. Many of these countries also have stricter measures under domestic policies and legislations that restricts and/or prohibit harvesting of these species, their trade, processing and exports. Some of the countries have systems and procedures for traceability and transparency in the management and trade of flora species. Tools and technology (DNA, isotope, barcode, etc.) used in a specific species context for legality and traceability could piloted for use by other species.

There is a clear need to link the national legislations governing plant management and trade to the CITES legislation for international trade. TRAFFIC together with WWF has developed a Common Framework for Assessing Legality for Forestry Operations, Timber Processing and Trade, which provides guidance on the various aspects on legality and associated sustainability requirements for timber harvest and trade. The integration of the common framework with the CITES permitting system will help with the understanding, monitoring and enforcement of tree species used in the wood industry along the supply chain. TRAFFIC is also exploring the possibility of expanding the Common Framework for timber legality to other wildlife species, including medicinal and aromatic plants.

Of direct relevance to CITES, the conservation status all tree species currently listed on the Appendices will be assessed by the Global Tree Assessment (see Box 2) and published on the IUCN Red List™ by the end of 2020. Associated documentation may be important in developing Non Detriment Findings (NDFs), supporting significant trade reviews and identifying appropriate expertise. In addition, all other trees that are used for timber and traded commercially at an international scale are being prioritised for assessment through the GTA. This will provide a baseline for considering future CITES listing proposals.

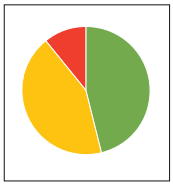
Currently conservation assessments for 289 CITES-listed tree species are published on the IUCN Red List™, meaning over 50% of all CITES trees have been assessed. Of these assessments, 192 have been published since 2010 including a complete assessment for all species of the agarwood-producing genus *Aquilaria* (20 spp.). Timber species make up the majority of the published assessments for CITES trees, with 199 timber species assessed. Over 90% of the Malagasy *Dalbergia* species assessed were categorised as threatened with extinction in the wild, including two Critically Endangered and five Endangered species. Ongoing illegal trade was acknowledged to be a major a factor in the decline of these species - although difficult to quantify. Assessments for *Dalbergia* in Central America have also been prepared at recent GTA workshops.

In total, over 30,000 plant species are listed in the CITES Appendixes, when it comes to regulating trade in these species CITES is concerned with circumvention of CITES regulations by claiming 'lookalike' species, poor records of plants traded, and ever-increasing porosity of international borders.

Box 30: The Kew World Forest ID Collection

The RBG, Kew timber anatomy laboratory houses a reference collection that is used by enforcement authorities around the world for identification of specimens of timber products. These collections help with species identification which is essential for legal prosecutions and product verification. This reference collection includes 36,000 wood anatomy slides and over 42,000 wood collections and plans are in place to expand the collection with duplicate collections in other countries.

National implementation



Around a third of countries reporting on this target, have reported progress sufficient to meet the target by 2020. These include countries such as Belize, Peru, South Africa and Thailand which have a great amount of plant diversity, including species listed under CITES. Belize reports that its Sustainable Forest Management (SFM) Programme has institutionalized mechanisms which enable the monitoring of timber extraction to ensure compliance with operational standards, felling of specified trees and the accurate tagging of trees. The Forest Department, through the SFM programme, closely monitors the quantities of CITES species being extracted. Similarly, in Thailand, the Department of Agriculture takes strict control measures to regulate import, export and re-export of Siamese rosewood and orchids, appearing in CITES Annex 2. A CITES research group is established in the Department of Agriculture to analyse the risks associated with non-detriment findings and there is a register of growers of conserved plants that are listed in CITES.

In South Africa, a sensitive species list that identifies species at risk of trade has been developed by SANBI. It includes 6,000 species that are collectable, of which 1,257 are threatened or range restricted. Distribution data for these species is not made publically available. Furthermore, a strategy for the conservation of cycads has been developed and is being implemented by the Department of Environmental Affairs,

Moray McLeish/The Nature Conservancy

Box 31: Conserving wild edible orchids in Zambia

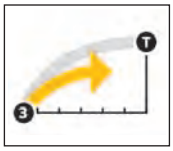
In 2016, RBG Kew initiated a three-year project looking at edible wild orchid trade in Zambia, funded by The Darwin Initiative (http://eulophiinae.e-monocot.org/content/chikanda-zambia-wild-edible-orchids-darwin-initiative-project-2016-2019). This project aims to understand the demand, trade and conservation of chikanda (edible orchids) in the southern African region in and around Zambia. The project is multifaceted, it works with women in local communities to develop community-led sustainable management strategies and conducting market surveys to improve knowledge of trade. Work on developing molecular barcodes aims to document chikanda orchid trade and support CITES regulation through species identifications. Specialist workshops on seed harvest and orchid cultivation for horticulture production and conservation of grassland orchids aim to build capacity within communities. Orchid conservation research, symbiotic culture and conservation assessments have also been conducted by experts at RBG Kew.

Mexico reported on enhanced regional collaboration to strengthen the implementation of CITES-Appendix II for priority flora species. The Action Plan for North America on Sustainable Trade in Timber includes 17 recommended actions for government experts from Canada, Mexico and the United States to support the sustainable use and trade of timber in North America. In 2018, a Regional Workshop was held for Training on the Trade and Identification of Wood for the Legal and Sustainable Trade of Priority Timber Species. In Mexico itself, 1,051 NDFs for plants were issued from 2014 to June, 2018.

As a significant outcome of a CITES MSc study in Sierra Leone, more information is now available to inform action on the threat to *Pterocarpus erinaceous*, a hard wood which is being exploited and depleted at an alarming rate in the north of the country. The findings of the study are contributing to designing regional mechanisms to discourage the smuggling of the wood across borders in West Africa. However, much needs to be done to prevent the destruction of vegetation of the Outamba-Kilimi National Park and environs. The key challenge with *Pterocarpus* is that it is a hard wood in high demand by Chinese manufacturers and so provide much needed foreign exchange for the country. Implicitly, the species is being indiscriminately exploited primarily because it brings income to the government.

TARGET 12: ALL WILD HARVESTED PLANT-BASED PRODUCTS SOURCED SUSTAINABLY

Global progress



There are roughly 30,000 plant species with medicinal or aromatic uses, with up to 90% of those in trade being wild collected. Of the 7% that have been assessed by the IUCN Red List™, 1 in 5 are threatened with extinction. The increasing demand for wild plants – as ingredients for food, cosmetics, well-being and medicinal products – poses major ecological and social challenges. The pressure on potentially vulnerable plant species can endanger local ecosystems and the livelihoods of collectors.

As a response to these concerns, the FairWild Foundation is working with TRAFFIC and other partners worldwide to improve the conservation, management and sustainable use of wild plants in trade, as well as the livelihoods of rural harvesters involved in wild collection. The FairWild Standard has been developed as a set of guidelines that ensures the continued use and long-term survival of wild plant species in their habitats. The Standard, which is available in multiple languages, has 11 Principles and 29 Criteria addressing ecological, social and economic requirements for sustainable wild collection. The FairWild Standard applies to wild plant collection operations wishing to demonstrate their commitment to sustainable collection, social responsibility and fair trade principles. Respecting traditions and cultures, and supporting the livelihoods of all stakeholders, in particular collectors and workers, are also key components.

The FairWild Standards form the basis of the FairWild certification scheme, operational since 2010. So far, 25 species have been certified from more than ten source countries (including Bosnia and Herzegovina, Bulgaria, Georgia, Hungary, India, Kazakhstan, Poland, Serbia, Spain and Zimbabwe) and over 30 companies are involved in supply chains, with products on sale in the USA, the European Union, Japan and other counties, labelled as 'FairWild' (http://www.fairwild.org/).

Besides certification, the FairWild Standard can be applied in a variety of other scenarios, including resource assessment, the development of management plans and legislative frameworks. The FairWild Standard provides a set of best practice principles for wild collection, that can be applied in a number of different ways. Projects promoting adherence to the principles and supporting their implementation are being carried out by the FairWild Foundation and partner organisations worldwide.

Barney Wilczak

Audits under the certification scheme (to verify that wild collection operations are meeting the provisions of the FairWild Standard) are carried out by independent control bodies that have been approved by the FairWild Foundation.

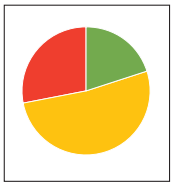
Box 32: FairWild Week

First launched in 2017 by the FairWild Foundation, FairWild Week champions the vital need to harvest wild plant ingredients sustainably. Based online, the week aims to inspire curiosity and excitement about the plant species we all depend upon and responds to the urgent need for greater public awareness about the issues of wild plant harvesting and trading. In 2019, participating companies and organisations included TRAFFIC, IUCN, WWF, Pukka Herbs, Traditional Medicinals, the American Botanical Council, Neal's Yard Remedies, Chantecaille, Dr Jacksons, International Flavours and Fragrances, United Plant Savers, and Organic Herb Trading. Through the #IFoundWild hashtag, consumers were encouraged to be curious about potential wild plants in the products they buy, with the 12 key species – the "wild dozen" identified by TRAFFIC being particularly promoted.

In relation to the changing consumer awareness of biodiversity, the Union for Ethical Biotrade (UEBT) has been tracking people's interest in and general awareness of biodiversity since 2009. Over the last 10 years, UEBT has surveyed 68,000 people from 16 countries, with the information generated providing valuable insights. For example, the Biodiversity Barometers have shown a close connection between people and biodiversity: high biodiversity in a country goes hand in hand with high biodiversity awareness and ability to describe it. Furthermore, high awareness of biodiversity translates into high expectations towards companies that use biodiversity. They have also shown that young consumers remain the best informed and that biodiversity is becoming a mainstream concept for consumers.

A certification scheme is also offered by UEBT. The UEBT Certified label is awarded to companies that meet the criteria of the Ethical BioTrade Standard. The Ethical BioTrade Standard requires practices that respect biodiversity and reduce biodiversity loss, such as restrictions on forest cutting, protection of endangered species and pollinators such as bees, enriching natural ecosystems and reducing pesticides. The Ethical BioTrade Standard is presently under revision and a new version will be published in 2020.

National implementation



At the national level, a number of countries report difficulties with monitoring progress towards this target. Often official information on existing harvesting levels is not available, and there is limited scientific data on 'safe' levels of harvesting for many species. In South Africa for example, some 10% of the national flora have a use in traditional medicine and over harvesting has resulted in many local extinctions. In response, plant material is increasingly being imported from Mozambique and Zimbabwe.

Some countries have put in place specific measures to address unsustainable harvesting. In Thailand for example, laws strictly prohibit the extraction of plants from the wild, except for research and academic purposes. However, a Community Act is under development that will provide opportunities for local communities to participate in the conservation and sustainable use of forest resources, both for home consumption and limited commerce, as agreed by members of the communities. The harvest of orchids from the wild is allowed, but is limited to a maximum of 20 plants. Commercialisation is limited to specific orchid farms.

Box 33: The cut flower trade in South Africa

About 60% of total indigenous flower retail in South Africa originates from natural populations. In the main area where flower harvesting takes place, the Agulhas Plan, a Sustainable Harvesting Programme has been established by stakeholders involved in fynbos harvesting, including Flower Valley Conservation Trust, CapeNature and the fynbos industry. This includes a Code of Best Practice for Wild Harvesters, for landowners and harvesters to follow, with guidance on how to sustainably harvest different species of Fynbos. A vulnerability index identifies which indigenous plant species have restricted distributions and life history characteristics that make them vulnerable to over-harvesting. Species that score high on the vulnerability index are not to be picked. Landowners and harvesters who are part of the Sustainable Harvesting Programme receive extension support from the Flower Valley Conservation Trust NGO as they undertake a journey to become sustainable by acting responsibly in the environment, and by meeting social and labour best practise standards. The programme provides a baseline assessment of the landowner or harvesting team's fynbos practices and provides capacity building to meet those best practice standards set out in the code.

Drying Jatamansi *rhizomes - sustainable harvesting is the subject of a Darwin Initiative project in Nepal (Khilendra Gurung)*

Sustainable harvesting training workshop, Vang Kheo Commune, Ba Be District, Viet Nam (Cuong Nguyen TRAFFIC)

Success stories involving sustainable harvesting include sustainable collection of Schisandra berries in the Upper Yangzte region of China, which is helping to preserve one of the most important sites for the Giant Panda. In India's Western Ghats, FairWild-certified sustainable collection of bibhitaki (*Terminalia bellirica*) and haritaki (*T. chebula*) fruit, produced by two medicinally and economically important tree species, has provided a better alternative to destructive and dangerous logging. Unlike logging, harvesting the fruits provides a recurring benefit. Moreover, this FairWild effort has also protected nesting/roosting sites of two rare hornbill species: the great hornbill (*Buceros bicornis*), also called the great pied hornbill, and the Malabar pied hornbill (*Anthracoceros coronatus*), both of which may eat the *Terminalia* fruits and disperse the seeds.

In Viet Nam, in a project implemented by TRAFFIC and its partners, collectors have received advice on how to harvest sustainably and protect their livelihoods. Together with the Bac Kan Forest Protection Department, A Pocket Guide for the Sustainable Collection of Jiaogulan, Woolly Fern, and other Medicinal and Aromatic Plants has been produced and distributed to collectors. At the national level, the project contributed to a review of gaps in Viet Nam's policy and law regarding the harvesting and trade of forest resources, and recommended steps for improvement. These included integrating FairWild best practices into the National Circular that focuses on the implementation of Good Agricultural and Collection Practices, with the Ministry of Health.

Box 34: Sustainable wild harvesting of plants in the Danube region

The *"Local Economy and Nature Conservation in the Danube Region"* (LENA) project helps to promote the implementation of local sustainable wild plant harvesting activities. The project involves 13 partners from seven countries along the Danube. It aims to connect people to nature and support livelihoods and business opportunities for low-income communities based in and around protected areas. Four capacity-building workshops have been jointly organized with local project partners. Relevant stakeholders participated in the events, including representatives from local collectors, processing and trading companies, university experts, protected area authorities and local politicians actively participated in the events. Discussions focused on issues such as the threat of losing valuable traditional knowledge, the vanishing number of collectors, necessary training on sustainable harvesting practices, business planning and relevant legislation. The FairWild Standard and its Principles were introduced to the participants to demonstrate possible opportunities, solutions and best practice examples of successful sustainability frameworks to guide wild harvest and trade, including through the FairWild certification scheme.

http://www.traffic.org/home/2017/10/11/building-capacity-for-sustainable-wild-harvesting-of-wild-pl.html

Box 35: Overharvesting of *Sideritis* species in the Balkans

Perennial plants of the genus *Sideritis* spp. are often harvested illegally from the wild in the Balkan countries (Krigas *et al.*, 2014). As a consequence, a number of species are now under threat of extinction while others have severely depleted and restricted populations (Table 4).

Species	Distribution	IUCN/National assessments
Sideritis scardica (Greek mountain tea or shepherd's tea, 'Tsai Olymbou'	Balkan endemic	Near Threatened – IUCN (Global) Endangered – Bulgaria CR – Serbia Provisionally threatened - Albania
Sideritis raeseri subsp. *raeseri*	Balkan endemic	Endangered - Albania
Sideritis euboea (Mountain tea of Evia Island)	Single island endemic	Endangered - Greece
Sideritis sipylea (Mountain tea of the East Aegean Islands	East Aegean endemic	Endangered - Greece
Sideritis raeseri subsp. *attica* (Attica Mountain tea)	Greek endemic	Vulnerable - Greece
Sideritis syriaca subsp. syriaca (Cretan Mountain tea or Malotira)	Cretan endemic	Severely declined populations
Sideritis clandestina subsp. *clandestina* (Taygetus Mountain Tea) and subsp. *Peloponnesiaca* (Kyllini Mountain Tea)	Peloponnese, Greece	Confined to small geographical area

Table 4: Sideritis species under threat from overharvesting in the Balkan region

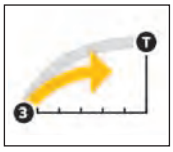
Implementing an innovative approach (Maloupa *et al.*, 2008, Grigoriadou *et al.*, 2020), the Balkan Botanical Garden of Kroussia (BBGK) of the Institute of Plant Breeding and Genetic Recourses of Hellenic Agricultural Organization-DEMETER has developed several species-specific propagation and cultivation protocols for all perennial *Sideritis* spp. found in Greece (10 taxa) (e.g. Sarropoulou & Maloupa 2015, 2017, Grigoriadou *et al.*, 2019). This approach aims to address both the long-term conservation and the sustainable utilisation of these valuable plant resources

Kazembe nursery group with Mulanje Cedar seedings

Field inventory of Jatamansi sample plot establishment, part of Darwin Initiative project (ANSAB)

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

Global progress



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.

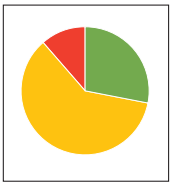
There is today a growing appreciation of the value of traditional knowledge. This knowledge is valuable not only to those who depend on it in their daily lives, but also to modern industry and agriculture as well. Many widely used products, such as plant-based medicines and cosmetics, are derived from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


BGCI

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

National implementation



This target was amongst those for which measuring progress was considered difficult in many countries. The adoption of the Nagoya Protocol has given added impetus to the need to document and record traditional knowledge and projects such as the UNDP-GEF Project *"Strengthening human resources, legal frameworks, and institutional capacities to implement the Nagoya Protocol"* (Global ABS Project) is providing assistance to countries in the national implementation of the Nagoya Protocol. One objective of the Global ABS project, is to strengthen the capacity of indigenous and local communities to contribute to the implementation of the Nagoya Protocol. This involves developing biocommunity/biocultural protocols and/or traditional knowledge registries with indigenous peoples and local communities in 22 countries.

Other initiatives to record information on indigenous and local knowledge and practices associated with plant resources include the publication of books and the recording of traditional knowledge in databases developed as part of plant collecting initiatives. In Ireland for example, a book called *"Ireland's Generous Nature: The Past and Present Uses of Wild Plants in Ireland"* has recently been published (Wyse Jackson, 2014). This is the first ever comprehensive account of the historical and present-day uses of wild plant species in Ireland.

(Robert Bye)

Box 36: Indigenous knowledge in Sierra Leone

In Sierra Leone, indigenous people are highly knowledgeable about plant species that occur in the vicinity of their villages and town. They depend on these naturally occurring plant resources as their key sources of survival - for food, medicine, housing materials etc. A number of ethnobotanical studies have been carried out, indicating a high degree of knowledge and dependence on plant resources by indigenous communities. Indigenous approaches to addressing problems of health is a well-known practice in many local settlements. Some of these traditional healers are being encouraged to increase the size of their living collections, which they maintain for the purpose of ease of access for medicinal purposes. However, they need financial support and resource management skills to ensure that their practices are sustainable. The support of government to the operations of traditional healers' associations and unions, is helping to conserve plant species used for traditional practices. In fact, these traditional healers now have district associations and a national union that are working towards ensuring that the plant resources that they use in their practices are sustainably harnessed. These associations and unions are registered with and supported by the local councils.

Information from Sierra Leone 6th National Report to the CBD. Available at: https://www.cbd.int/reports/

Box 37: Repatriation of local and indigenous knowledge

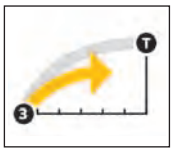
Repatriation of local and indigenous knowledge is a major research focus of the Missouri Botanical Garden's William L. Brown Center for Economic Botany in Bolivia, Peru and Madagascar. Over the past few years, traditional knowledge has been inventoried in joint research with indigenous counterparts in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

www.missouribotanicalgarden.org/plant-science/plant-science/william-l-brown-center.aspx

Ben Jones

TARGET 14: THE IMPORTANCE OF PLANT DIVERSITY AND THE NEED FOR ITS CONSERVATION INCORPORATED INTO COMMUNICATION, EDUCATION AND PUBLIC AWARENESS PROGRAMMES

Global progress



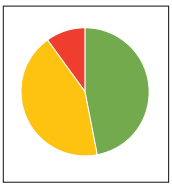
Plants are often under-represented in the conservation debate and neglected in efforts to engage the public in environmental action. Furthermore, increasing urbanization and population movements are resulting in a growing disconnect between people and nature, a trend that is especially notable amongst 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. However, there is still little evidence that plant conservation is being 'mainstreamed' and public awareness activities are not yet having the policy impact desired. The specific impacts of so called 'plant blindness' on issues such as the illegal wildlife trade have recently been reviewed by Margulies *et al.*, (2019) who consider not only broader plant blindness in society but also the practical and technological difficulties that plants pose for law enforcement and customs agencies addressing the illegal wildlife trade.

Considering that plant conservation is critical to many scientific breakthroughs, from more resilient food crops to more effective medicines, there is a clear need to focus greater efforts on achieving this target, and encourage more people to consider careers in plant science. Encouragingly, there is evidence that some initiatives are building a groundswell of support. Fascination of Plants Day (May 18) continues to grow in popularity with over 860 events held in 48 countries around the world in 2019. Organised under the umbrella of the European Plant Science Organisation, events are attended by a diverse range of people from all backgrounds and ages, and held at a variety of organizations including museums, universities, research institutes, schools and botanic gardens. The goal of the Fascination of Plants Day is to 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 other non-food products. The role of plants in environmental conservation is also a key message (https://plantday18may.org/).

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 (http://budburst.org/), Vigie-Nature in France (www.vigienature.fr/) and the Phenology Recording System of the New Zealand Plant Conservation Network (http://www.nzpcn.org.nz/).

Plant identification apps – such as PlantSnap and Pl@ntNet, and in China, the Flower Partner app, attract huge numbers of users (there are 1 million users of the Flower Partner app in China and 30 million PlantSnap app downloads) and are also helping to recreate the connections between people and plants.

National implementation



National reports indicate encouraging progress towards this target. Numerous initiatives have been developed, many taking innovative approaches, ranging from developing computer games to tackle tree health issues (CALEDON) to working with national space agencies (see Box 38).

Globally botanic gardens attract some 500 million visitors annually and are amongst the leading organisations implementing this target in most countries. 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 of 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.

The national reports indicate that botanic gardens are generally well versed in ways to get across the basic message that plants are important, using different techniques for different audiences and measuring their success through some kind of research or audience feedback.

In schools and formal learning programmes there is still a deficit in plant knowledge but many gardens are providing strong leadership to address this gap (e.g. eco-clubs, edible gardens, curriculum advice and modules).

Box 38: Growing Beyond Earth

The Growing Beyond Earth project is part of The Fairchild Challenge, an award-winning environmental science competition based in Miami, USA and led by the Fairchild Tropical Botanic Garden. In 2016, the project, which administers plant experiments for middle and high school students, was awarded $1.2 million by the National Aeronautics and Space Administration (NASA) to buy equipment for all participating schools. The students will test factors that might influence plant growth, flavor and nutrition in conditions mimicking the conditions aboard the International Space Station. NASA plans to use the students' results to identify edible plants that might be suitable for growth in space. The project helps to expand ongoing NASA research into a citizen science program for students, which includes experimental design, data collection and analysis, and a special emphasis on scientific communication.

www.fairchildgarden.org/nasa-challenge

Target 14 – issues to consider

While good progress may be being made engaging with peers in the environmental field, more impact is needed across society as a whole, and broadening the stakeholder base to include tourism, agriculture and other ministries will be required to bring about major policy changes.

There is also a need to reach out to specialist audiences outside the plant world - such as engineering (convincing them that plants offer a viable and sometimes better solution to 'concrete', that maintenance of a garden is as legitimate as a building or hard infrastructure maintenance, that diversity of planting is a good and sensible thing …). We need to find ways to engage with other disciplines and to help them make the change to a more environmentally sustainable approach.

Going forward, the great potential of social media to reach enormous audiences with plant conservation and other environmental messages still needs to be explored and can be expected to help achieve awareness and communication targets. Many botanical organisations are already reaching large audiences through their internet and social media presences. For example, in 2018, the Missouri Botanical Garden received 69 million 'hits' on its botanical science database 'Tropicos', as well as 32 million general webpage views, 19 million 'Gardening Help' views and it had 246,000 social media (Facebook, Instagram and Twitter) followers.

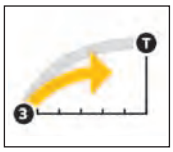
Box 39: Raising awareness to support Mulanje cedar conservation in Malawi

Public awareness has formed an important element of a conservation project in Malawi aiming to secure the future of the Mulanje cedar (*Widdringtonia whytei*). The species is Malawi's national tree and is endemic to Mulanje Mountain in South Eastern Malawi. Hundreds of thousands of trees used to exist on the mountain but as the timber is highly sought after (it is durable, termite proof, fragrant and can be used for carving) over-harvesting has led to the near extinction of this species on the mountain. Supported by the UK's Darwin Initiative, the very successful public outreach programme, which involved engaging the media at national and local levels, has generated support for Mulanje cedar conservation and restoration from Malawian corporations. As part of the outreach programme, Starfish Malawi, an organisation that links schools in the UK and Malawi, developed classroom teaching materials that were used in schools in both the UK and Malawi. The public outreach resulted in the project being featured in newspaper articles and on national TV and radio programmes. It also involved the development of a project 'jingle', announcements during local football matches, plays and public interviews with reformed loggers. The awareness generated has also achieved a policy outcome, with Mulanje Cedar now being listed on CITES.

Margarita Clarisa/Jiménez Bañuelos

TARGET 15: THE NUMBER OF TRAINED PEOPLE WORKING WITH APPROPRIATE FACILITIES SUFFICIENT ACCORDING TO NATIONAL NEEDS, TO ACHIEVE THE TARGETS OF THIS STRATEGY

Global progress



The scope of the GSPC goes beyond traditional plant conservation activities to include sustainable use, as well as working with local and indigenous communities and public outreach. The achievement of the 16 targets requires 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.

Progress towards Target 15 is considered key for the successful implementation of the GSPC. However available information suggests that progress is not sufficient to meet the target by 2020, and it is possible 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.

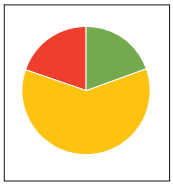
Recognising the widening gaps in capacity, organizations in the non-governmental sector (e.g. botanic gardens and other non-profit conservation organizations, as well as for-profit businesses and self-employed individuals) are stepping in, providing botanical training, expertise and infrastructure where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

Box 40: Sud Expert Plantes Développement Durable (SEP2D)

The SEP2D project aims to promote scientific research on plant diversity in 22 Francophone countries of the South. It provides support for capacity building and international cooperation, and particularly promotes research partnerships involving the private sector, civil society and policy makers. The project encourages multi-stakeholder projects as well as providing opportunities for North-South and South-South technology transfer. The SEP2D programme is supported by a multi-donor partnership composed of the French Development Agency (AFD), the French Global Environment Facility (FFEM), the French Ministry of Foreign Affairs and of International Development, the French National Research Institute for Sustainable Development and the National Museum of Natural History.

http://sep2d.org;
http://sep2d.org/partenaires/partenaires

National implementation



A number of countries note that no national assessments have been carried out to gauge the capacity needed to achieve the GSPC goals. It is therefore difficult to assess progress towards this target. Countries such as Indonesia, Malaysia and Madagascar with extensive plant diversity, often scattered over large areas, report insufficient capacity, and even in Europe, capacity gaps exist. For example, in Finland, it was noted that, due to budget cuts by the Finnish government, universities and other relevant organisations have not been able to employ the staff needed for plant conservation. As a consequence, the number of trained conservation, management and monitoring specialists in national and regional conservation authorities has diminished continuously during the 2000's.

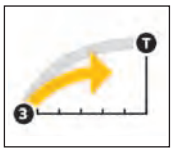
China on the other hand, is increasing its investment in training to support plant conservation. The National Forestry and Grassland Administration has organized training courses on wild plant monitoring, conservation and management techniques for the forest sector and botanical garden community every year since 2012. To date, about 1,600 conservation practitioners have been trained.

Box 41: Botanical capacity building in Switzerland

In Switzerland, as in other countries, biodiversity related courses and, specifically, the need for plant conservation, has almost disappeared in school, high school and University curricula. The major shortcoming in plant conservation is the creeping loss of knowledge in plant systematics and systematics in general due to the suppression of many professorships. In order to counteract this development, the Swiss Systematic Society (SSS) was founded in 2005. The SSS is a scientific society open to both professionals and amateurs. The basic objective of the SSS is to make sure that expertise in systematics is guaranteed in the long term in Switzerland. Some NGOs offer education programs or internships and collaborate more and more with Universities, but this can only partly compensate the gaps in official education. The Swiss Botanical Society has developed, in collaboration with Info Flora, a system of knowledge certification with regular and public certification exams. This system, implemented in 2012, has been very successful and seems to stimulate both course attendance and self-education.

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

Global progress

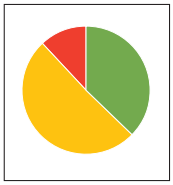


Networks supporting plant conservation activities provide the means to share experiences, exchange data, encourage professional development and build the capacity of the plant conservation community.

At the global level, the establishment of the GPPC has made a good start at bringing together the plant conservation community, and now includes over 60 partners (www.plants2020.net/gppcpartners/). However, greater efforts are still needed to engage other sectors, such as agriculture, industry, education, forestry, Indigenous and Local Communities etc.

International partnerships on thematic issues are essential to make rapid progress on addressing specific issues. The network of plant-focussed Specialists Groups of the IUCN Species Survival Commission has grown substantially over recent years and now includes 36 regional and taxonomic plant Specialist Groups. These Groups are available and willing to assist Parties with the implementation of plant-specific actions. Furthermore, the global botanic garden community consists of over 3,000 institutions, many of which active in plant conservation and linked through BGCI. Amongst these, BGCI is establishing a series of consortia with specialist knowledge of particular genera that are technically challenging to conserve and manage. Bringing together botanic gardens and arboreta, consortia have been set up for Acer, Rhododendron, Oak and Magnolia. The goals of the consortia align with the GSPC, prioritising species of greatest concern for action including conserving Endangered and Critically Endangered species in their natural habitats and in a network of *ex situ* collections. The consortia will also undertake research on a variety of issues affecting threatened taxa within the groups.

National implementation



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 (http://biodiversityadvisor.sanbi.org/planning-and-assessment/plant-conservation-strategy/).

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Box 42: The Global Conservation Consortium for Oaks

The Global Conservation Consortium for Oaks was initiated in 2015 between BGCI, Fauna and Flora International (FFI) and The Morton Arboretum. The project's aim is to prevent extinctions and ensure healthy populations of oak species for the future. This is accomplished by identifying and prioritizing threatened oak species and integrating tailored *in situ* protection and management activities in coordination with genetically diverse *ex situ* collections of living trees. The Partnership supports oak conservation in three regional oak diversity hotspots: Mexico & Central America, the United States, and China & Southeast Asia.

http://globaltrees.org/projects/global-oak-conservation-partnership/

A review of the existing networks available to support GSPC implementation in Brazil was carried out by Dalcin and Wyse Jackson in 2018. The approach used the Brazilian National Biodiversity Strategies and Action Plans and other key documents to identify and map institutions, roles and actions related to each of the GSPC targets. The visualization showed that some GSPC targets were supported by an effective network of institutions (Figure 12), but other GSPC targets (Figure 13) lacked proper support. This visualization approach may be useful to indicate gaps, opportunities for new actions and areas where network linkages may be extended to achieve the GSPC targets more fully in other countries too.

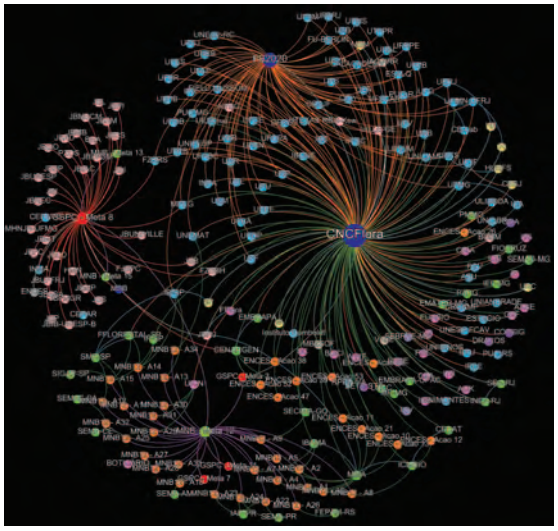

Figure 12: The GSPC Target 2 network visualization shows an initiative dedicated to achieving this target, the National Center for Flora Conservation - CNCFlora. Sharing with the Flora of Brazil initiative the technical support of universities and research institutions, the network also shows a significant amount of technical and data flow.

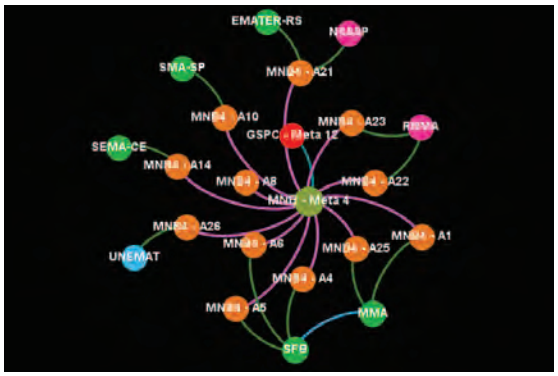

Figure 13: GSPC Target 12 is the simplest graph of all Brazil's Targets. The simplicity of this graph probably relates, at least in part, to a lack of knowledge about the degree to which many plant-based products are currently being sourced sustainably, used for food, medicine, timber and other purposes. Nevertheless, it is probably the case that this target is also amongst those where the least progress has been made in its achievement.

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DISCUSSION


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The Global Strategy for Plant Conservation (GSPC) has been widely adopted, particularly by the botanic garden community, and while it is unlikely to achieve its ultimate goal of halting the loss of plant diversity by 2020, it has achieved many successes, not least in allowing and facilitating many individuals and organisations from the botanical community to engage with the CBD and to contribute to the achievement of its objectives, targets and priorities. In focusing efforts around a set of easily understood, common targets, significant progress has been made in a number of areas, including the likely achievement of a World Flora on-line by 2020 (Target 1) and accelerated progress in plant red listing (Target 2), issues that underpin and support the achievement of many other targets.

The GSPC has also played an important role in helping to broaden the base of plant conservation activities worldwide, including increasingly sophisticated and effective responses to the growing threats to plant diversity and natural habitats. This has allowed and encouraged the development of new programmes related to plant conservation in such areas as conservation biology, conservation genetics, ecological restoration, climate change and mitigation, species recovery, the conservation of traditional knowledge relating to plants and in other areas.

However, significant challenges have also been presented, particularly in relation to reporting and data management. As the GSPC targets were originally developed before the Aichi targets, the two sets of targets are not well aligned. As a result, some activities focussed on the GSPC targets do not directly link to Aichi targets and the results obtained may be only poorly captured in NBSAP reporting, which is generally focused around the Aichi targets. Furthermore, reporting templates for GSPC targets are not available to collect data in a similar format across countries and indicators of progress are still lacking for some GSPC targets.

While GSPC implementation has had considerable success in developing new global datasets, mechanisms to ensure that information from these datasets feeds back to national programmes are not well developed. This is particularly an issue where there are inter-dependencies between targets, and lack of progress on Target 2 for example, constrains progress on Targets 7 and 8. Furthermore, in many countries there is lack of coordination and information sharing across sectors (e.g. between agriculture and environment, and between government and non-governmental bodies), which constrains both efficient implementation and accurate reporting of progress.

To be truly successful, the scientific contribution of key players needs to be strengthened, as does government policy, commitment and implementation measures. Botanic garden research to underpin conservation action, including the role of botanic garden horticulture, training and international capacity building, has a major part to play and needs to be better understood and better communicated. Government policy, at national and international levels, needs to reflect the fundamental importance of plant diversity in maintaining the biosphere and supporting humanity (Blackmore *et al.*, 2011; Smith 2016).


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Government commitment to achieving plant conservation goals through the development of national plant conservation strategies has been demonstrated by relatively few countries. However, the development of such strategies has been shown to provide an important mechanism to bring together the wide range of stakeholders involved in plant conservation at the national level. In the case of South Africa for example, the strategy was developed under the leadership of SANBI, the focal point for the implementation of the GSPC nationally with support from the Botanical Society of South Africa (BotSoc). Through the development of this strategy a network of botanists was developed that includes conservation agencies, non-governmental organisations (NGOs) and academic institutions. It is this strong network that will ensure that South Africa's Strategy for Plant Conservation is implemented by 2020. South Africa's experience in ensuring the conservation of their extensive and unique plant diversity also provides lessons for others. For example, in ensuring *in situ* conservation, the approach is not only to work on a species-by-species basis, but also to include a focus on comprehensively assessing which plants are priorities for conservation, mobilising the spatial data on where these taxa occur and feeding this information into the decision making processes for the country. This is primarily important in determining where protected areas are expanded and influencing the use of land to prevent transformation of remaining habitat occupied by plants of conservation concern.

The commitment of significant new resources is an essential prerequisite for success, but this needs to be well coordinated, inclusive of all stakeholders and carefully targeted. A further challenge is the need to integrate better the plant diversity-related activities of what are currently diverse and disconnected sectors, including agriculture, forestry, protected area management and botanic gardens (Blackmore *et al*. 2011). In this context, megadiverse countries face particular sets of challenges (e.g. Eline Martins *et a*l. 2017).

Ben Jones

LESSONS LEARNED

Implementation of the GSPC to date has highlighted a number of issues which will be addressed in taking the GSPC forwards beyond 2020.

Most importantly is the need to ensure plant-specific targets are closely embedded in the post-2020 biodiversity framework and well aligned with the higher level post-2020 biodiversity targets. This will ensure that implementation clearly contributes to the overall biodiversity work programme and there is no additional reporting burden for countries. However, at the same time as ensuring close alignment with the overall biodiversity framework, to ensure the continued commitment of the botanical community, it will also be important for the plant targets to have certain degree of visibility within this framework.

It is clear that most progress has been made with those targets that are SMART and which have a committed community working together to achieve the target. The focus for future targets will therefore be to ensure not only that they are they are SMART, but that they also have well identified indicators and means of measuring progress.

It is important to recognise inter-dependencies between targets and use data generated for one target to support the implementation of other targets

At the national level, good progress has been associated with having dedicated champions for each target driving the work forward, as well as active NGOs and public support through citizen science programmes with dedicated plant conservation volunteers.

LOOKING TO THE FUTURE

It is clear that plant resources and wild habitats will require increasingly active management, including protection of remaining natural and semi-natural lands, as well as the restoration of natural capital, including ecological restoration and species recovery. Safeguarding the components of biodiversity, both *in situ* and *ex situ*, will also play a part in ensuring not only that this biodiversity and associated ecosystem services remain available to support present-day and future use, but also that such biodiversity will be available for restoration and management purposes.

Redefining the objectives and targets of the GSPC beyond 2020 up to 2030 is an essential part in continuing to engage the thousands of scientists, citizen scientists, ecologists, horticulturists, educators and activists around the world needed to achieve such targets. While strong support for a continued GSPC beyond 2020 has been expressed in a number of fora and by a wide range of Parties and institutions, it is clear that such a Strategy must be more closely embedded within the post-2020 biodiversity framework than the existing Strategy.

A new set of draft GSPC targets for 2021-2030 have therefore been developed by the GPPC, at the request of a CBD Liaison Group meeting on the GSPC held in Cape Town, South Africa in August, 2018. These draft global targets aim to build on the experience with the present Strategy, and while maintaining a focus on the key aspects of the present GSPC, the proposed new targets of the GSPC also incorporate a number of new elements.

These include the need for recovery plans as a prerequisite for successful conservation; a focus on conservation in urban areas, alleviating poverty and addressing economic development; a greater emphasis on integrated conservation, with *ex situ* conservation being closely linked to recovery and restoration programmes; and compliance with the Nagoya protocol, but focusing on ensuring access to plants for conservation, scientific research and sustainability.

The revised draft GSPC targets aim to be approachable, concise and clear, addressing specific goals in a measurable way. They include conservation at both species and ecosystem level and take into account the importance of plants for people, especially in relation to sustainable use, ecosystem services and the impacts of climate change. The targets are thought to be ambitious but realistic, and aim to make a real contribution to the achievement of the post-2020 biodiversity agenda. The draft targets were discussed at the Global Forum on the GSPC which was held in China from 28-30 October, 2019, organized by the China Wild Plant Conservation Association (CWPCA) and further consultations on the post-2020 targets are on-going.

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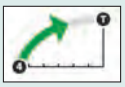
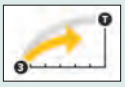
ANNEX 1: OVERVIEW OF PROGRESS IN ACHIEVING THE GSPC TARGETS AT GLOBAL AND NATIONAL LEVEL

Key

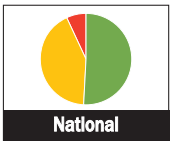
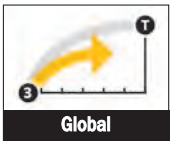
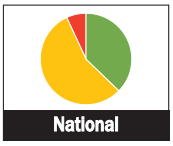


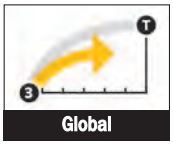
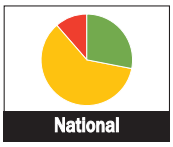
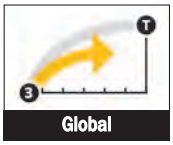
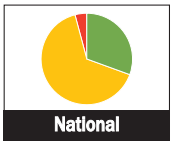
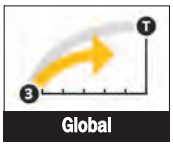
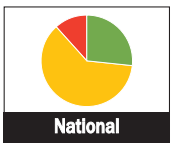
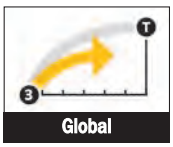
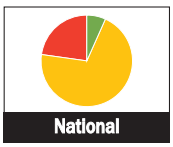
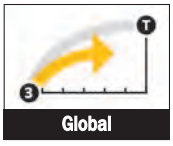
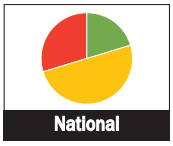
On track to achieve target

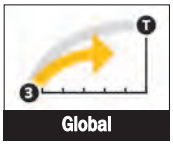
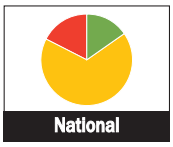
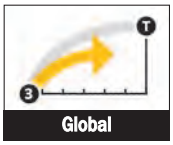
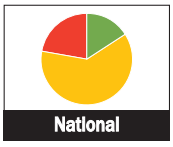
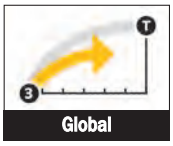
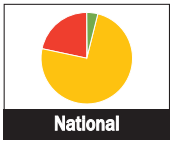
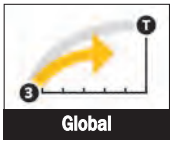
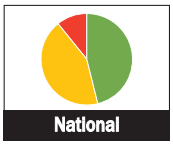
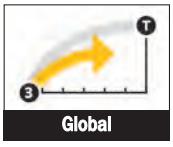
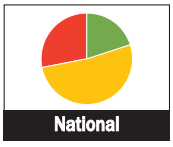


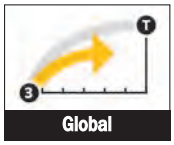
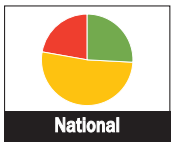
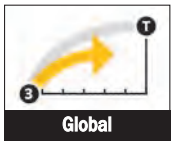
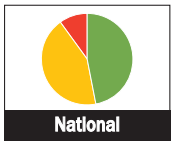
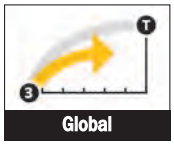
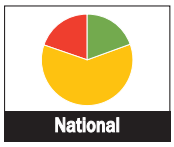
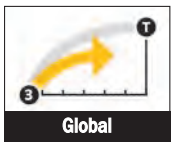
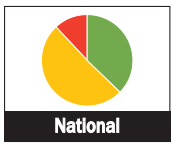
Progress towards target but not to achieve it

Pie charts show the percentage of countries that reported (i) being on track to achieve target (green), (ii) making progress but not sufficient to achieve the target (yellow) or (iii) making no progress towards the target (red), as reported though 6th national reports to the CBD

GSPC Target	Progress	Overview of current status
Target 1: An online flora of all known plants	 	Good progress is being made towards this target at both global and national levels. At the global level, the target is considered achieved, with the World Flora Online (WFO) website being available for searching at: http://worldfloraonline.org/. This currently includes 1,325,205 names, 350,510 accepted species, 55,272 images, 129,400 descriptions, 31,683 distributions and 1,154,754 references. The WFO project will continue beyond 2020 as new records are continuously added. Updating of the taxonomic backbone will also be an on-going process as the understanding of the relationships among plants continues to be refined. Many countries are on track to meet this target at the national level, including a number of megadiverse countries **Relates to Aichi Target 19: Knowledge improved, shared and applied**
Target 2: An assessment of the conservation status of all known plants as far as possible, to guide conservation action	 	Global conservation assessments listed by IUCN are available for little more than 10% of known plant species of which 41% are threatened with extinction. The ThreatSearch database developed by BGCI and partners includes over 340,000 assessments representing more than 180,000 taxa covering global, regional and national assessments. The results to date show that one third of the species that have been assessed are threatened at some level. **Relates to Aichi Target 19: Knowledge improved, shared and applied**

GSPC Target	Progress	Overview of current status
Target 3: Information, research and associated outputs and methods necessary to implement the Strategy developed and shared	 	While many methodologies have been developed, much relevant information lies in unpublished reports and manuscripts, not easily accessible to practitioners. An on-line toolkit has been developed and is available in all 6 UN languages. This provides a platform for sharing information, methodologies and resources: www.plants2020.net. At the national level, a number of areas where further tools and resources are required have been identified. **Relates to Aichi Target 19: Knowledge improved, shared and applied**
Target 4: At least 15% of each ecological region or vegetation type secured through effective management and/or restoration	 	Much of the focus of the plant conservation community is on the restoration element of this target, with members of the Global Partnership for Plant Conservation (GPPC) contributing scientifically to recent large-scale ecosystem restoration efforts including the African Forest Landscape Restoration Initiative (AFR100) Initiative and the Great Green Wall across the African Sahel. The establishment of the Ecological Restoration Alliance of Botanic Gardens has brought together partners with a focus on the use of native species in restoration, drawing on the horticultural and propagation skills of botanic gardens. www.erabg.org/. **Relates to Aichi Target 11: Protected areas and Aichi Target 15: Restoration**
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	 	Guidelines to support the identification of IPAs have been developed and an on-line database of IPA sites and projects is available: https://www.plantlife.org.uk/international/important-plant-areas-international. IPAs have now been identified across large sections of Europe, Africa and the Middle East with 1,994 IPAs in 27 countries identified and documented to date. In some countries, IPA networks have been integrated into national conservation planning and monitoring schemes. **Relates to Aichi Target 11: Protected areas**
Target 6: At least 75% of production lands in each sector managed sustainably, consistent with the conservation of plant diversity	 	This Target is achieved mainly through broader land-use initiatives. 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 and there needs to be more cross-sectoral collaboration. **Relates to AichiTarget 7: Sustainable agriculture, aquaculture and forestry**
Target 7: At least 75% of known threatened plant species conserved *in situ*	 	The number of 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 difficult to measure. However, rapid progress in the Global Tree Assessment under Target 2 has resulted in the collection of a significant amount of data related to the world's tree species. Of the species analysed, 11,003 are threatened either nationally or globally, and of these, 71% can be found in at least one protected area. At the national level, progress towards this target is closely linked to progress with Target 2. **Relates to Aichi Target 12: Extinction prevented**

GSPC Target	Progress	Overview of current status
Target 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	 	The combined living plant collections of the world's botanic gardens include around 30% of all known plants and 41% of known threatened plant species. However 93% of these species are held in the Northern Hemisphere and an estimated 76% of species absent from living collections are tropical in origin. Furthermore, over half of endemic threatened species are not held *ex situ* within their country of origin, implying reduced availability for ecological or species restoration. At the national level, many countries, particularly those with a high level of plant diversity, have found this target challenging due to lack of capacity to maintain or store large numbers of plant species *ex situ*. **Relates to Aichi Target 12: Extinction prevented**
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	 	According to the latest reports, there are some 7.4 million accessions of Plant Genetic Resources for Food and Agriculture (PGRFA) stored in 1,750 genebanks around the world. However, the material held in these crop genebanks is overwhelmingly of domesticated origin, with wild species being significantly under-represented. At the national level, one of the major challenges is to identify the many thousands of species that are of socio-economic importance as well as managing the indigenous knowledge associated with these species. At the individual crop level, a number of countries report that significant efforts are underway to conserve CWRs or other species that have a special significance in their countries. **Relates to Aichi Target 13: Genetic diversity maintained.**
Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded	 	Increasing global trade and the multiple pathways of introduction represent a major challenge to preventing new biological invasions. Applying preventative measures requires action by multiple stakeholders at both international and national levels. Actions taken by many countries include the establishment of inventories of invasive plant species and the development of national strategies on alien invasive species. Some issues that have been raised at the national level are the need for capacity building for customs and quarantine officers and enhanced public awareness. **Relates to Aichi Target 9: Invasive alien species prevented and controlled**
Target 11: No species of wild flora endangered by international trade	 	This target is unique in the context of the GSPC in that its implementation, monitoring and review is through linkages with CITES under its Plants Committee. Traditionally the plants covered by CITES have been ornamental (such as orchids and cacti) threatened by commercial collecting from the wild. However, more attention is now being focused on the major commercial groups of internationally traded species such as timbers and medicinal plants. Around a third of countries reporting on this target, have reported progress sufficient to meet the target by 2020. **Relates to Aichi Target 4: Sustainable consumption and production**
Target 12: All wild harvested plant-based products sourced sustainably	 	Up to 90% of plant species in trade with medicinal or aromatic uses are wild collected. Of the 7% that have been assessed, 1 in 5 are threatened with extinction. The FairWild sustainable harvest certification scheme has been operational since 2010. So far, 25 species have been certified from more than ten source countries. A certification scheme is also offered by the Union for Ethical Biotrade (UEBT) which requires practices that respect biodiversity and reduce biodiversity loss. At the national level. countries report difficulties with monitoring progress towards this target with information on existing harvesting levels not available, and limited scientific data on 'safe' levels of harvesting.

GSPC Target	Progress	Overview of current status
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	 	There is a growing appreciation of the value of traditional knowledge, not only to those who depend on it in their daily lives, but also to modern industry and agriculture. While the adoption of the Nagoya Protocol has given added impetus to the need to document and record traditional knowledge, progress towards this target is difficult to measure as baselines have not been quantified. A wide range of initiatives have been developed at national and local levels, including developing bio-community/ biocultural protocols and/or traditional knowledge registries with indigenous peoples and local communities, the publication of books and the recording of traditional knowledge in databases developed as part of plant collecting initiatives. **Relates to Aichi Target 18: Traditional knowledge respected**
Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes	 	Engaging the public in new and innovative ways is key to raising awareness of plant conservation issues. Although there is still little evidence that public awareness activities on plant conservation are having the policy impact desired, citizen-science projects focused around plant monitoring are increasing in popularity. Furthermore, plant identification apps are attracting huge numbers of users globally. National reports indicate significant progress towards this target in some countries with numerous innovative initiatives being developed, from computer games to tackle tree health issues to working with national space agencies. **Relates to Aichi Target 1: Awareness increased**
Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy	 	Progress towards Target 15 is considered key for the successful implementation of the GSPC. However available information suggests that progress is not sufficient to meet the target by 2020, and it is possible 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. A number of countries note that no national assessments have been carried out to gauge the capacity needed to achieve the GSPC goals. **Relates to Aichi Target 19: Knowledge improved, shared and applied**
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	 	At the global level, the establishment of the Global Partnership for Plant Conservation (GPPC) has made a good start at bringing together the plant conservation community, and now includes some 58 partners (www.plants2020.net/gppcpartners/). However, greater efforts are still needed to engage other sectors, such as agriculture, industry, education, forestry, Indigenous and Local Communities etc. 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. **Relates to Aichi Target 19: Knowledge improved, shared and applied**

ANNEX 2: THE AICHI TARGETS OF THE CBD'S STRATEGIC PLAN FOR BIODIVERSITY 2011-2020

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

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

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

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

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

Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

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

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

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

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

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

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.