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81

# PLANT CONSERVATION REPORT 2014:

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

Convention on Biological Diversity

United Nations Decade on Biodiversity 2011-2020

BGCI Plants for the Planet

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# PLANT CONSERVATION REPORT 2014:

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

A contribution to the mid-term review of the Strategic Plan for Biodiversity 2011-2020 and the fourth edition of Global Biodiversity Outlook.

Convention on Biological Diversity

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BGCI Plants for the Planet

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# FOREWORD

It is impossible to overstate the importance of plants in the life of our planet. The process of photosynthesis is the fundamental way in which the energy of the sun is harnessed. Food and fossil fuels are just two of the benefits flowing to us from photosynthesis. From within the huge diversity of wild plants, estimated to number around 400,000 species, we have selected and domesticated only a small percentage. Just three crops: maize, rice and wheat provide 40% of the calories we consume. Thousands more are harvested from the wild to meet demand for food, fibres, medicines and other products from nature. But the bounty of plants goes far beyond commodities: the water cycle, carbon cycle and countless other processes in nature depend upon the rich diversity of vegetation. Without plants maintaining and renewing the biosphere, there would be no place in it for us.

Why then do we neglect the Earth's green inheritance, allowing old growth forests to be converted to mere plantations, permitting once common species to become rare and driving others into extinction? Perhaps, in a world of 7 billion people, where more than half of us live in cities, we have simply forgotten how the world works.

This timely report on the status of the world's wild plants comes as an urgent reminder of their significance and role in nature. It makes no claim of being encyclopaedic, but presents a snapshot of the current state of affairs in a rapidly changing world. What it shows is that there is much to be concerned about, but also that we have much to celebrate. Our planet is still home to large tracts of forest and grasslands with many of its most outstanding wild places benefitting from designation as biosphere reserves or other kinds of protected area. Our exploration of nature remains incomplete, we continue to discover new plants, some with direct value to us, and all with a part to play in the web of life. Yet, in too many places, even protected areas are threatened by development or the illegal exploitation of natural resources. Climate change adds enormously to such challenges and, with food security and poverty alleviation, is a defining issue our times. By locking away carbon, creating carbohydrates, liberating oxygen and sustaining life, plants are a vital part of the solution to all of these great challenges. As the report highlights, there are many inspiring examples of plant conservation and ecological restoration from which we can learn.

Today, we continue to lose plant diversity with almost casual disregard. We cannot afford to watch from the sidelines. To create the more equal and sustainable world envisaged in the post-2105 development agenda and the 2050 vision of the Strategic Plan for Biodiversity 2011-2020 requires us to invest in securing continuity in the silent work of plants. We do know how to do this. We commend the authors of this report on their skill and expertise in compiling it and hope that by reminding us why we call environmental issues "green" they secure a more active commitment to plants.

**Stephen Blackmore**
Chair of BGCI

**Braulio Ferreira de Souza Dias**
Executive Secretary of the
Convention on Biological Diversity

# EXECUTIVE SUMMARY

Plants are essential for all life on earth. The uptake of carbon dioxide, one of the principle greenhouse gases, during photosynthesis is the major pathway by which carbon is removed from the atmosphere and made available to humans and animals for growth and development. Plant diversity also underpins all terrestrial ecosystems and these provide the basic life-support systems on which all life depends.

Wild plants are also vitally important in supporting livelihoods for millions of people around the world. The most significant is timber, with wood removals from forests being valued at over US$100 billion annually between 2003 and 2007. Other important wild plant products include fuel wood (valued at US$7 billion in 2005), food (non-cultivated plants are especially important in enhancing dietary diversity and combating micro-nutrient deficiency), medicine (global exports of medicinal plants were valued at US$2.2 billion in 2012) and raw materials for cosmetics. A number of plant species are also harvested from the wild for ornamental purposes providing an important source of income for rural communities. However, the unregulated exploitation of wild plants can put severe pressure on populations and even threaten the survival of species. Greater efforts are required to ensure the sustainability of wild harvested plant products.

Despite the importance of plants, the total number of species in existence is not yet accurately known. Plant scientists estimate that there are around 400,000 species, but with an average of 2,000 new species being discovered and described every year, and a possible 10-20% of flowering plants as yet unknown to science, this number may still grow.

The first consolidated list of the world's plants (The Plant List) was completed in 2010 and now includes over 350,000 accepted plant names. Building on the knowledge gained in producing The Plant List, efforts are now focused on the development of a World Flora Online by 2020.

Despite not knowing all the world's plant species, we do know that they are unevenly distributed across the globe, with the majority of plants being found in the tropics. Many plant species are restricted in range with a significant number being single country endemics. Islands have particularly high numbers of endemic plants and are home to 35% of the world's plants.

Plant diversity is under increasing threat from the combined effects of habitat loss, pollution, invasive species and climate change. Although this crisis is a reality, the scale of the problem is not yet clear and there is no list of globally threatened plants. Estimates suggest that at least one in five of all plant species are under threat of extinction.

The Global Strategy for Plant Conservation (GSPC), adopted by the Convention on Biological Diversity in 2002 and updated in 2010 provides the overall framework for plant conservation at the global and national level. It consists of 16 output-oriented targets covering all aspects of conservation and sustainable use of plants. A number of countries have developed national responses to the GSPC, including several mega-diverse countries (e.g. Brazil, China, Mexico and South Africa). Other countries are implementing the GSPC through their National Biodiversity Strategies and Action Plans (NBSAPs). Implementation of the GSPC provides a direct contribution to the achievement of the CBD's Strategic Plan for Biodiversity 2011-2020 and the associated Aichi targets.

**This report provides a review of progress towards the 16 targets of the GSPC. It shows that progress is being made towards all the targets, but generally not at a sufficient rate to achieve the targets in full by 2020. Lack of information on the distribution and conservation status of plants constrains efforts to conserve plants effectively, both *in situ* and *ex situ*. Furthermore, as the threats to plant conservation increase, botanical capacity and funding for plant conservation are decreasing in many parts of the world. Having said this, the GSPC is generally recognised as a successful strategy. It has stimulated the development of new initiatives at both national and global level and has helped to focus the attention of the biodiversity community on the importance of plants.**

**Although encouraging progress is being made in some areas towards conserving and sustainably using wild plants, these efforts are not enough. Activities are still constrained by a general lack of recognition of the importance of plants and the insufficient allocation of resources for their effective conservation. It is essential that CBD Parties and other Governments further engage with partner organizations to make the best use of available expertise and find ways to fully involve indigenous and local communities and the widest range of stakeholders, to enhance plant conservation and ensure full implementation of the GSPC.**

# 1 . INTRODUCTION

Plant diversity is an essential component of the biosphere and underpins societal development worldwide. Our basic needs are supplied by plants. Plants provide the world's oxygen and produce the biochemical components for all food. Despite global development and the increasing sophistication of agriculture, horticulture and forestry, wild plants still provide a huge diversity of products of subsistence and financial value. Millions of people around the world depend directly on wild plant resources for at least part of their livelihoods, be it for food, medicine, building materials, fuelwood or financial income.

This report provides a snapshot of the status and importance to humankind of the world's plant diversity. We highlight examples of the livelihood values of wild plants with recent data on the financial value of wild plant resources wherever possible. Information on the value of plants is drawn mainly from a literature and internet survey.

Although the world's flora is of immense importance, plant species are under threat globally as a result of habitat transformation, climate change, over-exploitation, pollution and the impact of invasive alien species. The Global Strategy for Plant Conservation (GSPC) provides an overall framework to address this situation through measures at the global and national level. The Strategy, with its 16 output-oriented targets was originally adopted by the Parties to the Convention on Biological Diversity (CBD) in 2002, marking the first ever internationally agreed targets for biodiversity conservation. In 2010, updated GSPC targets for 2020 were adopted (A full list of GSPC targets is provided in Section 5).

The GSPC aims to halt the continuing loss of plant diversity. The vision of this essential Strategy states:

***Without plants, there is no life. The functioning of the planet, and our survival, depends on plants. The Strategy seeks to halt the continuing loss of plant diversity.***

***Our vision is of a positive sustainable future where human activities support the diversity of plant life (including the endurance of plant genetic diversity, survival of plant species and communities and their associated habitats and ecological associations), and where in turn the diversity of plants support and improve our livelihoods and well-being.***

As well as highlighting the value of plants, this report evaluates plant conservation progress in relation to the 16 targets of GSPC. The evaluation is based primarily on a mid-term review of progress towards the 2020 targets which was carried out in early 2014[1]. Further information has been extracted from the GSPC Toolkit[2] which provides resources and case studies in support of GSPC implementation and from related literature.

Implementation of the GSPC Targets directly supports the implementation of the Strategic Plan for Biodiversity 2011-2020 of the CBD and its 20 Aichi Targets (See Annex 1). Unless the GSPC Targets are met the Aichi Targets cannot be delivered because all life depends on plants.

# 2 . THE STATE OF THE WORLD'S FLORA

**Plants cover virtually all terrestrial regions of the earth with the exception of ice-covered regions and extremely arid lands. Plant species diversity represents millions of years of evolution and provides an important visible expression of biodiversity, giving character to ecosystems and shape to genetic diversity.**

***"To such an extent does nature delight and abound in variety that among her trees there is not one plant to be found which is exactly like another; and not only among the plants, but among the boughs, the leaves and the fruits, you will not find one which is exactly similar to another."***
Leonardo da Vinci.

## 2.1. HOW MANY PLANTS ARE THERE?

The total number of vascular plant species (flowering plants, conifers, ferns, etc.) in existence is not yet accurately known but is estimated to be in the order of 400,000 (Paton *et al.*, 2008). Of these, between 80,000 – 100,000 species are thought to be woody plants and trees, representing a quarter of all plants.

Despite the importance of plants to humankind, the first consolidated checklist list of the world's plants was only completed in 2010. This list was developed as a direct response to the GSPC, which called for such a list to be in place by 2010. The Plant List[3] provides a catalogue of plant names organised to show which names are accepted and which should be considered as synonyms. The Plant List currently includes 1,064,035 scientific plant names of species rank. Of these 350,699 are accepted species names, 470,624 are synonyms and 242,712 are names remaining to be resolved. Knowledge of the true number of plants existing in the world relies not only on completing the identification of synonyms amongst existing plant names, but also on further botanical exploration for new species in particular areas of rich plant diversity. Scheffers *et al.*, (2012) estimate that 10-20% of existing flowering plant species are still unknown to science.

**Box 1: Plant names**

Linnaeus named more than 9,000 plants including most major crops, medicinal plants and many important ornamentals. Charles Darwin bequeathed money to the Royal Botanic Gardens, Kew (RBG, Kew) for the development of the *Index Kewensis* a list of all flowering plant names from the time of Linnaeus, which is still compiled today. Building on this, the International Plant Names Index (IPNI) is the product of collaboration between RBG, Kew; The Harvard University Herbaria and the Australian National Herbarium. In the last ten years (2004-2013) over 21,000 new plant species names were published, which averages about 2,000 new species being discovered and described each year. In addition, in the last decade, nearly 2,000 new genera and over 3,000 infraspecific names were also added to the world's known flora. These figures exclude new taxonomic combinations and new taxonomic ranks.

*Source: www.ipni.org*

Drawing from the knowledge gained in producing The Plant List, Target 1 of the GSPC now calls for the development of an online World Flora by 2020 (Box 2).

***GSPC Target 1:***
***An online flora of all known plants.***

**Box 2: The World Flora Online – responding to GSPC Target 1**

The World Flora Online (WFO) project was launched at the 11th Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) in Hyderabad, India in October, 2012 where the COP adopted a decision welcoming the World Flora Online initiative. In January, 2013 the *Memorandum of Understanding on the World Flora Online*, was opened for signature. Up to the end of August 2014, 24 institutions and organizations had signed the MOU. A range of other institutions and organizations worldwide is also being invited to participate in the WFO Consortium. This represents a major step forward in developing a consolidated global information service on the world's flora.

The WFO will be an information discovery portal, bringing together floristic data on all known plant species that are currently available in various electronic formats. WFO will include baseline information on plant names, distributions, descriptions, and related information. It will provide a single consensus classification, and give the user expert guidance on reliability, accuracy and completeness. The WFO aims to primarily be a reference for conservationists. Currently a roadmap for the project is being prepared with planning of which elements should be included in the first release.

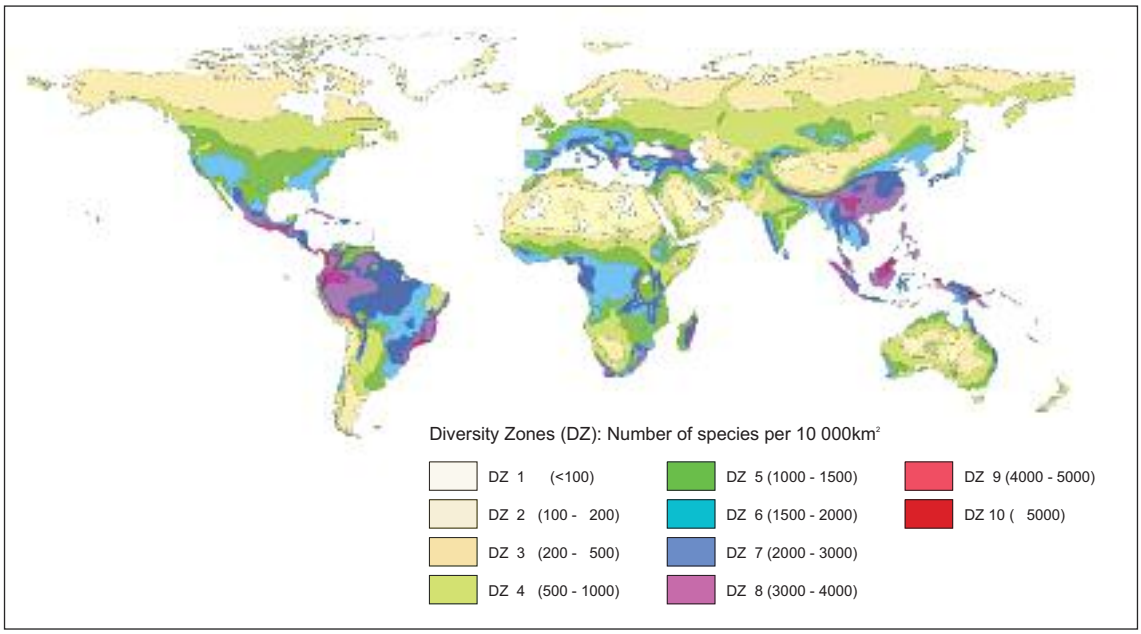
*Source: http://www.plants2020.net/world_flora/*

## 2.2 THE GLOBAL DISTRIBUTION OF PLANT DIVERSITY

Despite not knowing all the world's plant species, we do know that the world's plant diversity is unevenly distributed across the globe, with the majority of plants found in the tropics.

Areas of the world which have the greatest vascular plant species richness (higher than 3,000 species / 10,000 km$^2$) are the Chocó-Costa Rica region extending from NW South America through Meso-America; tropical eastern Andes and NW Amazonia, eastern Brazil, northern Borneo, and New Guinea, the Cape Region of South Africa, southern Mexico, East Himalaya, western Sumatra, Malaysia, and eastern Madagascar (Barthlott et.al, 2007).

*Figure 1: Geographic patterns of vascular plant diversity at continental to global scales (reproduced from Barthlott* et al.*, 2007)*



All these areas fall within the 34 areas which qualify as global biodiversity hotspots based on the concept originally proposed by Myers *et al*., (2000). To qualify as a hotspot an area must have at least 1,500 endemic vascular plants and 30% or less of its original natural vegetation remaining. These 34 global biodiversity hotspots represent only 2.3% of the Earth's land surface, but support more than half of the world's endemic plant species, including the majority of yet-to-be-described species (Joppa *et al* 2011a).

While, the majority of biodiversity hotspots and the vascular plant richness regions are within the tropics, other important areas for plant diversity are mainly located in Mediterranean climatic zones (Central Chile, Cape Floristic Province, Succulent Karoo, California Floristic Province, Mediterranean Basin and Southwest Australia). The Caucasus, New Zealand and the mountains of Southwest China are also home to important plant diversity.

Plants are not only unevenly distributed geographically but species are also uneven in their range sizes. The majority of plant species are restricted in ranges (Joppa *et al*., 2013). Species recently discovered are also often very range restricted (Joppa *et al*, 2011b). A plant unique to a specific geographical area is said to be endemic to that area. Often when we talk about endemics, we talk about endemics to a specific country or island (see Box 3).

### Box 3: The special case of islands

Islands have higher than expected values of endemism richness than mainland counterparts. The high endemism of islands is thought to be due to geographical isolation, both in terms of evolution in isolation and also the absence of certain competitors/predators/pests.

Islands cover about 5% of the Earth's land surface but have more than 35% of the world's vascular plant species. There are around 50,000 insular endemic plants of which 20,000 are estimated to be threatened with extinction. Of the 34 global biodiversity hotspots, 14 are islands, archipelagos or have an important insular component. Six other hotspots include offshore islands within their limits

*Source: Bramwell, 2011*

## 2.3. PLANTS UNDER THREAT

The preamble to the GSPC notes that:

*Of urgent concern is the fact that many plant species, communities, and their ecological interactions, including the many relationships between plant species and human communities and cultures, are in danger of extinction, threatened by such human-induced factors as, inter alia, climate change, habitat loss and transformation, over-exploitation, alien invasive species, pollution, clearing for agriculture and other development. If this loss is not stemmed, countless opportunities to develop new solutions to pressing economic, social, health and industrial problems will also be lost.*

The plant extinction crisis is a reality but the true scale of this is not yet clear. GSPC Target 2 therefore aims to address this gap:

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

Various attempts have been made to estimate the number of threatened plants on a global scale. 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. Unfortunately as noted by Vié *et al.*, (2009) the number of plant assessments on the Red List has increased very slowly compared to other taxonomic groups. By the end of 2013, only 6% of plant species had been assessed at the global level using the IUCN Red List categories and criteria. In addition, the taxa on the list are skewed both in terms of taxonomic and geographic coverage. An attempt to provide an objective overview based on a subset of the world's flora, is the Sampled Red List Index for plants undertaken by RBG, Kew and the Natural History Museum, London which indicated that 20% of the world's plants are threatened with extinction (Anon, 2012).

As an interim measure to support the achievement of GSPC Target 2, RBG, Kew is leading an effort to produce a list of plant conservation assessments by compiling existing datasets, including the IUCN Red List but also including assessments made on a national (or regional) level, and assessments made using other systems. The interim list of plant assessments (for 2013) includes 58,494 unique plant assessments (approx. 16% of all plants). Of these, 43% plants assessed are categorised as 'threatened' with extinction (Figure 2).

We are clearly still some way from reaching GSPC Target 2 and a complete global analysis of plant extinction on a species basis. However there is a presumption that certain

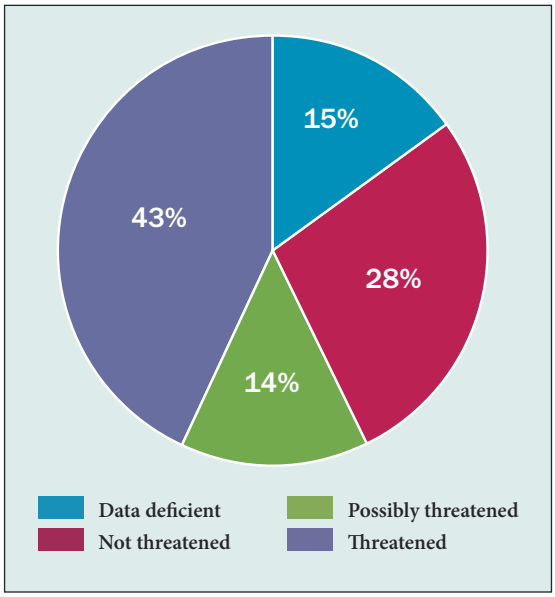



*Figure 2: Interim results of the global plant assessment (RBG, Kew)*

geographical regions i.e. the global biodiversity hotspots defined on plant endemism and habitat loss are areas of greatest plant extinction risk.

At a national level there has been good progress in red listing. According to an analysis of National Red Lists (NRLs) carried out in 2010, vascular and nonvascular plants were the most assessed of all taxonomic groups in NRLs, with vascular and nonvascular plants being assessed by 88% and 76% of countries with NRLs, respectively, although not always comprehensively (Zamin *et al.*, 2010). 96 countries presently have a national plant red list (Figure 3).

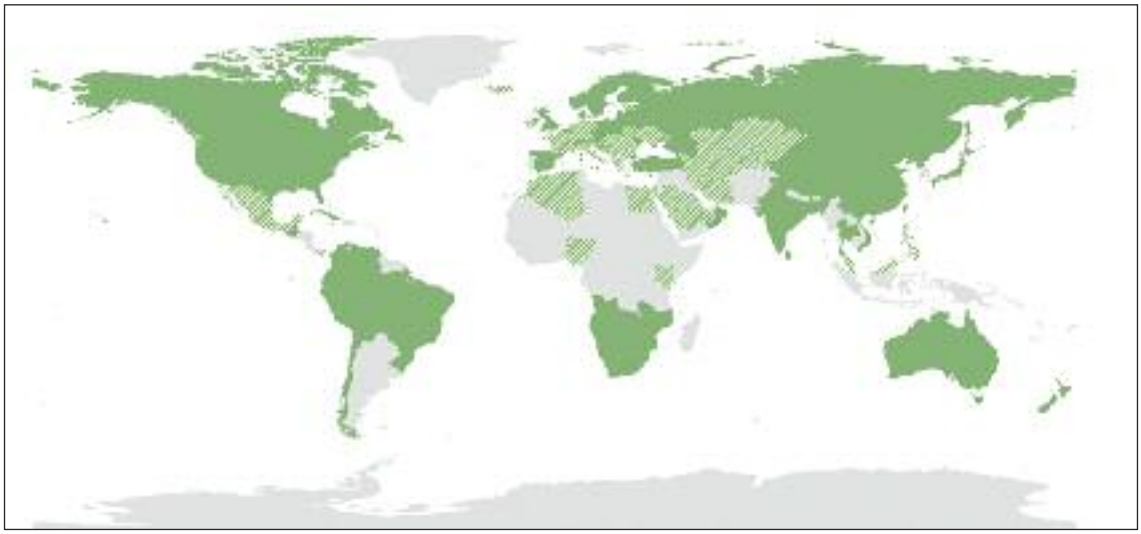


*Figure 3: Countries with national plant Red Lists (data from Zamin* et al.*, 2010 and www.nationalredlist.org). (Solid colour, countries with a national plant Red List updated since 2000 and hatched, countries with a Red List published before 2000).*

## Box 4: Red Listing in megadiverse countries

### South Africa

South Africa has the world's richest temperate flora with 20,456 recorded indigenous plant taxa. Of these, 65% are endemic to the country. In 2009, South African botanists completed comprehensive assessments of the country's flora using the *IUCN 3.1 Red List Categories and Criteria*, becoming the first megadiverse country to achieve GSPC Target 2. The results showed that nearly a quarter of the South African flora is considered either threatened with extinction or of conservation concern. Habitat loss is by far the most severe threat to South African plants.

*Source: http://redlist.sanbi.org*

### Brazil

Brazil has the world's richest flora with 43,448 recorded indigenous vascular plant taxa, of which 41% (17,9840 taxa) are endemic. Two of the world's biodiversity hotspots (the Atlantic rainforest and the Cerradao) are included within its borders. In 2011, in collaboration with the South African National Biodiversity institute (SANBI), the National Centre for Plant Conservation (CNCFlora) began the task of completing a comprehensive national assessment of Brazil's flora. The first step in this process was the assessment of 4,617 selected species. The results of this assessment work revealed the following:

- 45% of assessed species were categorized as threatened at some level;
- Habitat loss was considered the major threat for 87% of species;
- Nearly 15% of species assessed had at least one use ascribed to it in literature;
- Only 1% of threatened species has their total area of distribution within protected areas and 17% were distributed completely outside protected areas.

*Source: Red Book of the Flora of Brazil in 2013 (Martinelli and Moraes, 2013)*

### Colombia

The two-way partnership between South Africa and Brazil expanded in 2013 to include Colombia, a country with one the highest recorded number of plant species per unit area worldwide. A plan to assess the entire Colombian flora (ca 24,000 species) was developed during a workshop involving botanists from the Humboldt Institute, Colombia, CNC Flora and SANBI. This relationship will continue over the next two years with SANBI and CNC-Flora providing continuing support for Colombian plant Red List assessments.

### Madagascar

Madagascar, the fourth largest island in the world, is a global biodiversity hotspot. Madagascar has between 10,000 and 14,000 species of plants, 90% of which are endemic. For woody plants the degree of endemism is even higher at 96%. It has been estimated that Madagascar had already lost more than half its forests by 1950 and subsequently there has been a 33% reduction in forest area since the 1970s (Moat and Smith, 2007). Only an estimated 18% of Madagascar's primary vegetation remains.

Comprehensive Red Listing of Malagasy plants has not taken place but recent estimates suggest that 54% of Madagascar's flora as a whole is under threat, with risks being even greater for some groups – such as palms (83% threatened) and Pandanaceae (91% threatened).

*Source: Rakotoarinivo* et al.*, (2014) and Callmander,* et al.*, (2007)*

The cost of plant Red Listing for megadiverse countries has been estimated at around US$30 for Madagascar and South Africa and US$50 for Brazil. In South Africa the costs have decreased as Red List experience increases (Martinelli & Moraes, 2013). This suggests that other countries with rich floras should able to benefit from adopting similar cost-effective approaches to conservation assessments for plants.

# 3 . THE IMPORTANCE OF THE WORLD'S PLANTS

**Plants are an essential component of the biosphere. They use the sun's energy in the process of photosynthesis to capture carbon dioxide from the atmosphere and generate oxygen. Plant diversity also underpins all terrestrial ecosystems, providing vital life support systems for other forms of biodiversity, including humankind. This section explores the role wild plant species play in supporting human well-being – both as component parts of ecosystems and through providing direct livelihood support.**

***"Plants are not optional; they are essential to life and central to the future of human well-being."***
(Havens *et al.*, 2014)

## 3.1 WILD PLANTS AND ECOSYSTEMS

Collectively, the benefits ecosystems provide are known as ecosystem services and these can be grouped into four main areas (Millennium Ecosystem Assessment (MA), 2005):

- Provisioning (e.g. wild foods, plant-derived medicines, fresh water);
- Regulating (e.g. climate regulation through carbon storage, pollination);
- Supporting (e.g. nutrient cycling, photosynthesis);
- Cultural (e.g. spiritual, aesthetic and cultural benefits).

It is clear that wild plants, as the building blocks of ecosystems, make a significant, if not unique contribution to all these services. A study in 1997 estimated the total annual non-marketed contribution of ecosystems to human welfare at between US$16 - US$54 Trillion (Costanza *et al.*, 1997). More recently, The Economics of Ecosystems and Biodiversity (TEEB) report highlighted that nature provides trillions of dollars in 'free', life-supporting services to us each year (TEEB, 2010). However, as Salles (2011) indicates:

***"The total value of biodiversity is infinite, so having a debate about what is the total value of nature is actually pointless because we can't live without it."***

### Box 5: Wild plants and pollination

One of the essential ecosystem services that has received widespread attention is pollination. Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee (Klein *et al.*, 2007). In turn, animal pollinators rely on nectar and pollen from wild plants to survive. On a global scale, it has been estimated that the services that insect pollinators provide are worth around US$200 billion, which is 9.5% of the total value of the world's agricultural food production in 2005 (Gallai *et al.*, 2009). Insect pollination is also estimated to increase the yields of 75% of globally important crops and is responsible for an estimated 35% of world crop production (Klein *et al.*, 2007).

*Source: http://www.teebweb.org/wp-content/uploads/2012/10/Green-Economy-Report.pdf*

The societal benefits provided by wild plant species at the ecosystem level can be illustrated by looking at forest and grassland ecosystems, which together cover over 70% of the world's land surface.

### 3.1.1 Forest ecosystems

Tree species (of which there are an estimated 80,000) are the main biological components of forest ecosystems which cover some 31% of the world's land surface area. As such they provide critical ecosystem goods and services, including food, fodder, water, shelter, nutrient cycling, and cultural and recreational value. Forests provide habitat for a wide range of species supporting at least half of the Earth's terrestrial biodiversity (MA, 2005) including 80% of amphibian, 75% of bird and 68% of mammal species (Vié *et al*., 2009). It has been shown that tree species richness significantly influences richness in other species groups (Novotny *et al*., 2006).

Forest ecosystems play a major role in the Earth's biogeochemical processes, influencing hydrological, nutrient and carbon cycles, as well as global climate (MA, 2005). Forests contain about 50% of the world's terrestrial carbon stocks (FAO, 2010; MA, 2005), illustrating their importance for mitigation of climate change.

**Box 6: Conserving forests avoids greenhouse gas emissions worth US$ 3.7 trillion**

Halving deforestation rates by 2030 would reduce global greenhouse gas emissions by 1.5 to 2.7 GT $CO_2$ per year, thereby avoiding damages from climate change estimated at more than US$ 3.7 trillion in Net Present Value terms. This figure does not include the many co-benefits of forest ecosystems.

*Source: Eliasch 2009*

Forests contribute to the maintenance of good water quality by trapping or filtering water pollutants. They also minimize soil erosion and mitigate flash water flows that cause erosion downstream. As water quality levels around the world deteriorate and the cost of filtration facilities remains high, several municipalities have decided to invest resources in the conservation of water catchment areas, including protected forests.

Approximately 9 million people in New York City and nearby areas enjoy access to clean, inexpensive drinking water. About 90% of that water is drawn from the Catskill/Delaware watershed where the abundant forest reserves, as well as soil with adequate carbon levels, provides excellent conditions for natural filtration (WRI 2008).

The annual value of the ecosystem services provided by forests has been estimated at US$4.7 trillion, or 38% of the terrestrial total (Costanza *et al*., 1997). The estimated value of aesthetic and passive use of forest ecosystem services alone is US$280 million a year in the United States[4].

### 3.1.2. Grassland ecosystems

Grass species (of which there are an estimated 10,000) dominate the world's grasslands and prairies. Grassland ecosystems cover approximately 40% of the world's land surface area excluding Greenland and Antarctica and are found in every region of the world; Sub-Saharan Africa and Asia have the largest total area in grassland, 14.5 and 8.9 million $km^2$ respectively. Worldwide, these ecosystems provide livelihoods for nearly 800 million people.

Grasslands are home to many food grains - wheat, maize, rice, rye, millet, and sorghum - and they remain the primary source of genetic resources for improving our crops. Grasslands produce forage for domestic livestock, which in turn support human livelihoods with meat, milk, wool, and leather products. Grasslands provide habitat for breeding, migrating, and wintering birds;


*Chicago Botanic Garden*

ideal conditions for many soil fauna; and rangelands for wild herbivores. These ecosystems cycle water and nutrients, and build and maintain stabilization mechanisms for soil (White *et al.*, 2000).

Grassland vegetation, above and below ground, as well as the soil itself, serve as large storehouses for carbon, helping to limit global warming. Grasslands also supply energy, increasingly generated from windfarms that are proliferating in such areas.

***Grasslands store approximately 34% of the global stock of carbon in terrestrial ecosystems while forests store approximately 39%***
(White *et al.*, 2000).

The large open landscapes grasslands provide also support recreational activities such as hunting, wildlife-watching, and tourism more generally, and offer aesthetic and spiritual gratification. The economic contribution of grasslands through recreation and tourism, especially safari tours and hunting, can be high. However, excessive human use and wildlife poaching could decrease the capacity of grasslands to maintain such tourism services.

### Box 7: Restoring ecosystem services

The financial value of wild plant diversity is often not realised until it needs to be restored. In the US, the Bureau of Land Management's Plant Conservation Program aims to ensure sufficient native plant materials are available in the commercial market for restoring and maintaining the native plant communities on 655 million acres of land managed by the federal government; including sufficient quantity of native seed for emergency stabilisation and rehabilitation following a 15 million acre wildfire season. From 2001 – 2014, over US$70 million has been spent on this program. The Bureau of Land Management is working together with many different partners who have contributed over US$20 million towards this collaborative effort. A supply of over 1,000 native restoration species is being developed because native plant species stabilise soils and reduce erosion; they more effectively filter storm water than exotic plantings, thus improving water quality and supporting biodiversity including pollinators such as bees, bats and birds.

*Source: Peggy Olwell, 2014 pers. comm.*

## 3.2 WILD PLANTS AND LIVELIHOODS

Wild plants support human livelihoods worldwide but we do not yet have a full inventory of all the plants that are or could be utilised. We therefore do not know what we have or what we are losing.

The most significant wild plant contribution to livelihoods on a global scale is provided by timber.

### 3.2.1 Trees for timber and fuel

Globally, 3.4 billion $m^3$ of wood was extracted from forests in 2005 – not including the 100 million $m^3$ of illegally cut timber believed to be produced each year[5]. This timber comes from a mixture of planted forests, and managed natural forests (Figure 4).

***Wood removals from forests were evaluated at just over US$100 billion annually between 2003 and 2007[6].***

Only 7% of the world's forested land is planted forest (a category which includes afforested land as well as various plantation types) and some 1.4 billion of the 3.4 billion $m^3$ of wood removals recorded in 2005 is thought to have come from such sources[7].

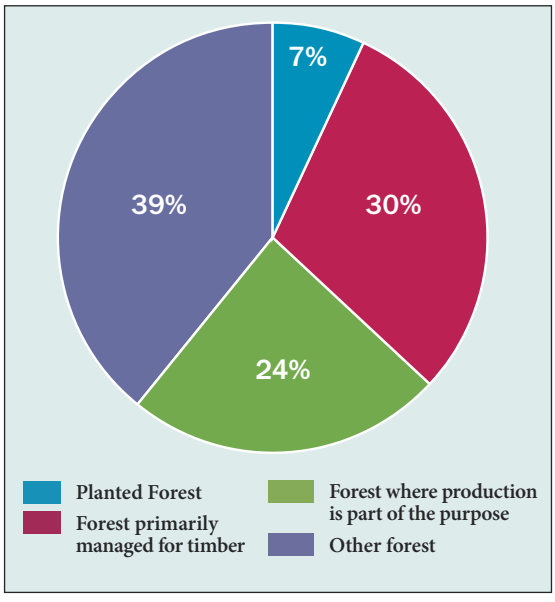



*Figure 4: Types of global forest cover.*

This means that around two thirds of all harvested timber comes from natural or semi-natural forests[8]. This is particularly true in the tropics. In 2011, the International Tropical Timber Organisation (ITTO) (whose member

countries are involved in 90% of the global tropical timber trade and hold 80% of the world's tropical forests) reported tropical timber imports worth US$13.6 billion, the majority sourced from natural forests[9]. Just 22.4 million ha. of the total 783 million ha. permanent forest estate (PFE) reported by ITTO producer countries in 2010 was planted, and more than half of the natural forest area was designated for production with 165 million ha. available for harvesting[10].

A recent list of commercial timbers traded internationally includes over 1,500 species (Mark *et al.*, 2014).

### Box 8: Artisanal logging in the Democratic Republic of Congo (DRC)

Estimates for the amount of forested land in the Democratic Republic of Congo vary widely, from 112 million ha. to 205.5 million ha. of tree cover, but it is believed to constitute two thirds of the remaining humid forest in tropical Africa. While much of the exploitation of this resource is on a commercial scale, the DRC's artisanal loggers and millers produce an estimated average of 3.4 million $m^3$ of logs a year, more than 13 times the output of the large concessions of the country's commercial timber sector. The 25,000 people directly employed in the artisanal sector in DRC produce more than a million $m^3$ of sawn wood, around 85% of which is bought on domestic markets which generate in excess of US$100 million per year. Importantly, local people benefit from the trade, to the tune of approximately US$50 million a year; it is not yet known, however, whether an expanded artisanal timber sector would lead to unsustainable exploitation of the forest.[11,12,13]

*Source: various – see notes*

As well as timber, trees continue to provide an essential source of energy for many communities. Despite the development of oil supplies during the twentieth century, fuel wood remains the most important single source of renewable energy, providing over 9% of global total primary energy supplies.

***The total reported value of fuel wood harvested in 2005 was US$7 billion (FAO, 2010).***

Wood energy is as important as all other renewable energy sources combined (hydro, geothermal, wastes, biogas, solar and liquid biofuels). Over two billion people depend on energy from wood collected from natural forests for cooking and/or heating, particularly in households in developing countries.[14]

### 3.2.2. Wild plants for food

Plants are essential for food production. The majority of our food needs are met from cultivated crops, with a small number having global importance – for example, seven plant species that provide wheat, sugar and rice are among the most significant contributors to *per-capita* calorie intake in 90% of countries around the world[15]. However, in addition, thousands of species are grown locally for food or used in traditional agriculture, some of them scarcely or only partially domesticated, and many thousands more are gathered from the wild (Heywood, 2011).

The importance of wild plants for food should not be overlooked: some are valuable traded commodities and at a local level, many species contribute directly to meeting people's nutritional needs and improving their food security. While much attention is rightly given to people in chronic hunger (which affected around one in eight people in 2011-13[16]), the significant dangers of the 'hidden hunger' of micronutrient deficiency (affecting around 30% of the global population[17]) must also be addressed. Wild foods can play a crucial role in preventing such malnutrition: one study in Tanzania found that wild foods contributed just 2% of the total energy in informants' diets, but 19% of the iron, 20% of the vitamin C, and 31% of the vitamin A[18]; another (looking at >93,000 children across 21 African countries) found that children had more diverse and nutritious diets in areas with more tree cover[19].

### Box 9: Edible nuts

The global market for edible nuts excluding groundnuts is projected to exceed 13 million tons by the year 2015, while world unshelled groundnut output could reach 39 million tons.

The majority of edible nuts are cultivated in plantations or orchards but some species are still harvested from the wild for international trade. The brazil nut *Bertholletia excelsa* is a well-known example. Global production of Brazil nuts in 2011 is estimated at 23,995 metric tons, a 9% decrease from the previous year, of which Bolivia accounts for 76% of total production, followed by Brazil with 8% and Peru with 7%. The Brazil nut is the most economically important plant product that is harvested sustainably from the Amazonian rain forest. Today, around 70% of the world's supply comes from the Pando region, an area that represents only 3% of the Amazon forest.

*Source: http://www.intracen.org/itc/market-insider/edible-nuts/#sthash.jVZxFlOd.dpuf and http://www.nutfruit.org/global-statistical-review_13608.pdf*

Detailed inventories of wild vegetables are rarely available at national level. Hundreds of species are used in countries such as Kenya, India and Ethiopia. Traditional leafy vegetables also remain important in Mediterranean countries such as France, Greece, Italy, Spain and Turkey. Over 90 wild vegetables have been catalogued in Crete; 419 edible wild plants recorded in Spain and over 40 wild food species are regularly harvested in Anatolian Turkey (Heywood, 2011).

By filling cyclical food gaps like the hungry season between harvests, and acting as a safety net in times of unexpected shortage, wild foods can play a major role in improving people's food security[20].

### Box 10: Counting the cost of micronutrient deficiencies:

Iron deficiencies mean two billion people worldwide are anaemic, impairing their growth, productivity and cognitive development, and increasing maternal mortality[21]. Iodine deficiencies in pregnancy cause 20 million babies a year to be born mentally impaired, lowering the average IQ in deficient areas by 10-15 points[22]. Vitamin A deficiencies affect 250 million preschool-aged children around the world: this causes up to half a million children to go blind each year, half of whom die within 12 months as a result of reduced immunity and increased rates of infection[23,24].

*Source: various – see notes*

The food and drinks industries have a significant interest in wild plants for product development and marketing. In recent years interest in wild species and associated traditional knowledge in these sectors has increased and is likely to be maintained as these help companies to market their products in competitive markets (Laird and Wynberg, 2012).

One species that has recently received increased global attention is the baobab, an iconic African tree that features in many stories and myths. Baobabs are extremely long-lived, and have a wide variety of traditional uses. The leaves, fruit, seeds and trunk are all utilized for diverse purposes including water storage, food, medicine, oils, cosmetics, rope and clothes. International interest is mainly in baobab as a nutritional supplement. Trying to define the global baobab market is very difficult as there are no published figures. Broadly, Aduna, an African-inspired health and beauty brand based in the UK, estimate the current market at around US$5 million at factory level and around US$50 million at consumer level with the potential to be worth at least US$500 million within the next few years.

***The global market for seasonings, spices and herbs is likely to exceed US$6.5 billion per year in the near future[25].***

## Crop Wild Relatives

Crop wild relatives (CWR) are wild plant taxa with relatively close genetic relationships to crop plants which make them valuable to agriculture[26]. 77 of the world's major and minor crops are believed to have around 700 close wild relatives, species which can be used readily as sources for desirable traits in crop breeding[27,28]. This potential makes CWR species extremely valuable. At present their contributions to the production chains of rice, wheat, potatoes and cassava are worth US$25 billion, and could potentially be worth US$73 billion in the future; for 29 crops with major importance to global food security[29] these figures rise to current and potential values of US$42 billion and US$120 billion respectively[30].

### Box 11: Wild relatives in the cultivation of yams

Yams (*Dioscorea* spp.) are an important staple crop around the world. They make significant contributions to the food supply of more than a dozen countries, particularly in West Africa, which accounts for 95% of global production. In Benin, around 5% of yam farmers exploit local CWR diversity in a process called ennoblement. Ennoblement involves farmers selecting wild yams with desirable traits and bringing them into cultivation over several years. Genetic analyses show that around a fifth of cultivated individuals are of wild or wild-cultivated hybrid origin, highlighting the role ennoblement plays in diversifying the genetic makeup of farmers' crops and increasing their adaptive potential. This is especially important as yams are a vegetatively propagated crop and there are few other opportunities for variation to be introduced.[31,32,33,34]

*Source: various – see notes*

Considering the significance of wild foods to food security and nutrition, and the value of CWR taxa to agriculture – especially as global food demand is set to continue rising until mid-century[35] – the importance of conserving wild plants for food cannot be overstated.

### 3.2.3 Wild plants for medicine

Plants have been significant parts of traditional medical systems for millennia, and these healthcare systems continue to be extremely important today. 100 million Europeans are thought to use traditional and complementary medicine; in 2008, out of pocket spending on natural products in the USA was US$14.8 billion; in China (where 90% of hospitals have a traditional medicine department) in 2009, there were 907 million visits to Traditional Chinese Medicine (TCM) institutions and 13.6 million TCM in-patients, equating to 18% of all visits and 16% of in-patients in surveyed institutions and in 2012, the Chinese *materia medica*, 80% of which is plant-based, was estimated to have an output of US$83.1 billion (Hawkins, 2008)[36].

Plants also play a major role in allopathic (or 'Western') medicine. Over a twenty year period (1981-2002), 61% of new pharmaceutical drugs (including 67% of cancer treatment drugs and almost 70% of anti-infectives) had novel chemical entities that were derived or inspired by natural chemicals[37] (although not necessarily all derived from plants), with a quarter of prescription medicines derived directly from flowering plants or modelled on molecules they contain[38]. With these uses in mind, it is unsurprising that the trade in plants for medicine is highly valuable.

***In 2012 global exports of plants whose use was primarily pharmaceutical were valued at US$2.2 billion[39,40], and in 2000 global sales of herbal products were estimated at US$60 billion[41].***

This can have important effects on plants in the wild. There are thought to be in the region of 400,000 flowering plant species in the world (Paton *et al.*, 2008; see also Section 1), an estimated one in eight (12.5%) of which have medicinal uses: these figures give a crude approximation of 45,000 – 50,000 medicinal plant species in the world flora. While the majority of commercial material comes from cultivated sources, no more than a few hundred of the estimated 2,500 internationally traded medicinal plant species are thought to be commercially cultivated[42], so both international trade and unsustainable local use put wild medicinal plants under significant pressure. In India around 90% of the medicinal plants used by the country's industry are harvested from the wild, and 315 of the 6,560 known medicinal species are threatened with extinction[43,44].

**Box 12: *Prunus africana***

*Prunus africana* is a montane tree species of tropical Africa. It yields a valuable medicinal product used to manufacture treatments for benign prostatic hyperplasia sold internationally and has a wide range of local uses in Africa. The bark is harvested in the largest quantity of any tree species and this has led to concerns about sustainability. The international market is robust and projected to increase. Retail value of *Prunus africana* products is estimated at over US$200 million annually, and may be considerably higher.

There has been strong interest in developing *Prunus africana* as a plantation and agroforestry crop. *Prunus africana* grows moderately fast and is quite adaptable to different conditions. In Cameroon there are considerable numbers of planted trees, on private lands and in community forest areas. Overall however collection is predominantly from the wild. International trade is subject to the provisions of CITES.

*Source: http://www.cites.org/common/prog/african-cherry/11-CUNNINGHAM.pdf*

**Box 13: The Loliondo Wonder Tree**

One species facing extreme pressure is the Tanzanian medicinal plant Murigariga (*Carissa spinarum* L. [syn. *C. edulis* (Forssk.) Vahl.]). Between October 2010 and April 2012, seven million people visited Samunge village in Arusha province for a purported miracle cure made from Murigariga roots. The volume of visitors, with people queuing for tens of kilometres and several days, has led to environmental degradation in the area; and with many acres of wild *C. spinarum* destructively harvested to meet demand, there are concerns that the species is now at significant risk of local extinction.[45,46,47]

*Source: Various – see notes*

### Box 14: Collecting wild orchids in Iran

Orchid tubers, Salep, play a significant role in Iranian folk and traditional medicine. Recently however, despite official legislation banning export, the harvest of wild orchids for international trade appears to have grown. Salep is highly demanded in Turkey with estimates of the number of orchids harvested annually being between 40 and 50 million plants. This huge exploitation of orchid plants has led to a depletion of wild resources, with many orchid species becoming rare. It appears that a side effect of orchid resource scarcity in Turkey has been that traders there have started to tap into new sources of Salep abroad, especially in Iran. Demand also comes from India and Pakistan. In the 2013 season, Salep trade in Golestan province (Northern Iran) alone was worth nearly US$320,000 and involved the harvesting of between 5.5-6.1 million orchids. In the Tehran Bazar, dried Salep is traded for 160 US$/kg, and the estimated value of this trade for 2013 was nearly US$310,000. Current orchid collection practices in Iran do not seem sustainable as all tubers are collected destructively and the harvest mostly happens before seed is produced.

*Source: Ghorbani* et al.*, 2014*

### 3.2.4. Wild plants for cosmetics, perfumery and essential oils

The global cosmetics and perfumery trade covers a wide variety of skincare, haircare, make-up, fragrances and toiletry products many of which contain plant based natural ingredients such as essential oils, pigments, wax and extracts. In 2013, cosmetics retail sales were valued at US$90 billion in Europe, compared to US$62 billion in USA and US$38 billion in China[48]. Arabian markets as well as those in India, Brazil and Russia are also in continuous expansion. Although 'natural' products account for just 6% of the overall cosmetics market[49], revenues increased by US$24.9 billion over the 15 years between 1996 and 2011[50].

***Global sales in 2011 for the 'natural cosmetics' segment of the personal care industry comprised about US$26.3 billion.***

The growth in the use of natural ingredients in the cosmetics industry in recent years has been driven by growing consumer interest in health and well-being, as well as organic and fair trade products. This has led to an increased demand for botanical ingredients. The new market segment for "natural" or "botanical" products is growing in Europe at a rate of 20% each year.

The trend towards the use of natural ingredients is not limited to the pure 'natural cosmetics' part of the market, but is now widespread in conventional cosmetics. Such products incorporate a wide range of plant-based materials, including oils, fats and waxes, essential oils and oleoresins, plant extracts and colourants.

### Box 15: Unilever wins new patent for *Allanblackia*

Cosmetic giant Unilever has been awarded the Biodiversity Innovation award from the Union for Ethical Bio Trade after discovering the potential of a new novel ingredient *Allanblackia*, and proposing a sustainable business plan involving local small scale farmers. At present the *Allanblackia* tree can be found growing in the humid forests of West, Central and East Africa – (Sierra Leone through to Tanzania) it produces fruit containing oil rich seeds (high fat content) the properties of which allow it to be easily melted (34 degrees). This unique structure makes it ideal for vegetable spreads, dairy cream and recently soaps. The Novella Partnership made up of The World Agroforestry Centre (ICRAF-as the leading scientific partner), IUCN, and Technoserve (providing business advice) was created to support a programme of commercial production of *Allanblackia* oil in Ghana, Tanzania and Nigeria. Over US$10 million has been invested in developing the supply chain since 2002.

*Source: http://www.unilever.com/sustainable-living-2014/news-and-resources/sustainable-living-news/unileverwinsawardforAllanblackia.aspx and http://www.rural21.com/uploads/media/R21_Allanblackia_0310_01.pdf*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### Box 16: *Aniba rosaeodora* (Brazilian rosewood)

*Aniba rosaeodora* is exploited to obtain linalool-rich essential oil from its timber for use as a fragrance ingredient and as a fixative in fine perfumes. In Brazil, the species occurs in the Federal States of Amazonas, Pará and Amapá. At present, the species can be found relatively frequently in the interior forests of Amapá, near the border with Guyana, where access is difficult. Harvesting is carried out by teams of collectors under contract to distillery owners. The harvest of the species has been regulated by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) since 2002 and by the Ministry of Sustainable Development of the State of Amazonas since 2006, when forest management was decentralized in Brazil. Since 2007, with the implementation of the 'DOF System' (Documento de Origem Florestal – document of forest origin), the control of the chain of custody of this and other species has become stricter. An estimated 85% of the essential oil is exported and *Aniba rosaeodora* is included in CITES Appendix II. Despite its high value and international interest, the distribution and abundance of the species has never been determined in detail.

*Source: Oldfield and Jenkins, 2012*

### Box 17: Candelilla – a lipstick ingredient sourced from the wild in Mexico

*Euphorbia antisyphilitica* is a succulent plant that grows in the US and Mexico. It yields an important source of wax known as Candelilla that is used widely in the food and cosmetics industry. The collection of Candelilla wax is one of the most important economic activities for families in the Chihuahuan desert of Mexico where more than 20,000 families depend on the wax for their livelihood. Collectors of Candelilla known as 'Candelilleros' work in small groups, leaving their families for a minimum of five days to collect Candelilla in the wild. Experienced collectors pull up Candelilla plants by hand to avoid contact with the toxic and caustic latex of the plant. Bundles of entire plants with small roots are transported by mule to processing sites where adequate supplies of water used in processing are available. Approximately one quarter of the range of *E. antisyphilitica* is exploited and plants in the more remote areas remain untouched. The level of harvesting is not thought to impact detrimentally on the species.

*Source: Oldfield and Jenkins, 2012*

## Essential oils and oleoresins

Essential oils and oleoresins cover a very broad range of products. They are used primarily as flavours and fragrances, but many essential oils have traditional uses as medicines and as food supplements to support good health, while some are also used as a feedstock to the chemicals industry.

Oleoresins are a product of spice extraction (solvent extraction of the dried spice) and are primarily used in the food processing industry as their composition (flavour profile and strength) can be standardized.

Essential oils are distilled from every plant part, from leaves (geranium) to flowers (ylang ylang), to bark (cinnamon) and roots (vetiver). Whilst India and China are strongly associated with the production of many essential oils, many other countries, are also involved as producers. Origins are a mix of the traditional (Comores for ylang ylang oil), to the new (Rwanda for geranium).[51]

***Total world trade in essential oils amounts to around US$1,000 million per year, including both wild and farmed source material.***

### Box 18: Sandalwood oil

Sandalwood oil, distilled from the heartwood and roots of *Santalum* spp. is one of the most valuable essential oils. Trees are slow-growing and harvesting to obtain the roots and heartwood is destructive. Rising demand and very high prices have led to uncontrolled and illegal harvesting and destruction of the natural resource. 40 years ago sandalwood oil was under US$100/kg; now it is over US$2,000/kg reflecting the constraint to supplies.

East Indian Sandalwood oil *Santalum album* is the most commonly traded species and has been in use for thousands of years. Cultivation centers in Mysore, India. The natural distribution of this species extends from India, through Malaysia and Indonesia. Plantations have been developed in tropical northwestern areas of Australia and more recently in a number of South Pacific Islands. Other species used commercially include Australian Sandalwood *Santalum spicatum* which is native to the SW Australia and *Santalum paniculatum* which is only found in Hawaii.

African sandalwood oil, *Osyris lanceolata*, is in the same *Santalaceae* family and is used in the same way in perfumery. The tree is found throughout East and Southern Africa, typically on the dry boundary areas of forests, but rarely in large stands. As a result of very heavy trade in wild material, populations of Burundi, Ethiopia, Kenya, Rwanda, Uganda and the United Republic of Tanzania were added to CITES Appendix II in 2013. Wood of *Osyris lanceolata* is exported from Africa to China and India and semi-processed products are exported to Indonesia, India, South Africa, France, Germany and eastern Asia countries for use in the cosmetic and pharmaceutical industry.

*Source: www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Market_Data_and_Information/Market_information/Market_Insider/Essential_Oils/Sandalwood%20oils.pdf*

### 3.2.5 Wild plants for ornamental horticulture

Ornamental horticulture has a long history and plants have always been considered valuable: in China horticulture is recorded in the second millennium BC, with one poem equating the cost of a tree peony with deep red flowers to ten families' taxes.

***In 2012, the world import trade value in horticultural plants (live trees and other plants, bulbs, roots, cut flowers and ornamental foliage) was $18.5 billion. The Netherlands was the largest individual country involved, with $8.86bn worth of imports[52].***

With the exception of a few specialized groups of plants, the vast majority of material in international trade is of cultivated origin. Exceptions include individual plant species desired by specialist collectors of groups such as orchids, succulents and cycads. There is also a significant trade in bulbs harvested from the wild.

### Box 19: Gingers – valuable commodities for ornamental horticulture

The ginger family, Zingiberaceae, is very important for production of ornamental plants. Gingers are one of the mainstays of the horticultural industry in Thailand, though they are also important in Europe (particularly the Netherlands) and Japan, and considerable research into the plants' characteristics is underway.

The main genera for breeding (for cut flowers and houseplants) are *Curcuma*, *Globba* and *Hedychium*, but breeders also work on *Alpinia* (e.g. *Alpinia purpurata*) and *Zingiber* (e.g. *Zingiber spectabile*), on a much smaller scale. Many more gingers are mass-propagated as landscape plants.

Related families include:

Marantaceae: many species (particularly from the genus *Calathea*) are cultivated and bred for new cultivars, with beautiful ornamented leaves (see e.g. *Calathea warszewiczii*). These are used for landscaping as well as for decorative cut leaves.

Costaceae – only a few species (e.g. *Costus woodsonii*) are used as cut flowers, but many species are important landscaping ornamentals seen in the streetscapes of many tropical cities.

Strelitziaceae – *Strelitzia reginae*, *S. alba* and *S. nicolai* (birds of paradise) are used in the cut flower industry and in landscaping, and the Traveller's palm (*Ravenala madagascariensis*) is one of the most popular landscaping plants in the tropics.

*Source: Dr Jana Skornickova, Singapore Botanic Garden,* pers. comm.

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The use of plant leaves in the florist trade is of growing importance, many of which are harvested from the wild. *Chamaedorea* is the most diverse Neotropical palm genus with over 100 species found mainly in rainforests from Mexico to Bolivia and Brazil. Three quarters of these species, often known locally as Xaté, and in commerce as fishtail palms, are thought to be threatened. Collection from the wild for ornamental horticulture contributes to species decline, as the leaves are valued for their appearance and resistance to wilting. Overharvesting is common as Xateros (collectors) are paid by the leaf rather than for quality. As a result 60-70% of leaves fail to meet standards for export, and in the five years to 2005/6 37.8 million leaves are thought to have been illegally harvested from Belize's Chiquibul Forest Reserve (Bridgewater *et al.*, 2006).

Exports of cut Xaté leaves come mainly from Mexico, Guatemala and Costa Rica[53], with the USA and Europe (especially Holland and Germany) representing the biggest markets, though there is also significant demand from Japan and Russia. In the mid-1990s this trade was worth US$30 million a year in Mexico and Guatemala, and in 2000 exports from Guatemala's Maya Biosphere Reserve were worth more than US$4 million – of comparable economic value to the region's timber exports, valued at US$3.5-5 million in 2003.

### Box 20: Monetary value of Western Australia's flora

Western Australia has a rich and diverse native flora, and is recognised as a global biodiversity hotspot. The commercial harvesting of native flora, which began in the 1950s, is a significant industry in the State and its management contributes to State flora conservation activities, with the regulated harvesting system providing economic incentives for actively conserving native vegetation.

In 2011/12 the wildflower and foliage industry in Western Australia was estimated to have an export value of approximately US$4.7 million, a 24% drop over the previous two years (indicating an uncertainty in overseas markets). In 2006/07 approximately 64% of exports were from wild-harvested wildflowers and foliage, but in 2011/12 this figure fell to 45% with the majority now coming from cultivation. In 2012, 82% of the wild-harvested flora exported directly from Western Australia was destined for Japan, with Canada and the UK the next biggest recipients of exports at 9% and 6% respectively.

The Western Australia Flora Industry also includes: seed harvesting, primarily for propagation and revegetation purposes; the stems of *Eucalyptus* species for production of didgeridoos; and nuts and grasstree stems for the craft market. Although no data on the value of these industries exists, anecdotal evidence suggests that they are worth millions of dollars to the State's economy.

Kings Park and Botanic Garden (Kings Park) has a plant breeding and development program targeting the Australian flora, especially that of Western Australian. The most successful outcome to date has been the commercial release of *Scaevola aemula* 'Blue Print'. This hardy, fast growing and extremely versatile intraspecific hybrid was bred in 2005 and commercially released worldwide in 2010 after stringent testing. Over 1.3 million plants have been sold since its release. The program is also targeting other genera including *Anigozanthos, Boronia, Chamelaucium, Corymbia,* and *Grevillea*, and from 2015/16 there will be a continual supply of new, elite Kings Park plant varieties into local, national and international markets.

*Source: Western Australian Department of Environment and Conservation (2013) and Mark Webb,* pers. comm.

# 4 . GLOBAL PLANT CONSERVATION

**The world's flora is of immense importance but is under threat. The Global Strategy for Plant Conservation (GSPC) provides an overall framework to address this situation through measures at the global and national level. The GSPC was originally adopted in 2002 and was updated in 2010 when revised and more ambitious targets for 2020 were adopted (See Section 5). The information provided in this section is based primarily on a mid-term review of progress towards the 16 targets of the GSPC which was carried out in early 2014. Further information has been extracted from the GSPC Toolkit which provides resources and case studies in support of GSPC implementation.**

*"Ever since we arrived on this planet as a species, we've cut them down, dug them up, burnt them and poisoned them. Today we're doing so on a greater scale than ever [...] We destroy plants at our peril. Neither we nor any other animal can survive without them. The time has now come for us to cherish our green inheritance, not to pillage it — for without it, we will surely perish."*
(David Attenborough - The Private Life of Plants).

### The Global Strategy for Plant Conservation 2011-2020

The 16 targets of the GSPC cover all aspects of plant conservation, with targets set at both species and habitat-levels. The targets address conservation in both natural and managed landscapes, and also include the management of invasive species and the sustainable use of plant resources. Public awareness, education and capacity building for plant conservation are also recognised as crucial cross-cutting issues. Full implementation of the GSPC requires action by a broad range of stakeholders working at both national and international levels. Partnerships and networking are essential elements of implementation.

## 4.1 NATIONAL RESPONSES TO THE GSPC

As a programme of the CBD, the focus for implementation of the GSPC is at the national level and a number of countries have developed national plant conservation strategies, with quantifiable, time-bound targets as a direct response to the GSPC. It is of note that these include some countries with very high levels of plant diversity – e.g. Brazil, China, Costa Rica, Malaysia, the Philippines, Mexico and South Africa.

Constraints to GSPC implementation at the national level include the lack of cross-sectoral networks, 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 between the key stakeholders.

Countries that have not developed a specific response to the GSPC are generally addressing plant conservation through their National Biodiversity Strategies and Action Plans (NBSAPs).

### 4.1.1 Developing a national strategy in South Africa

In March 2013, the South African National Biodiversity Institute (SANBI) hosted a workshop to develop South Africa's National Strategy for Plant Conservation. The workshop was very well attended with a wide range of stakeholders from national and provincial conservation authorities, taxonomists, NGOs (e.g. the Botanical Society of South Africa), independent botanists, conservationists working on business and biodiversity initiatives and conservation planners. The workshop resulted in national level targets being developed for all 16 targets. In addition, milestones were identified for measuring progress with implementation, and commitments from various organisations and individuals to lead on the different targets, were made. Task teams of between 5 and 10 individuals were constituted to take the implementation of each target forward. South Africa will host an evaluation meeting every 2.5 years to measure progress towards implementation of national targets. During the workshop, global targets were modified to

ensure that they are achievable in the megadiverse flora context in which plant conservation work takes place - South Africa has ca 20,500 plant taxa. For example, the global target for *ex situ* conservation - Target 8: At least 75% of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes - is unachievable for South Africa due to the very high numbers of threatened plants (2,551 taxa). To date (2013) only 35% of threatened taxa are represented in *ex situ* collections. South Africa has modified this target to be more achievable to: *At least 60% (1,530 taxa) of threatened plants in* ex situ *collections, preferably in the country of origin, and available for recovery (restoration) programmes, with 1% in active reintroduction programmes.* Many of the other targets in the Strategy have been similarly modified and it is hoped that this should result in the Strategy being achieved in South Africa by 2020.

### 4.1.2 Progress in Brazil

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

CNCFlora has also been assisting scientists from the Humboldt Institute, Colombia develop and implement a national Red Listing process for the country (See Box 4). The Brazilian Red Listing Project has also helped the Zoobotanic Foundation from Rio Grande do Sul state to achieve their goal of assessing the state's flora. Furthermore, the Action Planning Project has acted as adviser for the Arboretum program from Bahia state in north eastern Brazil, identifying species to be included for forest restoration in this region and providing instruction on how to do so.

### 4.1.3 Progress in China

The Chinese Strategy for Plant Conservation (CSPC) was adopted in 2008 as a joint initiative of the Chinese Academy of Sciences, the State Forestry Administration and the State Environmental Protection Agency[54]. In late 2011, a review of progress in implementing the CSPC was carried out by BGCI[55]. Focussing on the implementation of CSPC Targets pertaining directly to *in* and *ex situ* conservation (Targets 7 and 8), this analysis also considered progress made in interrelated CSPC objectives including Targets 1, 2, 14, 15 and 16. The review noted that tremendous and commendable efforts to safeguard the country's extraordinarily rich and diverse botanical wealth had been undertaken by numerous CSPC stakeholders These included an enhanced network of sites and people dedicated to *in situ* and *ex situ* conservation and a multi-volume Chinese flora, giving evidence of both China's plant diversity and botanical expertise, and many other projects and programmes to strengthen conservation capacity, education and public outreach. However, as elsewhere in the world, enormous conservation challenges continue to constrain progress in securing China's plant diversity for future generations. The analysis offered a number of recommendations on how to address these challenges:

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

## 4.2 INTERNATIONAL PARTNERSHIPS

The Global Partnership for Plant Conservation (GPPC) was established in 2004 in order to bring together institutions with international plant conservation programmes. The Partnership now includes some 50 members (Annex 2) and has made a good start at bringing together the plant conservation community. However the tasks they face are daunting and much greater efforts are needed to inspire and engage other relevant sectors. The contribution to plant conservation from commercial interests in agriculture, mineral extraction and other sectors needs to be recognised and scaled up. A stronger dialogue also needs to be developed with the big NGOs that do not have specific plant conservation programmes but are active in biodiversity conservation at many levels. There is a need for all sectors of society to recognise the importance of plants and to be motivated to take appropriate action.

A number of the large botanical institutions, mainly botanic gardens, have international programmes that are making a significant contribution to plant conservation around the world. Examples include the work of Missouri Botanical Garden in Central and South America, New York Botanical Garden in the Caribbean, the Botanic Garden Meise, Belgium in the Democratic Republic of Congo and RBG, Kew in Madagascar.

### Box 21: Supporting plant conservation in the Democratic Republic of Congo

The Meise Botanic Garden, Belgium (Meise) has strong and historical links with the Democratic Republic of Congo (DRC), and these are reflected in the amount and variety of work it undertakes there, principally research and capacity building.

Meise has taken the lead in completing the Flora of Central Africa (started in 1948 but still 40% incomplete), aiming to revise any outdated information, complete the remaining taxa and have the work available online within the next 15 years. Other research carried out in DRC includes valuing non-timber forest products in the Miombo woodlands, examining carbon-biodiversity relationships in forested areas and conserving the unique plants of the Katanga copper belt in the Garden's seed bank.

Since 2004 Meise has been fundraising and helping restore Kisantu, Kinshasa and Mbandaka botanic gardens. Assistance given to the Kisantu botanical garden has established or improved infrastructure from paths to glasshouses to a library, with visitor numbers almost quadrupling as a result. Collections of orchids, aquatic plants and ancient vegetables have all been developed, and several workshops (including one on red listing the Central African flora) have been held. Kisantu is now one of the most advanced botanic gardens in Central Africa.

At the Yangambi agricultural research station, installing solar panels, electricity and internet access has helped connect the institute's herbarium – one of the biggest and most comprehensive of its kind in Africa – with the wider scientific world.

Meise also reaches out to schools, producing educational games, experiments and posters in conjunction with an NGO in Kinshasa, and even supports the planting of useful trees in playgrounds.

*Source: Botanic Garden Meise Annual Reports 2011-2013*

## 4.3 *IN SITU* CONSERVATION

*In situ* conservation of plant diversity is addressed by several targets in the GSPC. These include Target 4 (ecosystem conservation), Target 5 (protecting important areas for plant diversity), Target 6 (conservation within production areas) and Target 7 (species-level conservation).

### 4.3.1 Ecosystem conservation

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

Ecosystem conservation is mainly being addressed through the global protected area system. Well-governed and effectively managed protected areas are considered to be a proven method for safeguarding both habitats and populations of species and for delivering important ecosystem services. This target is closely related to the CBD's Aichi Target 11 which calls for 17% of terrestrial areas to be conserved[56]. The background technical document on Aichi Target 11 prepared for the 4th edition of the Global Biodiversity Outlook (2014) notes that protected area coverage on land has increased rapidly in

recent years and 55% of terrestrial ecosystems now have at least 10% of their areas covered by protected areas. However, protected area coverage varies widely across ecosystems, with 7% of terrestrial ecosystems having less than 1% coverage.

While it is considered likely that the 17% target will be met globally by 2020, recent studies confirm that the current global network of terrestrial protected areas still falls short of adequately representing all ecosystems and many important vegetation types continue to be neglected. In general, forests and mountain areas are well represented in protected area networks, while natural grasslands (such as prairies) and coastal and estuarine ecosystems, including mangroves, are poorly represented.

Little information exists on the actual effectiveness of protected areas in conserving and improving species populations. Where such studies have been carried out, they have generally focused on animal and not plant diversity (Geldmann *et al.*, 2013). Simply protecting land where threatened plant species occur is not sufficient for their long-term conservation. Even protected lands face the ever-present threats of climate change, invasive species, and often habitat fragmentation (Havens *et al.*, 2014).

### Restoring damaged ecosystems

Ecosystem restoration is defined as the process of actively managing the recovery of an ecosystem that has been degraded, damaged or destroyed. It is a conscious intervention based on traditional or local knowledge and scientific understanding[57]. A CBD paper in 2010 noted that nearly two-thirds of the world's ecosystems are considered degraded to some degree. The GEF-FAO-UNEP Land Degradation Assessment in Drylands Project, revealed that some 24% of the world's land degradation occurs mainly in Africa south of the Equator, South East Asia, North Central Australia, the Pampas, and the boreal forest in Siberia and North America.[58] More than 20% of this total degrading land falls under croplands; 42% under forests, and 20-25% under rangelands (grasslands and other non-forest habitats).

The World Resources Institute (WRI) in partnership with the University of Maryland and IUCN developed a map on the opportunities for forest and landscape restoration. This indicated that about 30% of the global forest cover has been completely lost and a further 20% degraded to some extent. The partnership concluded that more than two billion ha. worldwide offer opportunities for restoration and rehabilitation.[59]

So far, the success of ecological restoration projects has been limited, especially when compared to the scale of damage to global ecosystems. Large-scale and long-term projects are rare but new initiatives should provide a significant boost to restoration on a global scale. *The Bonn Challenge* was launched in September 2011, at a ministerial roundtable hosted by Germany, IUCN and the Global Partnership on Forest Landscape Restoration (GPFLR), and aims to restore 150 million has of deforested and degraded lands by 2020.[60] At Rio+20, the US Forest Service, Rwanda, a Brazilian Mata Atlantica Forest Restoration Pact, and the Mesoamerican Alliance of Indigenous Peoples committed to restoring more than 18 million has of forest landscape as an important contribution to the Bonn Challenge. The Ecological Restoration Alliance of botanic gardens (see p.33) specifically aims to incorporate the conservation of threatened plant species within the restoration of ecosystems.

### 4.3.2 Protecting important areas for plant diversity

***GSPC 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.***

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

At the global level, the areas of highest plant diversity have been identified by Barthlott *et al.*, (2007) (see also Section 2). 20 areas have been identified where vascular plant species richness surpasses 3,000 species per 10,000km$^2$. The percent of these areas under protection (according to the WDPA, 2006) ranges from 62% to 0.7%, with only 8.8% of the total area of the 20 sites under protection (Mutke *et al.*, 2011).

At the national level, while a number of countries have made significant efforts to identify important areas for plant diversity, it is not clear how many of these are being effectively managed or how well these are distributed across ecological regions.

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

### Box 22: Important Plant Areas in Turkey

Turkey was one of the first countries to identify IPAS with 144 areas listed in 2003 covering 13% of the land area. An IPANet of volunteers has been established to engage with site conservation and awareness raising. With about 11,000 native vascular plants – and one in every three endemic – the flora of Turkey is of outstanding significance. The flora is also of exceptional importance from an economic point of view. Major parts of two of the eight centres of crop plant diversity lie within Turkey; over 350 medicinal plants are collected for trading purposes and garden plants have been derived from over 200 genera. This diversity reflects the variety of habitats which range from semi-desert and salt steppe through Mediterranean cedar/fir forests and temperate rainforest to a wide range of grasslands, wetlands, peatlands and heathlands. Unfortunately growth in the agricultural and industrial sectors, combined with a rapidly-increasing population is placing immense pressures the often-unique habitats in which threatened plants grow in Turkey. Few if any of the IPAs identified remain altogether unscathed by the negative impacts of development. Accordingly much still needs to be done to adequately conserve Turkey's botanical diversity.

*Source: Atay* et al., *2009*

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

### 4.3.3 Conservation in production landscapes

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

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 Sustainable Agriculture Network

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

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

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

### Box 23: The cost of biodiversity conservation

The cost of reducing the extinction risk of threatened plant and animal species known to be globally threatened has been estimated at US$3.41-$4.76 billion annually based on information for threatened bird species which are relatively well-known. The cost of protecting and effectively managing all terrestrial sites of global avian conservation significance (11,731 Important Bird Areas) would cost US$65.1 billion annually. Globally important sites have also been systematically identified for mammals, amphibians and some reptile, fish, plant and invertebrate groups in a number of countries. Of these sites, 71% already qualify as IBAs. Assuming this relationship holds worldwide, the costs of protecting and effectively managing a global network of sites for nature more broadly is estimated to be US$76.1 billion annually.

These costs have been compared with the net value of ecosystem services being lost annually, for which estimates range from US$2 to US$6.6 trillion. The total is just 1-4% of the net value.

*Source: McCarthy* et al., *2012*

### Box 24: An action plan to conserve arable 'weeds' in France

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

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

*Source: Fédération des Conservatoires botaniques nationaux, France. Information provided for the mid-term review of the GSPC, 2014*

#### Forest certification

Forest certification schemes are designed to allow extraction while sustaining or enhancing the forest's biodiversity and ecosystem services, and protecting and respecting the rights of workers and local people. At the global level, currently more than 10% of the world's forested land is certified (>400 million ha. in 2013), with the figure rising to 23% in the UNECE region (Europe, Russia, the Commonwealth of Independent States, Israel, Canada and the USA)[61]. The Forest Stewardship Council (FSC) has certified 182 million ha. of forests, while the Programme for the Endorsement of Forest Certification (PEFC) has certified 255 million ha.

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

China is the second Asian country after Malaysia to successfully achieve PEFC endorsement for a national certification system, and the Indonesian Forestry

Certification Cooperation (IFCC) submitted its scheme for PEFC assessment in November 2013. A range of other countries in the region, including India, Japan, Myanmar, Nepal, Philippines, South Korea and Thailand are advancing in national system development and exploring options for eventual international recognition by PEFC.

### 4.3.4 Species-level conservation

#### *GSPC Target 7: At least 75% of known threatened plant species conserved* in situ.

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

The technical rationale for Target 7 notes that: *Mechanisms contributing to this target include ecological networks, protected areas, sites subject to REDD+ initiatives (Reducing emissions from deforestation and forest degradation), corridors, peace parks, Indigenous and community conserved areas (ICCAs) including sacred forests, wetlands and landscapes, village lakes, catchment forests, river and coastal stretches and marine areas. Actions taking place under the CBD programme of work on protected areas and under GSPC Target 5 will contribute to this target.*

The exact number of globally threatened plants in the world remains to be determined through the achievement of GSPC Target 2. At this stage therefore, despite encouraging progress in some countries, global progress towards Target 7 remains impossible to measure. Moreover, the continuing loss of natural habitat means that the *in situ* conservation status of many species is getting worse.

However, the approach taken by South Africa provides an interesting case study of how a mega-diverse country can address Target 7 and expect to achieve it by 2020 (see Box 25).

### Box 25: *In situ* conservation of threatened plants in South Africa

South Africa has put significant effort over the past few years into measuring progress in achieving GSPC Target 7. This has involved obtaining accurate information on the locations of populations of threatened species, done by:

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

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

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

*Source: South African National Biodiversity Institute – information provided for the mid-term review of the GSPC, 2014*

### Box 26: Assisted migration – the great conservation debate

The effects of climate change on plant diversity are becoming ever more evident, and in some cases, are expected to outpace the ability of many plant species to migrate (Corlett and Westcott 2013). As a result, ecological communities may lose species, with some even expected to suffer extinction (Thomas *et al*., 2004). One proposed solution to this dilemma is "assisted migration," in which species would be intentionally transferred outside their historical ranges into locations they could have reached were climate change occurring at a slower pace. Along with other conservation measures, such as seed banking and *in situ* management, assisted migration could help ensure the survival of many plant species.

Unfortunately, assisted migration also poses many risks, and this has made it the centre of a vociferous debate over ethics and ecological pragmatism. Namely, moving species outside their historical ranges risks: a) introducing species that could become invasive; b) transferring pests and diseases that may harm other species; and c) hybridization with closely related, rare species and dilution of their gene pool.

To date proponents of assisted migration have attempted to allay these fears by development of risk assessment and management frameworks. Nonetheless, risk assessment and management can never fully eliminate all risks, and even well-intentioned transfers can result in ecological calamities (Webber *et al*., 2011).

An alternative strategy of 'chaperoned' assisted migration has been proposed to address these problems, in which botanic gardens would serve as waypoints for transferred species (Smith *et al*., 2014). Such a programme would allow species to be moved into gardens located outside their historical distribution, but within their potential dispersal envelopes. The managed environment of a botanic garden would allow their behaviour and performance in the new environment to be closely monitored.

*Source: Smith* et al., *2014*

## 4.4 *EX SITU* CONSERVATION

*Ex situ* conservation of plant diversity is addressed through GSPC Target 8 and may also be included in Target 9.

***GSPC 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.***

This target aims towards achieving a comprehensive programme of *ex situ* conservation that complements *in situ* conservation, through the development of genetically representative collections of threatened species. Such a programme would strengthen responses to the impacts of climate change, unsustainable land use and overharvesting of plant resources and support ecological restoration initiatives.

***"In the face of an uncertain future, an urgent priority must be conservation through seed banking and conservation in living collections for as many plant species as possible as an insurance policy"*** (Hawkins, *et al.*, 2008).

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. Botanic gardens are also active in most of the other targets of the GSPC (Williams and Sharrock, 2010).

The number of recorded botanic gardens in existence around the world has more than doubled in recent years and their combined plant collections, as recorded in BGCI's PlantSearch database[62], presently include over 1.2 million records, relating to more than 387,500 taxa (around 170,000 species). These records have been provided by over 1,000 botanic gardens.

A survey carried out in 2010 identified 23% of globally threatened species in *ex situ* collections. A more recent analysis (2014) has identified 29% of globally threatened species (as included on the IUCN 2013 Red List) in cultivation and/or seed banks, As with Target 7 however, lack of information on which species are globally threatened (Target 2) constrains accurate global monitoring.

As national and regional lists of threatened species are more widely available, assessments at this level can provide a more accurate assessment of progress, with 39% of threatened species in the USA and 56% in Australia/New Zealand being recorded in *ex situ* collections (Figure 5).

### Box 27: Funding plant conservation in the US

Funding for plant conservation in the US comes from a wide variety of sources, from federal, state, and local governments and federal grant programs such as the National Science Foundation to private foundations and individuals.

Despite plants comprising the majority of the federal endangered species list (57%), in 2011 they received less than 3.86% of federal endangered species expenditures. In a ranked list of endangered species and amount of spending they received, the first plant (*Astragalus holmgreniorum*) was 114th on the list. If state and federal expenditures are totalled, plants receive only 3.82% of the funding for endangered species nationwide (US Fish and Wildlife Service 2011). Fundamental plant science is similarly under-resourced, receiving just 2% of extramural spending for life sciences research in the United States (McCormick and Tjian 2010).

*Source: Havens* et al.*,2014.*

In the US, over 50 botanic gardens have an annual budget of over US$2.5 million. In a recent survey, the average reported operating budget for science and conservation programmes for these gardens was US$554,654, ranging from US$21,087 - US$9.5 million between gardens. This represents an average of 8.1% of the total garden budget. In these institutions, 8% of staff time was devoted to science and conservation work and on average volunteers provided 1,686 hours for *in situ* restoration work. 14 of these gardens maintain an average of 124 rare or threatened species per *ex situ* collection (range 10 - 300) with a total of 1,364 rare taxa being conserved between the gardens.

*Source: Directors of Large Gardens benchmarking study, 2012 and Cruse-Sanders* et al.*, 2013. Comparative Metrics for Assessing Conservation Capacity at Botanic Gardens (Poster presented at the 5th Global Botanic Gardens Congress, Dunedin, New Zealand, October 20-25, 2013.*

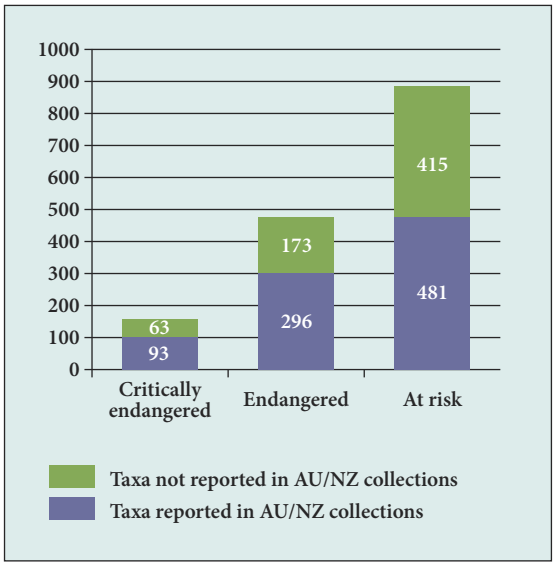



*Figure 5: Number of threatened taxa conserved in living plant collections in Australia and New Zealand*[63]

While the focus of conservation work by botanic gardens in the past has been through their living collections, there is increasing recognition that such collections do not include sufficient intra-specific genetic diversity. A growing number of botanic gardens are now establishing seed banks – with the Millennium Seed Bank of the RBG, Kew, playing a key role in this respect (Box 28). According to BGCI's GardenSearch database[64], 275 botanic gardens in 66 countries now record having a seed bank (Figure 6).

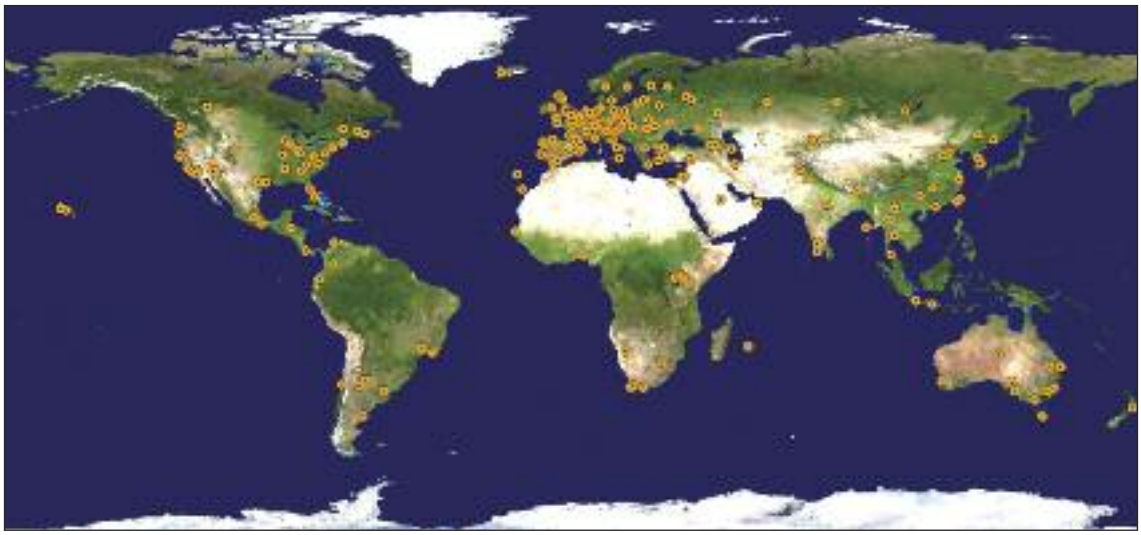


*Figure 6: The location of botanic gardens with seedbank facilities (data from BGCI's GardenSearch database).*

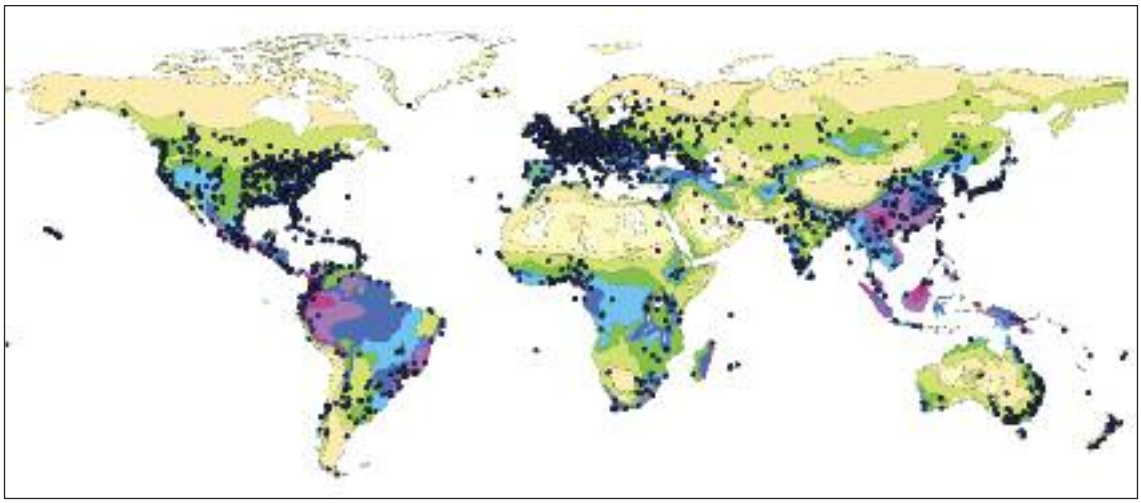


*Figure 7: The location of the world's botanic gardens with respect to the distribution of plant diversity.*

Although significant progress is being made towards this target, and it is likely that the first part of the target (*ex situ* collections) has already been achieved by some countries, it remains challenging for mega-diverse countries. While seed banking can be readily applied for many species, not all species can be conserved this way and alternative long-term conservation methods are required. Furthermore, there is a clear mismatch between the location of botanic gardens and the location of plant diversity, with relatively few gardens being located in plant diversity 'hot spots' (Figure 7).

Progress towards the second part of the target (recovery and restoration) remains challenging. However, there is an increasing understanding of the importance of linking *in situ* and *ex situ* conservation and using collections for restoration activities – both at species and ecosystem levels. This is exemplified by the recent establishment of the Ecological Restoration Alliance of Botanic Gardens.

### The Ecological Restoration Alliance of Botanic Gardens

Botanic gardens hold a huge amount of valuable knowledge for ecological restoration as well as plant material for propagation and use in restoration schemes. They have recently come together to form the Ecological Restoration Alliance of Botanic Gardens (ERA) coordinated by BGCI.

In response to the GSPC and Aichi Targets, members of the Alliance have agreed to support efforts to scale up the restoration of damaged, degraded and destroyed ecosystems around the world, with the goal of restoring 100 places by 2020. The ERA also aims to: (i) build expertise and restoration capacity through collaborations between gardens, large and small, as well as with partners in academia, industry and government; (ii) improve the quality and quantity of restoration research; and (iii) disseminate and advocate restoration knowledge, thus addressing global environmental problems on a broad and significant scale. As of August 2014, 17 botanic gardens had joined the Alliance. Information on the 27 restoration projects presently being implemented is available on the Alliance's website[65].

### Box 28: The Millennium Seed Bank Partnership

The RBG, Kew is host to the world's largest *ex situ* collection of seeds from wild flowering plants. Kew's Millennium Seed Bank Partnership (MSBP) is a network of botanical organisations working in more than 80 countries, coordinated by Kew scientists. The MSBP has two stated outputs:

1. Banking of seed collections. By 2020, the Partnership will have conserved 25% of the world's orthodox seed-bearing species;
2. Enabling the use of seed collection for innovation, adaptation and resilience in agriculture, forestry, horticulture and habitat restoration.

Priority is given to banking seed from those species which are either endemic, threatened or have known use. By August 2014, over 35,000 verified taxa had been stored in the Millennium Seed Bank (MSB). Of these, at least 4,666 are threatened taxa, according to the threatened species lists available. It is likely that many more collections are from threatened species which have not yet been captured on these lists.

In total, it is estimated that >18% of orthodox species (around 50,000 taxa) are held in the Partnership's seed banks. Efforts to assess the quality of these collections are ongoing. Once in a seed bank under conditions of low humidity and temperature, most seeds can survive for centuries. More importantly, material is available to researchers and conservationists for study and use. For example, collections held at the MSB and by its partners are available for restoration, and are frequently used for this purpose.

Seed conservation is an extremely cost effective method of conserving plant diversity. Based on the experience of the Millennium Seed Bank Project (2001-2010), the cost of effectively conserving the seed of one plant species is approximately US$3,000 (P. Smith, Pers. Comm.). This cost includes capacity building (training and improved facilities), seed collection, processing, germination testing and storage of at least two populations of a taxon in at least two seed banks. It does not include ongoing storage costs. These however are minimal. As an example, the MSB maintains 60,000 seed collections in three -20°C freezers on 10kWh of electricity. For some short-lived orthodox species it is necessary to keep seeds in liquid Nitrogen at ultra-low temperatures. However, seed conservation remains highly cost effective (Li and Pritchard, 2009).

*Source: The Millennium Seed Bank. Information provided for the mid-term review of the GSPC, 2014*

## 4.5 CONSERVING CROP DIVERSITY

***GSPC Target 9: 70% 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.***

The conservation of the genetic diversity of crops and other socio-economically important species is carried out partly through *ex situ* conservation (seed banks, field genebanks, tissue culture) partly through on-farm conservation and partly through *in situ* conservation.

As noted in the Technical rationale for this Target: *For some 200-300 major crops, it is likely that 70% of genetic diversity is already conserved* ex situ *in gene banks. Genetic diversity is also conserved through on-farm management and active* in situ *conservation in natural ecosystems, but this is currently un-quantified. 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. The conservation of genetic diversity of minor crops and other socio-economically important species, including those of local importance has received less attention. Priority species to be addressed under this target may include certain medicinal plants, non-timber forest products, local land races, wild relatives of crops, neglected and underutilized plant resources as well as major forage and tree species, which may become the crops of the future.*

At the global level, the Global Crop Diversity Trust (GCDT) has been established to ensure the conservation of crop diversity for food security worldwide. It works within the framework of the International Treaty on Plant Genetic Resources for Food and Agriculture, which is the key global instrument for the conservation of genetic diversity for food and agriculture. The GCDT is working in partnership with Kew's Millennium Seed Bank Partnership on the *'Adapting Agriculture to Climate Change'* project (2011-2020), funded by the Government of Norway. The aim of this project is to secure in safe storage all primary and secondary genepool members of 29 of the world's major crops, including wheat, rice and potatoes, and to make this material available to plant breeders. A gap analysis study carried out by the International Centre for Tropical Agriculture (CIAT) and the University of Birmingham found that 51% of these crop wild relatives are not currently conserved in gene banks.

Target 9 is also closely linked to the Global Plan of Action for Plant Genetic Resources for Food and Agriculture (PGRFA) of the Commission on Genetic Resources for Food and Agriculture of the Food and Agriculture Organization of the UN (FAO). In July 2011, the Second Global Plan of Action for PGRFA was adopted.

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

### 4.5.1 Seed conservation

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

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

### 4.5.2 On-farm and *in situ* conservation

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

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

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

- In Ethiopia, wild populations of *Coffea arabica* are being conserved in the montane rainforest;
- The Sierra de Manantlan Reserve in Southwest Mexico has been established specifically for the conservation of the endemic perennial wild relative of maize, *Zea mays* and significant efforts are continuing to identify areas of important maize genetic diversity (both landraces and wild relatives);
- The Erebuni Reserve has been established in Armenia to conserve populations of cereal wild relatives (for example *Triticum araraticum, T. boeoticum, T. urartu, Secale vavilovii, S. montanum, Hordeum spontaneum, H. bulbosum* and *H. glaucum*).

## 4.6 SUSTAINABILITY OF WILD PLANT RESOURCES FOR LOCAL USE AND TRADE.

As highlighted in section 1, many plants are harvested from the wild for direct use and trade. Sustainable use of wild plant resources is addressed by GSPC Targets 11, 12 and 13.

### 4.6.1 International trade in wild plants

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

The implementation of CITES contributes to many other of the GSPC Target as noted in Annex 3. Over 25,000 plant species are included in the Appendices of CITES. It is difficult to give a precise figure as the entire family Orchidaceae (with an estimated 18-30,000 species) is listed on Appendix II.

Fundamental to the effective implementation of CITES for all species is the requirement that exports of Appendix II specimens should only be permitted when the export has been validated as both legal and 'sustainable'. In relation to sustainability, the Scientific Authority of the exporting country is charged with making a so-called non-detriment finding (NDF) for a species listed in Appendix II prior to the granting of a CITES export permit. Methodology for making an NDF has been linked to the determination of sustainability in plant harvesting more generally as certified by FairWild and as required for GSPC Target 12.

**Box 29: The Non-Detriment Findings Guidance for Perennial Plants: the case of cycads in Viet Nam**

CITES Non-Detriment Findings (NDF) Guidance for Perennial Plants has been finalized by TRAFFIC in a project supported by the German Ministry of Nature Conservation (BfN)[66]. Wild specimens of CITES Appendix II listed species may only be exported if trade is deemed to be non-detrimental to the survival of the species (i.e. is sustainable). TRAFFIC, with WWF Germany and BfN have developed guidance for CITES Scientific authorities to assist them in making NDFs for perennial plants . TRAFFIC has also designed a training workshop around the 9 step NDF process to help CITES authorities in further understanding NDFs, and applied this in a workshop with CITES authorities in Viet Nam. The workshop examined cases of cycads, plants known to be heavily impacted by high levels of trade. Many cycads are popular in the horticultural trade and mature individuals can fetch high prices on the international market. Viet Nam has 24 cycad species, many of them highly threatened by habitat loss and unsustainable harvesting, both for domestic and international trade. Participants examined case studies of three species currently banned from trade in Viet Nam, to determine the information available for these species and whether trade would be considered detrimental or non-detrimental to the species' survival.

*Source: TRAFFIC. Information provided for the mid-term review of the GSPC*

Parties to CITES are obliged to report on the levels of trade in listed species. Usually, levels of trade reported are based on data recorded in export permits issued by the Management Authority. Periodically, the CITES Plants Committee reviews the levels of trade in selected species where there are concerns that trade volumes do not appear to be compatible with the survival of the species in the wild. Based on this Significant Trade Review process, remedial action can be taken including the imposition of sanctions in the form of temporary trade bans. The Significant Trade Review process helps to ensure that species are not endangered as a result of international trade.

Traditionally the plants covered by CITES have been ornamentals such as orchids, cacti and cycads threatened by commercial collecting from the wild for specialist collections. However, more attention is now being focused on the major commercial groups of internationally traded species such as timbers and medicinal plants. Over 220 timber species are currently included in the Appendices of the Convention.

For timbers not yet included under the provisions of CITES, mechanisms to tackle the huge illegal timber trade have an indirect role in preventing the endangerment of tree species in international trade. Such mechanisms include the EU Forest Law Enforcement Governance and Trade (FLEGT) Action Plan with its two key legal instruments. The 2005 FLEGT Regulation allows for the control of the entry of timber into the EU from countries which have bilateral FLEGT Voluntary Partnership Agreements (VPAs) with the EU. The first VPA to be developed was with Ghana. Republic of Congo and Cameroon are in the ratification process. Negotiations are ongoing with Liberia, Gabon, Democratic Republic of Congo, Central African Republic, Malaysia, Indonesia and Viet Nam[67]. The 2010 Timber Regulation is an overarching measure to prohibit the placing of illegal timber and timber products from any source including the EU on the internal market.

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

### 4.6.2. Sustainable sourcing

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

This target is consistent with the second objective of the CBD and its long-term goal is to achieve sustainable sourcing of all naturally occurring plant resources. "Sourced sustainably" ensures that practices along the supply chain integrate social, environmental and economic considerations, such as the fair and equitable sharing of benefits and the participation of indigenous and local communities. Value addition and processing should also aim to ensure that waste is reduced and does not damage the environment. Sources that are sustainably managed are understood to include natural or semi-natural ecosystems that are sustainably managed by avoiding overharvesting of plant products, or affecting other components of the ecosystem.

As noted in the Technical Rationale for this Target, the wording reflects the need to first inventory plant-based products (and identify the species from which they are derived) and to assess or certify their sustainability

according to explicit and scientific criteria. This is a huge undertaking given the range of plant species sourced from the wild and the general lack of data on such species. There is a need for strengthened linkages with the private sector and consumers consistent with the CBD's Business and Biodiversity Initiative.

With regard to timber, progress in forest certification (noted on p.29) should enhance the support of sustainably produced products. Between May 2012 and May 2013, it is estimated that 501 million $m^3$ of industrial roundwood logs were produced from certified forests (28.3% of the global total), but more than 95% of this was from Europe and North America; in ITTO countries in 2010 less than 5% of production forests were certified (17 million ha. of a total of 403 million ha.), including 2.1% of Asia's forests, 1.6% of those in Latin America and just 1.1% of forested land in Africa[68].

### The FairWild Standard

At the global level, TRAFFIC has played a key role in the development and implementation of the FairWild Standard, a best practice tool to support the delivery of Target 12[69]. The FairWild Standard allows for traceability and transparency, as well as improving product safety. It originated from the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) which was developed between 2001 and 2006 to ensure sustainability in the wild collection system.[70] In 2008, the Fair Trade standard[71] was merged with ISSC-MAP to form the FairWild Standard version 1.0 to provide all round implementation of ecological, social and economical aspects. The FairWild Standard is implemented as a third-party certification system, and is also used by communities and governments in their plant resource management strategies. For example, Japan's National Biodiversity Strategy published by Ministry of the Environment has included the FairWild Standard as a recommended certification framework for sustainable use of natural resources in Japan. Similarly in Germany, the FairWild Standard is included in Germany's National Annual Report 2013 on CBD Implementation as a best practice ('lighthouse' project).

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

Over 1,000 collectors have benefitted from involvement in FairWild certification, with fair pricing systems being introduced and Premium funds accumulating from the contributions of trading partners. A number of other companies are involved in handling the FairWild-certified ingredients along the trade chain – processing the ingredients and distributing them worldwide. Final products with the FairWild mark have been on the market since 2009. By 2013, three manufacturers in US and UK are trading final products with FairWild label on the US, Canadian, Japanese and many EU markets. The FairWild Standard is available in 13 languages, together with the suite of guidance documents (including on carrying out resource assessment, development of management plans, implementing social and fair trade requirements) supporting its implementation.

#### Box 30: Application of the FairWild Standard

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

*Source: TRAFFIC. Information provided for the mid-term review of the GSPC, 2014*

### 4.6.3 Protecting indigenous knowledge

***GSPC 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.***

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

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

Although a wide range of initiatives to conserve traditional knowledge have been developed at national and local levels, progress towards this target is difficult to measure as baselines have not been quantified.

#### Box 31: Repatriation of local and indigenous knowledge

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

*Source: Missouri Botanical Garden. Information provided for the mid-term review of the GSPC, 2014*

In May 2013, the Missouri Botanical Garden hosted an international workshop on the need for a global program on the conservation of useful plants and traditional knowledge. The workshop was attended by a series of international experts who issued a call to action which urged the development of a global program on the conservation of useful plants and associated knowledge to address the loss of essential knowledge about plants and their uses, especially at the level of local communities. The participants concluded that there was also a great urgency to address the vital importance of traditional knowledge about plants, their utility, management, and conservation. This unique, often ancient, and detailed knowledge is typically held and maintained by local and indigenous communities. Among the actions recommended, there was a call to:

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

#### Box 32: Booderee Botanic Gardens

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

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

*Source: GSPC Focal Point, Australia. Information provided for the mid-term review of the GSPC*

## 4.7 EDUCATION AND PUBLIC AWARENESS

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.

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

Lack of baseline information makes measuring progress towards this target difficult. Issues that still need to be addressed include the over-emphasis on animals and neglect of plants in environmental education programmes and a need for increased teacher-training relative to plant science. Much of the progress that is being made is due to activities that take place in the informal education sector – although some such activities are closely linked to and support national curricula.

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

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

It is also recognized that engaging the public in new and innovative ways is key to raising awareness of plant conservation issues. One example is the increasing popularity of citizen-science projects focused around plant monitoring. Examples of such programmes include Project BudBurst in the USA[72], Vigie-Nature in France[73] and the Phenology Recording System of the New Zealand Plant Conservation Network[74].

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

### Box 33: The Fairchild Challenge

The Fairchild Challenge is a unique school-based environmental education competition run by Fairchild Tropical Botanic Garden whereby students are engaged and actively involved in environmental education and stewardship. Through repeated exposure to highly experiential and inquiry-based environmental education, the Fairchild Challenge is influencing and empowering a diverse generation of scientists, researchers, educated voters, policy makers, and environmentally-minded citizens. The program encourages students to actively learn, explore and devise creative and effective responses to some of the most pressing environmental issues of our time.

*Source: Fairchild Tropical Botanic Garden. Information provided for the mid-term review of the GSPC*

### Box 34: Fascination of Plants Day

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

*Source: European Plant Science Organisation. Information provided for the mid-term review of the GSPC*

# 5 . SUMMARY OF PROGRESS TOWARDS THE GSPC TARGETS

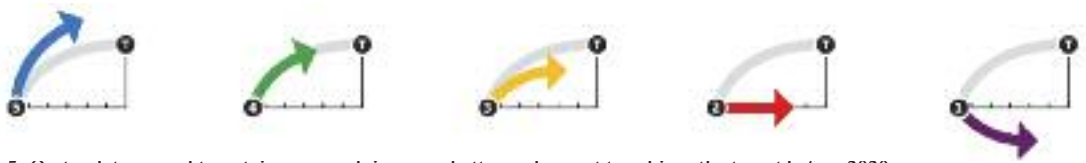
The conservation of plant diversity is of fundamental importance in addressing the challenges of climate change, sustainability of natural resources, food security, fuel security and preservation of ecosystem services. The Aichi Targets of the Strategic Plan for Biodiversity 2011-2020 will not be met unless plant diversity is effectively conserved. The GSPC has galvanized action in plant conservation and significant progress is being made towards certain targets. Overall, however, progress is constrained by lack of recognition of the importance of plants and allocation of resources for their effective conservation. It is important to demonstrate that not only is plant conservation essential but also achievable and affordable.

The table below provides an assessment of progress made towards each of the GSPC targets and notes which corresponding Aichi Biodiversity Target this contributes to. To increase the pace of action in global plant conservation, information needs to be assembled as a matter of urgency in support of GSPC Targets 1, 2 and 5 to inform the biodiversity debate and action more broadly. Information on the distribution and conservation status of plant species is fundamental for planning *in situ* conservation and sustainable use of biodiversity at the landscape level as required by GSPC Targets 4, 5, 6, 7 and 10.

With increasing impacts of climate change, at the same time information on the conservation status of species is urgently required to plan effective *ex situ* conservation strategies. Storing and growing genetically representative material of threatened plant species is of great value for research, for example in support of sustainable production, and for ecological restoration. *Ex situ* collections can and should also be used more effectively to convey to broad audiences the need for plant conservation as called for in GSPC Target 14.

As the threats to plant conservation increase, botanical capacity and funding for plant conservation are decreasing in many parts of the world and this impacts on the ability to implement the GSPC. CBD Parties and other Governments should further engage with partner organizations, including members of the Global Partnership for Plant Conservation (GPPC), to make the best use of available expertise and find ways to fully involve indigenous and local communities and the widest range of stakeholders, to enhance implementation of the Strategy. It is important to build on the successes of the Strategy and to continue sharing relevant tools, methodologies and successful case studies, through regional collaboration, through the GSPC toolkit[75] and through the clearing-house mechanism of the CBD.

The table below aims to provide summary information on whether or not we are on track to achieve the GSPC targets by 2020. The assessment uses a five-point scale:



5. On track to exceed target, i.e. we are doing even better and expect to achieve the target before 2020;
4. On track to achieve target, i.e. if we continue our efforts we expect to achieve the target by 2020;
3. Progress towards target but at an insufficient rate, i.e. unless we step up our efforts we will have missed the target in 2020;
2. No significant change, i.e. we are neither moving towards the target nor away from it;
1. Moving away from target, i.e. things are getting worse rather than better.

This assessment is based on the information provided for the mid-term review of the GSPC, largely by GPPC members and the level of confidence, based on the available evidence, is indicated for each target.

| GSPC Target | Current status (and level of confidence for ranking) | Comments |
|---|---|---|
| **Target 1:** An online flora of all known plants |  **high** On track to achieve target | The establishment of the World Flora Online Consortium is an important step towards this target. Good progress has been made at the national level in many countries, including several mega-diverse countries. Concerns about declining taxonomic capacity and levels of funding may be constraints to the achievement of this target.<br><br>**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 |  **high** Progress towards target but not to achieve it | This Target is essential to provide a baseline for setting priorities and measuring conservation progress. So far progress at the global level has been slow. IUCN is, however, on track to achieve its target of assessing 10% of the world's plants for the Red List by 2020. Progress at the national level is generally good and particularly encouraging in some mega-diverse countries. The Target may be achievable if information from the IUCN Red List and national sources were to be combined.<br><br>**Relates Aichi Target 19: Knowledge improved, shared and applied** |
| **Target 3:** Information, research and associated outputs and methods necessary to implement the Strategy developed and shared |  **medium** Progress towards target but not to achieve it | An on-line GSPC toolkit has been developed and is available in all UN languages. However, much relevant and practical 'how to' information continues to lie in unpublished reports, not easily accessible to plant conservation practitioners. Greater efforts are needed to promote the use of the toolkit and evaluate its use.<br><br>**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 |  **high** Progress towards target but not to achieve it | This target is achieved mainly by actions taken to implement Aichi Targets 11 and 15. A report on Aichi Target 11 notes that 55% of terrestrial ecosystems have at least 10% coverage by protected areas and 7% have at least 75%.<br><br>**Relates to Aichi Target 11: Protected areas** |

| GSPC Target | Current status (and level of confidence for ranking) | Comments |
|---|---|---|
| **Target 5:** At least 75 % of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity |  **high** Progress towards target but not to achieve it | This is a particularly important target to inform *in situ* plant conservation worldwide. A significant number of countries have identified important areas for plant diversity. However, it is not clear how many of these are incorporated into protected area systems, are being effectively managed or how well these are distributed across ecological regions. More support is needed for consolidation of national information at the global level.<br><br>**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 |  **medium** Progress towards target but not to achieve it | 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.<br><br>**Relates to Aichi Target 7: Sustainable agriculture, aquaculture and forestry** |
| **Target 7:** At least 75% of known threatened plant species conserved *in situ* |  **medium** No progress | At the global level it difficult to measure progress because of slow progress with Target 2 and lack of protected area inventories for plants. 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.<br><br>**Relates to Aichi Target 12: Extinction prevented** |
| **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 |  **medium** Progress towards target but not to achieve it | At the global level, 29% of the species listed on the 2013 IUCN Red List are known to be in *ex situ* collections but this is only a limited representation of globally threatened plants. Higher percentages are recorded at the regional and national levels. The first part of the target (*ex situ* collections) has already been achieved by some countries, but it remains challenging for mega-diverse countries.<br><br>For use in recovery and restoration programmes, more effort is needed to ensure that *ex situ* collections are genetically representative of species populations. Greater emphasis should be given to seed conservation to enhance restoration potential, with research needed to address species that cannot be seed banked.<br><br>**Relates to Aichi Target 12: Extinction prevented** |

| GSPC Target | Current status (and level of confidence for ranking) | Comments |
|---|---|---|
| **Target 9:** 70% of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge |  **low** Progress towards target but not to achieve it | The Global Plan of Action on Plant Genetic Resources for Food and Agriculture addresses this Target. It is likely that the Target has already been met for major crops that are important globally. However the challenge is to meet this target for the many thousands of other species that are of socio-economic importance at the national or local level. There is a need for a global inventory of such species to guide conservation and sustainable use priorities.<br><br>**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 |  **medium** No progress | Increasing global trade and the multiple pathways of introduction represent a major challenge to preventing new invasions.<br><br>Although some encouraging activities are on-going in managing areas already affected, the evidence suggests that progress is insufficient to meet the target.<br><br>**Relates to Aichi Target 9: Invasive alien species prevented and controlled** |
| **Target 11:** No species of wild flora endangered by international trade |  **high** Progress towards target but not to achieve it | This target is implemented through the action of CITES and a resolution on Cooperation with the GSPC was adopted in 2013 by CITES COP 16.<br><br>Significant progress has been made in developing Guidelines for determining Non-Detriment Findings for perennial species and these are now starting to be applied.<br><br>**Relates to Aichi Target 4: Sustainable consumption and production** |
| **Target 12:** All wild harvested plant-based products sourced sustainably |  **low** Progress towards target but not to achieve it | The introduction of the FairWild Standard provides a necessary tool to measure future progress towards this target. Although there are a number of interesting initiatives taking place at the national level, involving both the public and private sectors, it is unlikely that the target will be met at the global level. Sustainable sourcing is difficult to promote as information on species that are harvested and levels of exploitation is generally not available.<br><br>**Relates to Aichi Target 4: Sustainable consumption and production** |

| GSPC Target | Current status (and level of confidence for ranking) | Comments |
|---|---|---|
| **Target 13:** Indigenous and local knowledge innovations and practices associated with plant resources maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care |  **low** Progress towards target but not to achieve it | 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.<br><br>This Target can be considered an 'enabling' target, supporting the achievement of other targets.<br><br>**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 |  **high** Progress towards target but not to achieve it | Plants are often neglected in the conservation debate because of lack of information but also more fundamentally lack of popular interest and concern. Significant progress in Targets 1, 2 and 5 will help to make a stronger case for action.<br><br>Increasing participation in citizen science programmes, which are often focused on plants, is helping to raise awareness amongst a broader community but additional innovative approaches are needed.<br><br>**Relates to Aichi Target 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 |  **medium** No progress | The broad scope of the GSPC requires considerable capacity building across a range of disciplines. Botanical capacity generally is concentrated outside areas of high plant diversity and skill-sharing needs to be strengthened. There is a worrying decline in the teaching of botany at University level and much capacity building is being undertaken within the informal education sector, for example through botanic garden training courses.<br><br>**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 |  **medium** Progress towards target but not to achieve it | At the global level, the establishment of the GPPC has made a good start at bringing together the plant conservation community, but engagement needs to be further developed and sustained. Greater efforts are also needed to engage with the many other sectors that have a vital role to play.<br><br>**Relates to Aichi Target 19: Knowledge improved, shared and applied** |

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# NOTES

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[68] UNECE/FAO. 2013. *Forest Products Annual Market Review 2012-2013. Geneva Timber and Forest Study Paper 33* http://www.unece.org/fileadmin/DAM/timber/publications/FPAMR2013.pdf.

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

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

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

[72] http://budburst.org/

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

[74] http://www.nzpcn.org.nz/

[75] http://www.plants2020.net

# ANNEX 1: 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.

### 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.

# ANNEX 2: MEMBERS OF THE GLOBAL PARTNERSHIP FOR PLANT CONSERVATION

- 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
- Center for Plant Conservation, USA
- Chicago Botanic Garden, USA
- Conservatoire et Jardin botaniques de la Ville de Genève, Switzerland
- Chinese Academy of Sciences – Botanic Garden Network
- Denver Botanic Garden, 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)
- IUCN - International Union for the Conservation of Nature - Species Survival Commission
- Jardí Botànic de la Universitat de València, Spain
- Joint Nature Conservation Committee (JNCC), UK
- King's Park and Botanic Gardens, Australia
- Missouri Botanical Garden, St Louis, USA
- Muséum National d'Histoire Naturelle, Paris, France
- National Botanic Gardens Ireland, Glasnevin
- New York Botanical Garden, USA
- New Zealand Plant Conservation Network
- The University of Oxford Botanic Garden, UK
- People and Plants International (PPI)
- Plantlife International and Planta Europa
- PRONAPLAMED, University of Costa Rica, Costa Rica
- Red Latinoamericana de Botanica
- Rede Brasileira de Jardins Botanicos (RBJB)
- Red Nacional de Jardines Botánicos de Colombia
- Royal Botanical Gardens (Hamilton & Burlington, Canada)
- Royal Botanic Garden, Edinburgh, UK
- Royal Botanic Gardens Kew, UK
- Smithsonian Institution Natural History Museum, Washington D.C., USA
- Society for Ecological Restoration
- Society for Economic Botany
- South African National Biodiversity Institute, South Africa (SANBI)
- Species2000
- TRAFFIC
- UNEP World Conservation Monitoring Centre (UNEP-WCMC)
- UNESCO CHAIR Jardín Botánico Viera y Clavijo, Spain
- World Agroforestry Centre, ICRAF
- WWF International (WWF)
- Wuhan Botanic Garden Botanical Institute, China

# ANNEX 3: POTENTIAL CONTRIBUTION OF CITES TO THE GSPC TARGETS[1]

| GSPC Objective | GSPC Target | CITES's potential contribution |
|---|---|---|
| (I) Plant diversity is well understood, documented and recognized | 1. An online flora of all known plants. | CITES checklists available online. |
| | 2. An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action. | –CITES Appendices.<br>–Supporting statements for proposals to amend the Appendices.<br>–NDFs.<br>–Periodic Review results.<br>–Review of Significant Trade results. |
| | 3. Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared. | |
| (II) Plant diversity is urgently and effectively conserved | 4. At least 15 % of each ecological region or vegetation type secured through effective management and/or restoration. | Not directly applicable as CITES works at species level. |
| | 5. At least 75 % of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity. | |
| | 6. At least 75 % of production lands in each sector managed sustainably, consistent with the conservation of plant diversity. | |
| | 7. At least 75 % of known threatened plant species conserved *in situ*. | –Inclusion of species/populations in CITES Appendices.<br>–Identification of the location/habitat of Appendix I species.<br>–Efforts by CITES Parties to ensure sustainable use of CITES-listed species: NDFs and national quotas.<br>–Implementation of Resolution Conf. 13.9 on Encouraging cooperation between Parties with *ex-situ* breeding operations and those with *in situ* conservation programmes.<br>–CITES Certificate of Scientific Exchange. |
| | 8. At least 75 % of threatened plant species in *ex-situ* collections, preferably in the country of origin, and at least 20 % available for recovery and restoration programmes. | |
| | 9.70 % of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge. | Not directly applicable. |
| | 10. Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded. | Not directly applicable. Nevertheless, CITES Parties have recognized the link between trade and alien invasive species in Resolution Conf. 13.10 (Rev. CoP14) on *Trade in alien invasive species*. |

| GSPC Objective | GSPC Target | CITES's potential contribution |
|---|---|---|
| (III) Plant diversity is used in a sustainable and equitable manner | 11. No species of wild flora endangered by international trade. | All CITES activities contribute directly to this Target, and CITES is recognized as having a leadership role in implementing this Target. |
| | 12. All wild-harvested plant-based products sourced sustainably. | –NDFs, national quotas, Review of Significant Trade, and Periodic Review of the Appendices.<br>–Annotations to the Appendices enable regulation of certain target commodities. |
| | 13. Indigenous and local knowledge innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care. | –NDFs.<br>–Resolution Conf. 10.19 (Rev. CoP14) on Traditional medicines.<br>–CITES Standing Committee Working Group on CITES and Livelihoods. |
| (IV) Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on earth is promoted | 14. The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes. | CITES tools, such as:<br>–Training courses, workshops results and technical reports.<br>–CITES Virtual College<br>–CITES website<br>–CITES Identification Manual and Web pages.<br>–Training materials, including PowerPoint presentations and CD-ROMs.<br>–Capacity-building work of the Secretariat.<br><br>–CITES Parties and Plants Committee.<br>–Regional Directories. |
| (V)The capacities and public engagement necessary to implement the Strategy have been developed | 15. The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy. | |
| | 16. Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy. | |

[1] CITES Resolution Conf 16-5 Cooperation with the Global Strategy for Plant Conservation of the Convention on Biological Diversity. Accessible at: http://www.cites.org/eng/res/16/16-05.php.