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North American Botanic Garden Strategy for Plant Conservation 2016-2020

Botanic Gardens Conservation International

American Public Gardens Association

Asociacion Mexicana de Jardines

Center for Plant Conservation

Plant Conservation Alliance

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The 2016-2020 North American Botanic Garden Strategy for Plant Conservation is dedicated to the late Steven E. Clemants, who so diligently and ably led the creation of the original North American Strategy published in 2006.

Contributors

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Back cover: *Dudleya anthonyi* (Anthony's liveforever). Northwestern Baja California, Mexico. Rare endemic of the region. (Evan Meyer)



Frequently Asked Questions and Answers

The *North American Botanic Garden Strategy for Plant Conservation* is a tool for anyone. It is meant not only for botanic gardens but others as well such as zoos, natural history museums, universities, governments, native plant societies, and any other interested groups. From the smallest organization to the largest, all can find utility and the inspiration to action.

This document is organized by action areas and paired with related resources and case studies as a starting point for interested readers. Appropriate sections relevant to common questions you might have are highlighted below for quick reference.

Where could one get a basic understanding of North American plant conservation and its relationship to global biodiversity goals?

See the Prologue (page 4), the Foreword (page 5), and the Introduction (page 6-9)

Is there a history and quick overview of the *North American Botanic Garden Strategy for Plant Conservation*?

See the Introduction (page 6) and the Summary of Objectives and Targets (pages 10-14)

What is the status of creating North American and global plant checklists?

See the Prologue (page 4), the Foreword (page 5), and Objective A “Understanding and documenting Plant Diversity” and Related Resources (pages 15-16)

Where is information related to the care and preservation of rare and threatened plant species?

See Objective B “Conserving Plant Diversity” and Related Resources (pages 18-19)



Mammillaria herrerae (golfball). Querétaro, Mexico. At risk of extinction (NOM-059-SEMARNAT-2010); Critically endangered (IUCN Red List). Recorded in 32 ex situ sites (BGCI PlantSearch). (Beatriz Maruri Aguilar)

How would one ship, trade, use, or produce plants or plant products sustainably and understand their cultural uses?

See Objective C “Using plant diversity sustainably” and Related Resources (page 28)

How can public outreach and educational resources be used to support plant conservation?

See Objective D “Promoting public awareness about plant diversity” and Related Resources (pages 31-32)

How can I connect to a larger community of professional botanists and horticulturists?

See Objective E “Building capacity for conservation of plant diversity” and Related Resources (page 33)

How can I incorporate plant conservation goals into our institutional policy and plans?

See Objective F “Supporting the North American Strategy” and Related Resources (page 37)

Acronyms Used

AMJB	Asociación Mexicana de Jardines Botánicos
ASHS	American Society for Horticultural Science
AZH	Association of Zoological Horticulture
BGCI	Botanic Gardens Conservation International
CBD	<i>Convention on Biological Diversity</i>
CITES	<i>Convention on International Trade in Endangered Species</i>
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPC	Center for Plant Conservation
EMVC	<i>Estrategia Mexicana para la Conservación Vegetal</i>
ERA	Ecological Restoration Alliance
FAO	Food and Agriculture Organization of the United Nations
FNA	<i>Flora of North America</i>
GSP	IUCN Global Species Programme
GSPC	<i>Global Strategy for Plant Conservation</i>
LEED	Leadership in Energy & Environmental Design
INECOL	Instituto de Ecología A.C. de México
IPSN	International Plant Sentinel Network
IUCN	International Union for the Conservation of Nature
NACA	<i>North American Collections Assessment</i>
NOM-59-SEMARNAT	<i>Norma Oficial Mexicana</i>
NPDN	National Plant Diagnostic Network
PCA-NFCC	Plant Conservation Alliance Non-Federal Cooperators Committee
SARA	<i>Canadian Species at Risk Act</i>
SSC	IUCN Species Survival Commission
UN	United Nations
UNAM	National Autonomous University of Mexico
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USDA	United States Department of Agriculture
WHO	World Health Organization
WFO	<i>World Flora Online</i>



Zamia purpurea. Oaxaca and Veracruz, Mexico. At risk of extinction (NOM-059-SEMARNAT-2010); *Critically endangered* (IUCN Red List). Recorded in 5 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)



Quercus acerifolia. Arkansas, USA. *Critically imperiled* (NatureServe); *Endangered* (IUCN Red List). Recorded in 16 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)

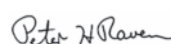
Prologue

When the botanical community began to realize a half century ago that plants were becoming extinct in nature, and many more were endangered, the role of botanic gardens in saving species was immediately evident. Particularly with the publication of Ronald Melville's first list of endangered plants by the IUCN in 1970, we began to consider how to amplify that role. Meetings were held during the course of the 1970s to work out a path forward. In 1984, the Center for Plant Conservation (CPC) was formed at the Arnold Arboretum of Harvard University as a way of uniting botanic gardens for plant conservation; the network has grown to more than 40 members, with some 800 of the most imperiled plant species in the United States currently preserved in seed banks or gardens as part of the CPC's National Collection.

The formation of Botanic Gardens Conservation International (BGCI) in 1987 at Kew, an institution that has long been active in the field, provided a framework for expanding these efforts worldwide. This dream became increasingly concrete during the period 1995-2006 when Peter Wyse Jackson served as BGCI's Secretary General. At the XVI International Botanical Congress in St. Louis, Missouri I, as Congress President, proposed that a worldwide system be established for plant conservation, and had in mind the importance of establishing a framework that would encourage individual nations to establish their own plans and goals for plant conservation as part of an overall effort. Thanks to subsequent hard work by Peter Wyse Jackson, Stella Simiyu, Cristián Samper, Bráulio Dias, and others, the *Global Strategy for Plant Conservation* (GSPC) was established in 2002, under the aegis of the Convention on Biological Diversity, providing concrete global objectives from that point forward.

Our early intention in establishing the GSPC was global, but its goals have been and will be pertinent to the strengthening of North American plant conservation and coordination. A consortium of the American Public Gardens Association, the Association of Mexican Botanic Gardens, the United States office of BGCI, the CPC, and the Plant Conservation Alliance has been formed to strengthen the network of botanic gardens active in plant conservation. The resulting Initiative led by this group will support the implementation of the *North American Botanic Garden Strategy for Plant Conservation* by coalescing existing activities and facilitating wider participation across the continent. For example, in addressing the need for a checklist of plants of North America, NatureServe, the USDA's PLANTS database, CPC and other partners are spearheading a joint project with the Flora of North America to produce and maintain an authoritative list of plants of Canada and the USA. This will provide important information for setting regional conservation priorities. Further, as a foundation for building genetically appropriate *ex situ* collections of threatened plants, the CPC's National Collection will be expanded.

In summary, the prospects for plant conservation in North America are excellent, with the goals established by the GSPC helping them through the establishment of the specific and measurable goals outlined in this document.



Peter H. Raven

Chairman, Board of Trustees, Center for Plant Conservation;
President Emeritus, Missouri Botanical Garden

Foreword

The adoption of the *Global Strategy for Plant Conservation* (GSPC) in 2002 ushered in a new direction in plant conservation worldwide. Not only was it the first time that measurable outcome targets had ever been approved by the international community in the conservation of biodiversity, but it was also the first time that a global consensus had been reached on the objectives and priorities needed to protect our greatest renewable natural resource, plants. Amongst those involved in plant conservation worldwide at the time, I remember that it was also a period of intense excitement and anticipation of the great progress that would be made in bringing tens of thousands of threatened plant species back from the brink of extinction.

Over the fourteen years since the United Nations Convention on Biological Diversity enacted the GSPC we have come to realize of course that there is no ‘easy fix’ for plant conservation. Neither would there be an overnight global awakening on the need for new resources to be applied to plant conservation. Every species conserved, every wild habitat safeguarded or restored, every cent or centavo brought to plant conservation has been hard won. We have travelled a long road, but the journey continues. Every mile we go we realize that the passage is longer and more complex than we ever imagined. We can all be proud at what has been achieved. But, we can recognize that we now have the firm foundations on which to build a resilient and sustainable future for plants.

A valuable spin-off achievement of the GSPC has been the increasing recognition of the value of botanic gardens (including arboreta) as indispensable resource centers for plants. Such recognition would surely have grown even without the GSPC, but the Strategy has provided a valuable common framework for our collective actions in plant conservation and, for the first time, clearly expressed shared goals. No matter where one goes in the world one can find a diversity of botanic gardens working to achieve the GSPC targets. For many of us, it has even led to an understandable shorthand, such as “those are great Target 8 or Target 14 projects”! Many valuable initiatives owe their genesis to the GSPC, such as the World Flora Online project, and the growth in BGCI’s PlantSearch database, documenting for the first time, the plants maintained in botanic garden collections.

Translating the GSPC into regional and sectorial actions has been and remains an important priority, and that is where the *North American Botanic Garden Strategy for Plant Conservation* is so valuable. For botanic gardens, we know that our efforts should and can be directed toward the complex tasks of conserving plants in cultivation and in the wild. We know that documenting plant diversity, at the levels of genes, populations, species and ecosystems is also a mission for which we are well suited. We believe that we can play increasingly effective roles in ecological restoration. Our skills and resources continue to be used in the development of conservation biology research, gaining an understanding of the processes, mechanisms and interactions at all levels of biological organization needed to sustain plant diversity.

Our work on studying and conserving plants of actual or potential economic value, and in documenting and safeguarding the millennia of human knowledge accumulated on such species, is more important than ever when unsustainable development and urbanization are divorcing us from our cultural roots that sustained our lives. Our advocacy for plants and the educational work with the millions who visit botanic gardens each year, help to spread the word about how essential plants are to our present lives and for the future. Our efforts to demonstrate the links between plants and sustainable livelihoods, human well-being, and poverty eradication are needed now more than ever.

The *North American Botanic Garden Strategy for Plant Conservation* provides a template from which we can each choose the parts we wish to play in plant conservation in this region, and in supporting the global efforts to achieve the GSPC throughout the world. Individually our efforts will be important wherever we work. But collectively they will amount to a world-changing initiative where the successes we achieve individually and together will ensure that plant life survives and thrives to sustain ourselves and our futures.



Peter Wyse Jackson

Chair, Global Partnership for Plant Conservation;
President, Missouri Botanical Garden

Introduction

Plant diversity is indispensable. Beyond sustaining a healthy planet, it impacts societal, economic, and political stability. The aspirations described herein provide a useful framework to focus local and regional plant conservation efforts toward the collective achievement of the *Global Strategy for Plant Conservation* (GSPC).

In the ten years since the original publication of the 2006 *North American Botanic Garden Strategy for Plant Conservation* (*North American Strategy*), the botanic garden community has grown significantly in its capacity and commitment for plant conservation. Increasingly, botanic gardens are making plant and habitat conservation core to their missions and strategies. This document provides a framework to leverage North American botanic gardens as a collective force to stop plant extinctions and the loss of wild habitats.

Botanic gardens enjoy the public trust and provide intellectually and spiritually stimulating destinations for hundreds of thousands of visitors annually of all ages and backgrounds, a testament to their collective social and economic power.

The *North American Strategy* and the North American Plant Conservation Initiative that will follow (more information on the Initiative below) are intended to provide a foundation for meeting ambitious and critical plant conservation targets. We can only meet these goals through collective, coordinated and enthusiastic action. The overall objective we all share is to sustain a healthy, biodiverse world where we can continue to enjoy the essential benefits of plants that support sustainable livelihoods, health and our well-being.



Agave toumeyana (Toumey agave). *Arizona, USA. Vulnerable* (NatureServe); *Vulnerable* (IUCN Red List). *Recorded in 31 ex situ sites* (BGCI PlantSearch). (Missouri Botanical Garden)



Cirsium pitcheri (dune thistle). *Ontario, Canada and Upper Great Lakes, USA. Imperiled* (NatureServe); *Special concern* (SARA). *Recorded in 4 ex situ sites* (BGCI PlantSearch). (Pati Vitt)

There are over 1,000 botanic gardens and similar organizations throughout North America according to data reported to BGCI's *GardenSearch* database, all of which have unique capabilities and programs that contribute to plant conservation. Each of these gardens can craft its own response to the regional, national, and global conservation challenges of the *North American Strategy* in the context of its own institutional mission.

Strong Partnerships Broaden Our View of Conservation

Collaboration among botanic gardens and other leading institutions in plant research and expertise, such as academic institutions, zoos, aquaria, natural history museums, and land management agencies, has been and will continue to be a key driver of conservation progress.

The GSPC is a template for the *North American Strategy* and accordingly places the plant conservation work of the North American institutes within a global context. The *North American Strategy's* geographic and cultural scope encompasses the nations of Canada, Mexico, and the United States of America and associated territories and dependencies. The plant conservation challenges of this region are diverse. As such, effective conservation efforts will depend upon the delivery of national, regional and local responses. This document and the supporting initiatives highlighted provide structure to bring even greater collective action.

Botanic gardens can support the *North American Strategy* in many ways, including:

- Help document local, regional, and national floras
- Assess threats and levels of risk to species and populations
- Conduct science-based ecological restoration
- Engage in proper land use and support protected areas and wilderness
- Build and maintain documented plant and seed collections as *ex situ* repositories
- Develop strategies to address food systems and security, cultural practices, and crop diversity

- Promote awareness, adaptation, and mitigation principles regarding climate change and invasive species
- Adopt sustainable practices, preserve ecosystem services, and promote cultural biodiversity
- Help conserve essential symbionts such as fungi and pollinators
- Create educational programs for professionals and the public
- Craft messages to raise awareness about human impacts on plant diversity

2016 Update of the 2006 North American Botanic Garden Strategy for Plant Conservation

The 2006 *North American Strategy* was an important milestone and the culmination of a three-year collaborative process. Collaborating organizations beyond the botanic garden community included representatives from non-governmental organizations, government agencies, and university researchers with expertise in plant conservation. The 2006 *North American Strategy* was intended to inspire individual and collective action and to link the efforts of North American botanic gardens with the 2010 goals of the GSPC.

Since the publication of the 2006 *North American Strategy* and the 2000 *Conservation Strategy for Mexican Botanic Gardens (Estrategia de Conservación para los Jardines Botánicos Mexicanos)*, significant progress has been made toward the achievement of the plant conservation targets established. However, there is still a great deal more work to be done. An array of resources has been assembled to support GSPC implementation, many of which have been developed by botanic gardens. Several are available in the *Plants2020 GSPC Toolkit*.

In 2011, the GSPC was renewed by the Convention on Biological Diversity (CBD), incorporating a series of revised targets to be achieved by 2020. This document represents the 2016 update of the *North American Strategy* to align its goals with the 2011-2020 GSPC.

The 2016 goals are essentially the same as the 2006 goals but many of the targets and subtargets have been updated. In addition, the 2016 *North American Strategy* includes updated supporting information and provides case studies illustrating the diversity of botanic gardens and plant conservation activities happening across North America.

The 2016-2020 North American Botanic Garden Strategy for Plant Conservation directly supports and incorporates the goals, mission, and vision of the 2011-2020 GSPC:

Vision *Without plants, there is no life. The functioning of the planet, and our survival, depends upon 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 resources, survival of plant*

species, communities and associated habitats and ecological associations), and where in turn the diversity of plants support and improve our livelihoods and well-being.

Mission *The Global Strategy for Plant Conservation is a catalyst for working together at all levels - local, national, regional and global - to understand, conserve and use sustainably the world's immense wealth of plant diversity while promoting awareness and building the necessary capacities for its implementation.*

The major objectives of the *North American Strategy* are also parallel to the GSPC objectives:

North American Strategy objectives:	GSPC objectives:
A. Understanding and documenting plant diversity	I. Plant diversity is well understood, documented and recognized
B. Conserving plant diversity	II. Plant diversity is urgently and effectively conserved
C. Using plant diversity sustainably	III. Plant diversity is used in a sustainable and equitable manner
D. Promoting public awareness of the importance of plant diversity and the wise use of resources	IV. Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on Earth is promoted
E. Building capacity for conservation of plant diversity	V. The capacities and public engagements necessary to implement the Strategy have been developed
F. Supporting the North American Strategy	

This updated *North American Strategy* acknowledges the significant role that botanic gardens in North America play in the promotion, research, conservation, and sustainable use of the plants of North America. However, it also relates to the roles that North American botanic gardens play elsewhere in the world. By highlighting the depth and breadth of botanic garden conservation capacity, this *North American Strategy* is intended to encourage more institutions to contribute to plant conservation in their region and globally.

In a broader context, other international goals that relate directly to biodiversity conservation have recently been adopted, such as the CBD's *Strategic Plan for Biodiversity 2011-2020* and its linked *Aichi Biodiversity Targets* and the United Nations' (UN) *Sustainable Development Goals*. Regional plant conservation strategies aligned with the GSPC have also been developed within North America, including the *Hawai'i Strategy for Plant Conservation* (2014), the *Colorado Rare Plant Conservation Strategy*, and the *Mexican Strategy for Plant Conservation (Estrategia Mexicana para la Conservación Vegetal 2012-2030)*. An action plan for Mexican botanic gardens, and a national assessment of Canadian plant conservation needs and priorities, are currently under development.

Because plant distributions do not generally follow political boundaries, a key to effective conservation is integrating the goals and activities of the many botanical and conservation organizations in Canada, Mexico, and the USA. A primary reason for the creation of the *North American Strategy* is to encourage such integration and collaboration.



Sarracenia rubra ssp. *jonesii* (Jones' pitcherplant). North Carolina and South Carolina, USA. Imperiled (NatureServe). Recorded in 30 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)

North American Plant Conservation Initiative

This update of the *North American Strategy* is the first step of the North American Plant Conservation Initiative, a joint effort to engage botanic gardens working actively in plant conservation. The Initiative is led jointly by the American Public Gardens Association, Botanic Gardens Conservation International, US (BGCI US), the Center for Plant Conservation (CPC), and the Plant Conservation Alliance Non-Federal Cooperators Committee (PCA-NFCC). These four collaborative networks are working together to empower all gardens toward achieving the regional, North American, and global plant conservation goals outlined here. The Mexican Association of Botanic Gardens (Asociación Mexicana de Jardines Botánicos, AMJB) is co-leading this Initiative and Canadian botanic gardens will also be actively engaged. More information about all of these networks can be found in Appendix A.

The next step is an update of the 2010 *North American Collections Assessment*, a voluntary inventory of threatened native plants in botanic garden and seed bank collections. Building on the work of CPC gardens and other scientists, this analysis will identify threatened species absent or underrepresented in *ex situ* collections in North America. Gardens of all sizes can then use this information to strategically develop plant conservation collections and help to guide conservation of all priority North American plant species. Coinciding with this gap analysis, an outreach effort to all North American gardens will aim to encourage and support plant conservation regionally in whatever manner they can best do so. It will take the collective effort of all stakeholders to meet these substantial and meaningful objectives. We hope the North American Plant Conservation Initiative will inspire organizations and individuals, to further protect and study threatened plants, develop new educational tools, and provide relevant information to policy makers. As a united North American plant conservation community, we will ensure that plant species, their natural communities, and other biota at risk will survive and thrive.

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Related Resources

Aichi Biodiversity Targets

<https://www.cbd.int/sp/targets/>

American Public Gardens Association

<https://publicgardens.org/>

Asociación Mexicana de Jardines Botánicos (AMJB, Mexican Association of Botanic Gardens)

<http://www.concyteq.edu.mx/amjb/>

Botanic Gardens Conservation International, US (BGCI US)

<http://www.bgci.org/usa/>

Center for Plant Conservation (CPC)

<http://www.centerforplantconservation.org/>

Colorado Rare Plant Conservation Strategy

http://www.cnhp.colostate.edu/download/documents/2009/CO_Plant_Conservation_Strategy_Report-links.pdf

Estrategia de Conservación para los Jardines Botánicos Mexicanos (2000, Conservation Strategy for Mexican Botanic Gardens)

http://www.conabio.gob.mx/institucion/cooperacion_internacional/doctos/b07/Estrategia%20de%20Conservacion%20para%20los%20jardines%20botanicos%20mexicanos%202000-1.pdf

Estrategia Mexicana para la Conservación Vegetal 2012-2030 (EMCV, Mexican Strategy for Plant Conservation)

http://www.biodiversidad.gob.mx/pais/emcv/pdf/EMCV_Completa_Baja.pdf



Rhododendron chapmanii (Chapman's rhododendron). Florida, USA. Critically imperiled (NatureServe). Recorded in 14 ex situ sites (BGCI PlantSearch). (United States Botanic Garden)



Echinacea tenesseeensis (Tennessee coneflower). Tennessee, USA. Imperiled (NatureServe). Recorded in 45 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)

Global Strategy for Plant Conservation (GSPC), 2011-2020

<https://www.cbd.int/gspc/>

Hawai'i Strategy for Plant Conservation

<http://laukahi.org/hawaii-strategy-for-plant-conservation/>

North American Botanic Garden Strategy for Plant Conservation (2006)

http://www.bgci.org/files/Worldwide/Conservation/north_american_plant_conservation_strategy.pdf

North American Collections Assessment

<http://www.bgci.org/usa/naca>

Plant Conservation Alliance Non-Federal Cooperators Committee (PCA-NFCC)

www.plantconservationalliance.org

Plants2020 GSPC Toolkit

<http://www.plants2020.net/>

Strategic Plan for Biodiversity 2011-2020

<https://www.cbd.int/sp/>

UN Sustainable Development Goals

<https://sustainabledevelopment.un.org/sdgs>

Summary of Objectives and Targets

This section offers a condensed view of the North American Botanic Garden Strategy for Plant Conservation, as an overview of all objectives, targets, and subtargets, and to allow quick reference for interested readers.

Target	Description	Page
Objective A. Understanding and documenting plant diversity		
A1	All botanic gardens in North America with the capacity for programs in plant systematics will review and contribute to the achievement of the GSPC Target 1 to have a complete online flora by 2020. Botanic gardens will contribute to their respective national flora projects and, where relevant, help document the floras of other parts of the world.	15
Subtarget 1	A working group will be convened to facilitate the reporting and compiling of existing comprehensive national and North American plant lists related to various categories of plant diversity including native, agricultural, horticultural, and medicinal plants.	15
A2	All botanic gardens with the capacity will review and contribute to assessments of the conservation status of plant species, using criteria and standards developed by NatureServe and the IUCN.	16
Subtarget 1	Botanic gardens will support and coordinate efforts, identify gaps, recruit expert contributors, and set priorities for assessing threats to plant species in taxonomic groups and regions where they work.	16
Subtarget 2	The number of botanic garden staff participating in threat assessment working groups and projects will increase.	16

Objective B. Conserving plant diversity		
B1	Botanic gardens will work collaboratively to support <i>in situ</i> conservation of threatened natural areas, habitats, and ecosystems locally, regionally, and internationally.	18
Subtarget 1	All botanic gardens in Canada and the USA will support local, national and international <i>in situ</i> conservation.	18
Subtarget 2	At least 40% of Mexican botanic gardens will participate in <i>in situ</i> conservation programs for areas of high biodiversity and at least 60% of threatened species in Mexico will be protected <i>in situ</i> as set forth in the EMVC Target 2.	18
B2	Botanic gardens will expand <i>ex situ</i> conservation efforts and partnerships.	19
Subtarget 1	75% of threatened native plant species in Canada and the USA will be maintained in botanic garden <i>ex situ</i> collections (as plants, tissues, or seeds) with appropriate genetic representation to support restoration and managed according to national and international standards, such as those of the Center for Plant Conservation.	19

Target	Description	Page
Subtarget 2	60% of native plant species in Mexico categorized as “at risk” (NOM-059-SEMARNAT-2010) will be represented in Mexican botanic garden <i>ex situ</i> collections of plants by 2020.	19
Subtarget 3	At least 20% of North American botanic gardens will collaborate with the international community in <i>ex situ</i> measures such as seed banking, cryopreservation, and tissue culture, and duplicate collections for the conservation of non-North American species.	19
Subtarget 4	All botanic gardens that maintain plant records will share their plant collections data with the community through tools such as BGCI’s PlantSearch database.	19
B3	Botanic gardens will increase their participation in formal recovery planning and implementation for species in their regions, working with state, provincial, and federal agencies.	22
Subtarget 1	At least 35% of botanic gardens in Canada will be partners in recovery planning for species in their regions.	22
Subtarget 2	At least 30% of botanic gardens in the USA will be partners in recovery planning for species in their regions.	22
Subtarget 3	At least 20% of botanic gardens in Mexico will be partners in recovery planning for species in their regions, including 20% of the native species categorized as “at risk” under NOM-059-SEMARNAT-2010.	22
Subtarget 4	Botanic gardens will increase their involvement in and support for recovery actions for non-North American species, particularly focused on species that are already included in their living collections.	22
Subtarget 5	Botanic gardens will increase the availability of propagated and appropriately provenanced plants and propagules to recover or restore natural ecosystems in North America.	22
Subtarget 6	All reintroduction efforts undertaken in North America for endangered plants will follow accepted protocols for science-based best practices for reintroduction such as those developed by the Center for Plant Conservation and the IUCN.	22
B4	Botanic gardens will contribute to the conservation and preservation of economically and culturally important plants, including crop wild relatives.	24
Subtarget 1	Botanic gardens will increase efforts to identify priorities, set targets and take action for preserving economically and culturally important plants in North America and other regions where they work.	24
Subtarget 2	Conservation programs for ornamental plant varieties will be developed, especially heirloom plants and plants of historical or cultural importance including those derived from non-native species.	24
B5	Botanic gardens will increase their roles in the management and control of invasive species and in raising public awareness of invasive species issues.	25
Subtarget 1	All botanic gardens will develop an invasive species policy that is comprehensive and integrated into their plant collections management practices.	25
Subtarget 2	All botanic gardens will adopt relevant national strategies and voluntary codes of conduct, such as in the <i>St. Louis Declaration on Invasive Plant Species</i> .	25
Subtarget 3	The number of botanic garden staff serving on invasive species working groups will increase.	25

Target	Description	Page
Subtarget 4	The number of botanic gardens providing the public with opportunities to engage in the prevention, reporting, and control of invasive species will increase.	25
Subtarget 5	All botanic gardens will implement awareness-raising programs for their visitors on the threats caused by invasive species.	25
B6	Botanic gardens and their networks will increase support and contributions to conservation biology research.	27
Subtarget 1	The number of botanic gardens conducting scientific research in relevant fields such as plant biology, ecology, and conservation genetics will increase.	27
Subtarget 2	The number of botanic gardens hosting research hubs and centers of expertise will increase.	27
Subtarget 3	The number of botanic gardens participating in formal research collaborations with other gardens, universities, government agencies, and non-governmental organizations will increase.	27
Subtarget 4	Results of botanic garden research projects will be disseminated not just in academic journals, but translated for broader audiences through channels such as industry newsletters, popular science media outlets, garden events and interpretation, and guidelines and resources for the general public.	27

Objective C. Using plant diversity sustainably

C1	Botanic gardens and their networks will support and contribute to the sustainable use of plant resources.	28
Subtarget 1	Botanic gardens will help to develop a set of best practices to ensure that all plant-based products procured and used by botanic gardens are derived from sustainable sources.	28
Subtarget 2	All botanic gardens will comply with state, national, and international laws and regulations regarding the collection, acquisition, importation, distribution, sale, and use of plant material, and promote and encourage compliance among affiliated groups, including nurseries, members, plant societies, and the general public.	28
C2	Botanic gardens will contribute to the awareness and protection of ethnobotanical knowledge, and cultural and indigenous uses of plants.	29
Subtarget 1	Targets for protection of cultural and indigenous knowledge will be set, current levels of local, national, regional, and international activity determined, and appropriate partners identified.	29

Target	Description	Page
Objective D. Promoting public awareness of the importance of plant diversity and the wise use of resources		
D1	Botanic gardens will educate their visitors, community members, partners, staff, volunteers, and other stakeholders about the importance of plant diversity such that its irreplaceable value to human and ecosystem well-being is recognized.	31
Subtarget 1	Botanic gardens will incorporate conservation and ethnobotanical messages in interpretation, outreach, and formal and informal educational programs directed to all ages and audiences.	31
Subtarget 2	All botanic gardens will promote the importance of plant diversity in supporting human well-being, livelihoods, health and in addressing poverty, as well as highlighting the need for the sustainable use of plant resources.	31
D2	Botanic gardens will be leaders in operational sustainability practices and provide guidance to fellow institutions and others.	32
Subtarget 1	Botanic gardens will improve the sustainability of their institutional operations with measurable success recognized by performance metrics established by such entities as LEED, SITES, the Public Garden Sustainability Index, and Veriflora.	32

Objective E. Building capacity for conservation of plant diversity		
E1	Botanic gardens will build national and international capacity for conservation and sustainable use of plant diversity.	33
Subtarget 1	All appropriate certificate, diploma, and degree programs offered by botanic gardens in North America will include conservation components.	33
Subtarget 2	Botanic gardens will support and promote existing regional, national, and international programs by providing professional training in plant conservation best practices and through the development of new programs as needed.	33
Subtarget 3	Botanic gardens will support and promote the training of professional horticulturists, recognizing that the conservation role of a botanic garden is dependent upon an ability to successfully propagate and cultivate threatened species.	33
E2	Botanic gardens will work with appropriate stakeholders to develop tools and methodologies to support policy formation and implementation and obtain resources to affect plant conservation activities.	35
Subtarget 1	Botanic gardens and their associations will work at national and international levels to increase the resources available for plant conservation activities based on scientifically derived priorities.	35
Subtarget 2	Botanic gardens will contribute to, inform, and provide expertise for public policy at the local, regional, national, and international levels to increase understanding, funding, and other resources available for plant conservation.	35
E3	Botanic gardens and their associations will identify and create partnerships to improve plant conservation within botanic gardens and the broader conservation community.	35

Target	Description	Page
Subtarget 1	All botanic gardens will work to establish strategic partnerships to enhance the delivery of plant and habitat conservation at national and international levels.	35
Subtarget 2	Botanic gardens, recognizing that they can have an important role in the conservation of essential plant symbionts such as fungi and pollinators, will work to actively engage in national and international conservation initiatives.	35
E4	Botanic gardens and their networks will better share and promote existing information and resources on how to achieve plant conservation objectives.	36
Subtarget 1	All botanic gardens will work to join, support, and participate in conservation networks to effectively share information and expertise.	36

Objective F. Supporting the North American Strategy

F1	Botanic gardens will demonstrate their support by inclusion of plant and habitat conservation in their institutional priorities and plans.	37
Subtarget 1	All botanic gardens will educate their governing bodies about the importance of plant conservation and the need to deliver the <i>North American Strategy</i> .	37
Subtarget 2	All botanic gardens will update their missions and strategic plans to include a declaration of their institutional commitment to plant and habitat conservation.	37
Subtarget 3	Botanic gardens will report and assess the proportion of their annual budgets committed to direct plant and habitat conservation and benchmark these allocations against similar North American institutions.	37
Subtarget 4	Botanic gardens will make institutional conservation investments using existing local, national and global priorities.	37
Subtarget 5	Botanic gardens will implement communication plans describing and updating plant and habitat conservation activities for their leadership, stakeholders, and communities.	37



Ceratozamia hildae (bamboo cycad). Querétaro and San Luis Potosí, Mexico. Threatened (NOM-059-SEMARNAT-2010); Endangered (IUCN Red List). Recorded in 48 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)



Trichophorum planifolium (bashful bulrush). Ontario, Canada and northeastern USA. Critically imperiled locally (NatureServe); Endangered (SARA). Recorded in 2 ex situ sites (BGCI PlantSearch). Royal Botanical Gardens (Canada)

Targets for Botanic Gardens

OBJECTIVE A.

Understanding and documenting plant diversity

Target A1. All botanic gardens in North America with the capacity for programs in plant systematics will review and contribute to the achievement of the *GSPC Target 1* to have a complete online flora by 2020. Botanic gardens will contribute to their respective national flora projects and, where relevant, help document the floras of other parts of the world.

Subtarget 1: A working group will be convened to facilitate the reporting and compiling of existing comprehensive national and North American plant lists related to various categories of plant diversity including native, agricultural, horticultural, and medicinal plants.

Terms and supporting information

Efforts to guide effective plant conservation action hinge on a firm command of taxonomy. Having a clear understanding of which plants are currently recognized as valid species helps government agencies, corporations, and other conservation groups determine which plants and populations merit action to protect them. Plant taxonomy has changed rapidly over the past 40 years, accelerated by the emergence of genetic and molecular analysis, discoveries of new plants, and new capacities of herbarium resources. These changes compel scientists to reconcile lingering taxonomic questions, especially as they pertain to conservation action.

The *Flora of North America* identifies more than 20,000 plant taxa (including bryophytes) that are native or naturalized in North America (USA and Canada), and Mexico supports over 23,000 vascular plant taxa. Based on the number of known endemic plants, Mexico and the USA are among the top 17 megadiverse countries which, in total, contain more than two-thirds of the Earth's biodiversity.

In 2012, responding to the *GSPC Target 1*, an international *World Flora Online* (WFO) project was launched, led by a consortium of botanical institutions, many of them botanic gardens. Botanic gardens in North America are among the leadership of this

project. Regionally, the *Flora of North America North of Mexico* (FNA) is a major contributor to the achievement of the WFO, as well as for producing the requisite flora that is fundamental to the plant conservation efforts in the United States and Canada. Other databases contribute much needed additional information on the plants of North America. The *PLANTS* database, administered by the U.S. Department of Agriculture (USDA), provides comprehensive information on the taxonomy, distribution, characteristics, and crop information of plants in the USA. The NatureServe Explorer database provides comprehensive information on the conservation status of plants native to the U.S. and Canada. The Integrated Taxonomic Information System (ITIS), run by the U.S. Geological Survey, provides authoritative taxonomic information on plants of North America and the world. Together with a number of regional and local floras, these resources are combined to inform conservation decisions.

Reconciling many different plant lists remains a time-consuming task. In order to facilitate the reporting and compiling of existing comprehensive national and North American plant lists, a working group was convened in 2015. The purpose of the group is to develop a unified *North American Checklist of Vascular Plants (north of Mexico)*. To date, the directors of USDA *PLANTS* and FNA have completed a pilot to crosswalk the taxonomy and nomenclature of Volume 7 of the *Flora North America* (Bataceae, Brassicaceae, Capparaceae, Caricaceae, Cleomaceae, Koerberliniaceae, Limnathaceae, Moringaceae, Resedaceae, Salicaceae, Tropaeolaceae) that used information from *PLANTS*, NatureServe, and many regional floristic manuals such as the *Jepson Manual* and *Flora of the Southern and Mid-Atlantic States*. A follow up meeting with all partners is tentatively scheduled for summer 2016, when scaling up this initial pilot effort will be discussed.

Conservation of the flora of Mexico is being guided by the Mexican Strategy for Plant Conservation (*Estrategia Mexicana para la Conservación Vegetal, 2012-2030*, EMVC). The Instituto de Ecología A.C. de México (INECOL), is but one organization in Mexico generating and transmitting knowledge for Mexican plant diversity.

According to data reported to BGCI's *GardenSearch* database as of 2015, at least 10% of North American botanic gardens maintain herbaria, and at least 6% actively contribute to floristics or taxonomic research.

Related resources

[BGCI's GardenSearch database](http://www.bgci.org/garden_search.php)

http://www.bgci.org/garden_search.php

[Catalogue of taxonomic authorities of the flora of Mexico](#)

CONABIO (comp.) (2015). Catálogo de autoridades taxonómicas de la flora con distribución en México. Bases de datos SNIB-CONABIO, México. Online at: www.enciclovida.mx

[Estrategia Mexicana para la Conservación Vegetal, 2012-2030 \(EMCV, Mexican Strategy for Plant Conservation\)](#)

http://www.biodiversidad.gob.mx/pais/emcv/pdf/EMCV_Completa_Baja.pdf

[Flora of North America \(FNA\)](#)

<http://floranorthamerica.org/>

[Flora of the Southern and Mid-Atlantic States](#)

<http://www.herbarium.unc.edu/flora.htm>

[GSPC Toolkit: Target 1](#)

<http://www.plants2020.net/target-1/>

[Instituto de Ecología A.C. de México \(INECOL, Mexican Institute of Ecology\)](#)

<http://www.inecol.edu.mx>

[Jepson Manual, Vascular Plants of California](#)

<http://ucjeps.berkeley.edu/jepman.html>

[Megadiverse Countries of the World](#)

<http://www.biodiversitya-z.org/content/megadiverse-countries>

[NatureServe Explorer database](#)

<http://explorer.natureserve.org/>

[USDA's PLANTS database](#)

<http://plants.usda.gov/>

[USGS's Integrated Taxonomic Information System \(ITIS\) database](#)

<http://www.itis.gov/>

[World Flora Online \(WFO\) project](#)

<http://www.worldfloraonline.org/>

Target A2. All botanic gardens with the capacity will review and contribute to assessments of the conservation status of plant species, using criteria and standards developed by NatureServe and the IUCN.

Subtarget 1. Botanic gardens will support and coordinate efforts, identify gaps, recruit expert contributors, and set priorities for assessing threats to plant species in taxonomic groups and regions where they work.

Subtarget 2. The number of botanic garden staff participating in threat assessment working groups and projects will increase.

Terms and supporting information

An assessment of the conservation status of all known plant species is a foundational step to guiding conservation action, and is highlighted as a global conservation priority in the *GSPC Target 2*.

Different methodologies have been developed over the years to assess the conservation status, or extinction risk of species. *The IUCN Red List of Threatened Species™* assessments, compiled and reviewed by the International Union for Conservation of Nature (IUCN), are widely used throughout the world. While all mammals and birds have been evaluated using the *IUCN Red List* assessment criteria, only 6% of the world's estimated 350,000 plant species have been assessed. Of the assessed plant species, 54% (11,233) are classified by the *IUCN Red List* as threatened with extinction. In the USA and Canada, NatureServe's Conservation Status Assessments are based on standardized methodology to document the extinction risk of species at global, national, and subnational scales. NatureServe's status assessments, frequently referred to as 'ranks', have been widely used in North America for over 30 years. Although the vast majority of North American plants have been assigned a global rank, many of these existing ranks have not been reviewed recently. Due to changing threats, conservation actions, and natural events, the conservation status of a species can change over time and consequently require regular review.

Assessing the conservation status of plant species requires detailed knowledge of the distribution, population size and trends, and critical threats. In recent years, NatureServe has worked with the *IUCN Red List* to standardize the assessment ratings for shared information fields. The standardized ratings permit sharing of data between organizations and countries and allow the information to be used in both IUCN and NatureServe assessments. The *IUCN Red List* is also updating their current information systems to facilitate the input of botanical data into the *Red List* assessment process, which will increase interoperability with external plant databases. These efforts should streamline conservation status assessments for North American plants.

Collaborative groups composed of members of the North American botanical community contribute to species conservation status assessments, such as the ongoing assessment for Hawaiian endemics and the recently completed *Global Cactus Assessment* published by the IUCN. In many cases, botanic gardens have the most detailed and current knowledge of the conservation status of threatened species. By contributing expertise to ongoing conservation status assessments, botanic gardens play an important role in determining which plant species are the most imperiled.

The 2010 *North American Collections Assessment* (NACA) compiled a list of North America's threatened plants and compared collection inventories contributed to BGCI's *PlantSearch* database by hundreds of living plant and seed collections throughout North America. The Assessment utilized a combination of conservation status data from NatureServe, the Canadian *Species at Risk Act* (SARA), Mexico's *NOM-059-SEMARNAT-2001 threatened species* list, and the *IUCN Red List of Threatened Species*. By harmonizing data from these lists, nearly 10,000 plant taxa in Canada, Mexico, and the USA

were identified as “of conservation concern” (roughly 20% of the total flora of the continent). The North American Collections Assessment will be updated in 2016 as a key resource for the North American Plant Conservation Initiative.

At the time of publication of this document, Royal Botanical Gardens (Canada) is completing an assessment of progress in Canada toward the GSPC and the Canadian targets under the *Convention on Biological Diversity* and the *Sustainable Development Goals*. Results will reference Canada’s SARA list and assess nationwide conservation needs and priorities.

Related resources

BGCI's *PlantSearch* database

http://www.bgci.org/plant_search.php

Canadian Species at Risk Act's (SARA) Public Registry

http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm

GSPC Toolkit: Target 2

<http://www.plants2020.net/target-2/>

Hawaiian endemic plant assessment

<http://laukahi.org/ex-situ-assessment/>

IUCN Red List of Threatened Species

www.iucnredlist.org

IUCN Red List assessment process

<http://www.iucnredlist.org/technical-documents/assessment-process>

NatureServe Conservation Status Assessments

www.natureserve.org/biodiversity-science/publications/natureserve-conservation-status-assessments-factors-evaluating

NOM-059-SEMARNAT-2010 Mexican Threatened Species List

http://www.profepa.gob.mx/innovaportal/file/435/1/NOM_059_SEMARNAT_2010.pdf

North American Collections Assessment (NACA)

<http://www.bgci.org/usa/NACA>

Case Study 1: Red listing efforts for North American oaks at The Morton Arboretum

Murphy Westwood, The Morton Arboretum, Lisle, Illinois USA

The Morton Arboretum is an internationally recognized 1,700 acre outdoor tree museum and tree research center located in Lisle, Illinois. The Arboretum’s Science & Conservation department supports over 40 staff members conducting research in forest ecology, systematics, taxonomy, soil science, root biology, pathology, urban forestry, and tree conservation. Its Global Tree Conservation Program works to save threatened tree species and populations through global collaborations.

In collaboration with BGCI (through the Global Trees Campaign) and the IUCN/SSC Global Tree Specialist Group, The Morton Arboretum is completing threat assessments for all of the world’s oak species for the *IUCN Red List*, in support of Target A2 of the *North American Strategy*.



Quercus georgiana, an endangered oak species from Georgia and Alabama. (Murphy Westwood)



Discussing threat assessments at an oak Red List workshop, International Oak Society conference, 2015. (Nicole Cavender)

The genus *Quercus* contains roughly 450 species of trees and shrubs distributed across the Northern Hemisphere, including over 200 species native to North America. It is known that many oak species are under threat from habitat destruction, climate change, invasive pests and pathogens, and competition from invasive plants. However, less than half of the world’s oak species have been evaluated for the Red List. Given the great global economic, ecological, and cultural value of oaks, it is important to understand the threats they face. To gather the necessary demographic and threat data, and to strengthen the global network of oak experts, the Arboretum hosted a one-day oak Red List workshop during the 8th triennial conference of the International Oak Society in October, 2015.

As of 2016, two-thirds of the oak species native to the USA and Canada have been fully assessed and accepted by the IUCN Red List Unit, and assessments for the oaks of Mexico are underway. Our preliminary results indicate as many as one in three North American oak species are threatened with extinction. Using this valuable information on threats and population trends, The Morton Arboretum is prioritizing species for conservation action on the ground (*in situ*) and in garden collections (*ex situ*).

OBJECTIVE B. Conserving plant diversity

Target B1. Botanic gardens will work collaboratively to support *in situ* conservation of threatened natural areas, habitats, and ecosystems locally, regionally, and internationally.

Subtarget 1: All botanic gardens in Canada and the USA will support local, national and international *in situ* conservation.

Subtarget 2: At least 40% of Mexican botanic gardens will support *in situ* conservation programs in areas of high biodiversity, and at least 60% of threatened species in Mexico will be protected *in situ* as set forth in the *EMVC Target 2*.

Case Study 2: Managing and Restoring Aquatic Vegetation at the Head of Lake Ontario, Canada

David Galbraith, Royal Botanical Gardens, Hamilton and Burlington, Ontario, Canada

Royal Botanical Gardens (RBG) owns and manages about 2,400 acres of protected nature sanctuaries at the western tip of Lake Ontario. Although urban, these lands include some of the richest habitats in Canada for plant diversity (c. 1,160 species recorded to date). Extensive wetlands and forests, savannahs, cliff-face ecosystems, and remnant prairies remain in these preserves, which have been disturbed over the past two centuries as farms and towns have grown around them. Formal protection of this complex landscape began in the 1920s with the declaration of Cootes Paradise Marsh as a bird sanctuary. The Marsh is one of the last major Great Lakes coastal wetlands, including critical fish spawning and bird habitat. Restoration strategies have included improving water quality entering the wetland (through enhanced waste water treatment), reducing invasive species (by eliminating invasive fish), and replanting native species.

RBG has made invasive species removal and revegetation efforts within Cootes Paradise Marsh and surrounding habitats a major priority since the 1940s, when introduced carp (*Cyprinus carpio*) were identified as being highly damaging to native aquatic vegetation. Since 1997 the Cootes Paradise Fishway has been operated by RBG, which captures fish entering the marsh and allows carp to be sorted and returned to Lake Ontario. This system has resulted in over 90% reduction in the carp population in the marsh and significant recovery of aquatic vegetation. Replanting of aquatic vegetation has also been undertaken in 90 acres of the Marsh since the 1990s, with species including southern wild rice,

Terms and supporting information

Botanic gardens are increasingly committing to the prevention of species extinction and habitat loss through *in situ* conservation activities, which is central to GSPC Target 4, to manage or restore 15% of each ecological region or vegetation type and GSPC Target 7, to conserve at least 75% of threatened plants *in situ*. A contemporary goal of plant conservation is to undertake an integrated approach that concentrates first on *in situ* measures, complemented by appropriate *ex situ* measures, preferably in the country of a species' origin.



Cootes Paradise Fishway operated by Royal Botanical Gardens (Canada) has reduced invasive carp by 90% in the Marsh. Royal Botanical Gardens (Canada)

cattails, and white water lily. In parallel, RBG has developed the “Mini Marsh Program” for schools, in which classrooms grow plants to be used in outplanting. Significant improvements in the diversity of other taxa have been noted since these programs have been underway, including recovery of rare fish and amphibian populations.



Wild Rice growing in Cootes Paradise Marsh. Restoration of 90 acres of Cootes Paradise Marsh has been completed by Royal Botanical Gardens (Canada) since the 1990s. Royal Botanical Gardens (Canada)

Many botanic gardens have valuable resources, technical staff and expertise for collaborative *in situ* work with government agencies and other organizations. As climate change and other environmental pressures progress, *in situ* conservation will become more challenging, but remain a fundamental component of integrated and successful plant conservation.

At least 18% of botanic gardens in Canada and the USA manage natural areas, and 7% are involved in restoration projects or restoration ecology research, according to data reported to BGCI's *GardenSearch* database as of 2015. In Mexico, at least 13% of botanic gardens manage natural areas 11% are involved in restoration projects or restoration ecology research. Botanic gardens collaborate with many types of organizations and individuals to restore and reintroduce species to native habitats. And there are several new initiatives to support further *in situ* activity. The AMJB is proposing collaboration with the National Commission of Natural Protected Areas to develop additional *in situ* activities and programs in over 170 federally protected natural areas throughout Mexico. At a broader level, BGCI's Ecological Restoration Alliance of Botanic Gardens (ERA) is a global consortium of over 20 botanic gardens (several in North America) actively engaged in ecological restoration. Members of the Alliance support efforts to scale up the restoration of damaged, degraded and destroyed ecosystems around the world.

North American botanic gardens also maintain some of the most diverse collections of plants from around the world as well. Many botanic gardens already play an active role in assisting other countries to conserve non-native plant species in their centers of origin. Many also have the expertise, knowledge, and resources to expand their plant conservation efforts beyond North America, and are being encouraged to do so through emerging networks such as BGCI's garden twinning program and The Morton Arboretum's Global Oak Conservation Initiative, designed to focus efforts in priority regions and plant groups at a global scale.

Related resources

[BGCI's garden twinning program](#)

<https://www.bgci.org/news-and-events/news/1279/>

[BGCI's *GardenSearch* database](#)

http://www.bgci.org/garden_search.php

[Ecological Restoration Alliance of Botanic Gardens \(ERA\)](#)

<http://www.erabg.org/>

[Global Oak Conservation Initiative based at The Morton Arboretum](#)

<https://www.youtube.com/watch?v=QloX58HUye4>

[GSPC Toolkit: Target 4](#)

<http://www.plants2020.net/target-4/>

[GSPC Toolkit: Target 7](#)

<http://www.plants2020.net/target-7/>

[National Commission of Natural Protected Areas](#)

<http://www.conanp.gob.mx/english.php>

Target B2. Botanic gardens will expand *ex situ* conservation efforts and partnerships.

Subtarget 1: 75% of threatened native plant species in Canada and the USA will be maintained in botanic garden *ex situ* collections (as plants, tissues, or seeds) with appropriate genetic representation to support restoration and managed according to science-based protocols.

Subtarget 2: 60% of native plant species in Mexico categorized as "at risk" (NOM-059-SEMARNAT-2010) will be represented in Mexican botanic garden *ex situ* collections of plants by 2020.

Subtarget 3: At least 20% of North American botanic gardens will collaborate with the international community in *ex situ* measures such as seed banking, cryopreservation, and tissue culture, and duplicate collections for the conservation of non-North American species.

Subtarget 4: All botanic gardens that maintain plant records will share their plant collections data with the community through tools such as BGCI's *PlantSearch* database.

Terms and supporting information

The GSPC Target 8 calls for *at least 75 percent of threatened plant species in ex situ collections, preferably in the country of origin* by 2020. The North American Strategy target B2 subtarget 1 is aligned with this global goal.

The role of botanic gardens as *ex situ* repositories is expanding as they take the lead in integrated conservation of threatened species and habitats. It is estimated that the world's botanic gardens hold more than 115,000 vascular plant species in their collections, more than one third of all known plants (BGCI's *PlantSearch* database). The *Plant Conservation Report 2014: A review of progress towards the Global Strategy for Plant Conservation* compiled by BGCI determined that 29% of globally threatened plant species assessed by the IUCN have been safeguarded in *ex situ* collections. More information about the *ex situ* management and genetic representation of these species is needed to assess the direct conservation value of known *ex situ* collections.

BGCI maintains *PlantSearch*, a globally unique database of plant taxa in living collections of botanic gardens around the world. *PlantSearch* is being used to monitor progress toward the achievement of the GSPC Target 8. It also connects *ex situ* collections to researchers, educators and conservationists around the world. All botanic gardens should make their collections data available to the broader plant conservation community via resources like *PlantSearch*. A *Collections Guide* created by BGCI and the Montgomery Botanical Center also presents general advice for developing conservation collections.

In 2014, BGCI-US produced a *U.S. Progress Report to the North American Collections Assessment (NACA)*, which identified 8,449 (39%) U.S. threatened plant species in *ex situ* collections, based on threat status data from NatureServe and the IUCN.

The Center for Plant Conservation's (CPC) National Collection of Endangered Plants contains genetically representative and documented plant material for 788 of the USA's most threatened native plants. An important conservation resource, the National Collection serves as a backup if a species becomes extinct or no longer reproduces in the wild. Of the approximately 4,000 plants of greatest conservation concern in North America, 1,400 or so require *ex situ* intervention for survival and are urgent conservation priorities for the CPC and its member gardens. Information on the genetics and population biology of rare plants and their relation to conservation is available from the CPC.

For Mexico, estimates range from 37% to 45% of threatened native species in Mexican *ex situ* collections. The 2010 NACA report, which included data from 28 living plant collections and two seed banks in Mexico, found that 37% of threatened Mexican taxa in the NOM-059-SEMARNAT-2001 list were

maintained in Mexican *ex situ* collections. In 2012, an additional *ex situ* assessment including 19 Mexican plant collections was conducted by the National Autonomous University of Mexico (UNAM). Of the nearly 985 threatened taxa in the NOM-059-SEMARNAT-2010 list, 441 (45%) were found in *ex situ* plant collections. However most of these, 415 taxa, were represented by only five or fewer individuals (see pages 159-169 of the assessment for details). There are currently few seed collections in Mexico of wild plants; Mexican seed collections are generally dedicated to the conservation of crop plants.

Marking the first strategy for the North American botanic garden community, the Conservation Strategy for Mexican Botanic Gardens (*Estrategia de Conservación para los Jardines Botánicos Mexicanos*) was developed in 2000 by the AMJB. An action plan for Mexican botanic gardens is currently being developed.

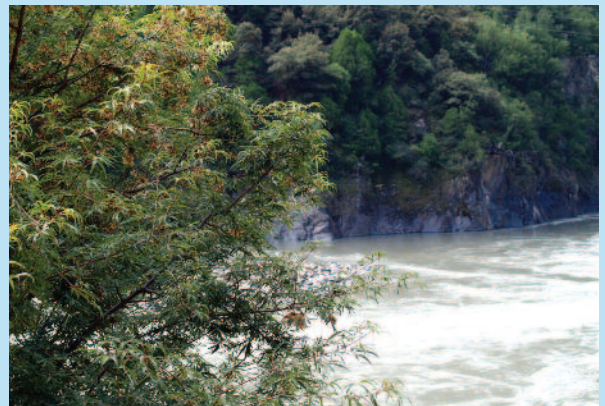
Halting extinctions in specific regions generally requires a deep understanding of the culturally and economically important plants and the drivers of loss. As community-based institutions, botanic gardens have a unique opportunity to address the needs and challenges of plant conservation in their regions. The *Plant Collections Network* administered by the American

Case Study 3: *Ex situ* Conservation of *Acer pentaphyllum* at UBC Botanical Garden

Douglas Justice, University of British Columbia Botanical Garden, Vancouver, British Columbia, Canada

One of the reasons UBC Botanical Garden places so highly in the BGCI's *Global Survey of Ex situ Maple Collections* is our collection of the rare *Acer pentaphyllum* (five-finger maple), which is native to the mountains of southwestern China and critically endangered in the wild. A recent seed collecting expedition to its only known habitat in the Hengduanshan (Hengduan Mountains), a rugged, difficult-to-access area in Sichuan, China, recorded only four populations of approximately 150 individual trees. Throughout that area trees of all kinds are threatened by grazing, firewood cutting, fires, landslides, road building, and flooding from the damming of rivers.

As wild populations of *Acer pentaphyllum* diminish, a genetic bottleneck has resulted, decreasing the species' genetic diversity, variability, and adaptability. For the past decade, the UBC Botanical Garden has supported conservation efforts for *Acer pentaphyllum* in collaboration with a geographically diverse set of institutions including the Quarryhill Botanical Garden in Glen Ellen, California; the Scott Arboretum of Swarthmore College in Swarthmore, Pennsylvania; the Arboretum Wespelaar in Wespelaar, Belgium; and Sichuan University in Chengdu, China. Specifically, UBC Botanical Garden staff have participated in expeditions to the species'



Acer pentaphyllum in the wild in China. (Christophe Crock)

remaining wild populations in Hengduanshan aimed at monitoring population dynamics and gathering DNA samples and seeds to support conservation activities. Additionally, over 100 wild-origin seedlings have been documented and planted at UBC Botanical Garden, as part of a larger *ex situ* plant collection being formed across all collaborating institutions. UBC Botanical Garden offers a unique climate to that of other *ex situ* sites which could result in the preservation of unique genes among surviving individuals. To date, most plants appear to be healthy and vigorous. Ultimately, when propagules are needed for reintroduction in Hengduanshan, this *ex situ* collection will provide the widest genetic complement possible. UBC Botanical Garden is proud to be a collaborator in this important initiative.



Sarracenia rubra subsp. *wherryi* (*Wherry's sweet pitcherplant*). Alabama and Mississippi, USA. Vulnerable (NatureServe); Endangered (IUCN Red List). Recorded in 24 ex situ sites (BGCI PlantSearch). (United States Botanic Garden)

Public Gardens Association represents North American public gardens taking a continent-wide approach to the conservation of plant genetic resources and to promoting excellence in plant collections management.

Related resources

BGCI's *PlantSearch* database

http://www.bgci.org/plant_search.php

Building living plant collections to support conservation: A guide for public gardens

http://www.bgci.org/files/UnitedStates/MBC_Collections_Guide_2014.pdf

CPC's Genetic Sampling Guidelines for Conservation Collections of Rare and Endangered Plants

Guerrant, EO Jr., PL Fiedler, K. Havens and M Maunder. 2004. Revised Genetic Sampling Guidelines for Conservation Collections of Rare and Endangered Plants. Pages 419-442 In Guerrant, EO Jr, K Havens, and M Maunder (eds.) *Ex Situ Plant Conservation: Supporting Species Survival in the Wild*. Island Press. Covelo.

CPC's National Collection of Endangered Plants

<http://www.centerforplantconservation.org/collection/nationalcollection.asp>

Estrategia de Conservación para los Jardines Botánicos Mexicanos (Conservation Strategy for Mexican Botanic Gardens)

http://www.conabio.gob.mx/institucion/cooperacion_internacional/doctos/b07/Estrategia%20de%20Conservacion%20para%20los%20jardines%20botanicos%20mexicanos%202000-1.pdf

Ex situ collections assessment by UNAM (2012; pages 159-169)

GSPC Toolkit: Target 8

<http://www.plants2020.net/target-8/>

North American Collections Assessment (2010 and 2014 U.S. Progress Report)

<http://www.bgci.org/usa/naca>

Plant Collections Network administered by the American Public Gardens Association

<https://publicgardens.org/programs/about-plant-collections-network>

Plant Conservation Report 2014: A review of progress towards the Global Strategy for Plant Conservation

<http://www.bgci.org/policy/gspc-mid-term-review/>

Case Study 4: *Mammillaria herrerae* Werderm. conservation efforts at the Cadereyta Regional Botanic Garden

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The southeastern end of the Chihuahuan Desert hosts an important amount of endemic Cactaceae taxa. *Mammillaria herrerae*, worldwide known as "golf ball", is a critically endangered microendemic species. Studies developed by the Cadereyta Regional Botanic Garden (CRBG) show that only a few hundred individuals survive in its native habitat. Regeneration pathways and population dynamics are not fully known. The CRBG has collected seed lineages, developed a propagation protocol and established a plot of individuals which will produce more germplasm and, eventually, could support reintroduction of the species in its native habitat. The CRBG has also evaluated the conservation status of this species for the *IUCN Red List of Threatened Species*. These conservation activities are further complemented with the establishment of an educational nursery for cacti production at "El Arbolito", a small town in the vicinity of the species' distribution area. At this nursery site, local youths can learn about the relevance and importance of their region's native flora.



In situ and ex situ conservation of golf ball (Mammillaria herrerae) led by the Cadereyta Regional Botanic Garden (Cadereyta Regional Botanic Garden)

Target B3. Botanic gardens will increase their participation in formal recovery planning and implementation for species in their regions, working with state, provincial, and federal agencies.

Subtarget 1: At least 35% of botanic gardens in Canada will be partners in recovery planning for species in their regions.

Subtarget 2: At least 30% of botanic gardens in the USA will be partners in recovery planning for species in their regions.

Subtarget 3: At least 20% of botanic gardens in Mexico will be partners in recovery planning for species in their regions, including 20% of the native species categorized as “at risk” under *NOM-059-SEMARNAT-2010*.

Subtarget 4: Botanic gardens will increase their involvement in and support for recovery actions for non-North American species, particularly focused on species that are already included in their living collections.

Subtarget 5: Botanic gardens will increase the availability of propagated and appropriately provenanced plants and propagules to recover or restore natural ecosystems in North America.

Subtarget 6: All reintroduction efforts undertaken in North America for endangered plants will follow accepted protocols for science-based best practices for reintroduction such as those developed by the Center for Plant Conservation and the IUCN.



Lilium iridollae (panhandle lily). Southeast USA. Imperiled (NatureServe). Recorded in 4 ex situ sites (BGCI PlantSearch). (United States Botanic Garden)

Terms and supporting information

At least 4% of botanic gardens in Canada, 14% in Mexico, and 8% in the USA have active reintroduction programs, according to data reported to BGCI's *GardenSearch* database as of 2015. The data do not specify whether these reintroductions are in or outside of North America. Target B3 of the North American Strategy supports the achievement of *GSPC Target 5* to protect *at least 75 percent of the most important areas for plant diversity in each ecological region, with effective management in place for conserving plants and their genetic diversity*. It also is consistent with the second component to the *GSPC Target 8* that 20% of all threatened plant species be available to support recovery and restoration programs by 2020.

It is estimated that only 5% of threatened species are currently included in recovery and restoration programs globally (BGCI, *Plant Conservation Report 2014*). North American federal, provincial, and state agencies have a legal mandate to protect threatened species on public lands. Botanic gardens can help extend government conservation efforts by increasing their role as partners in the formal recovery and restoration process. All such reintroductions should be monitored carefully as climate change progresses, which is expected to threaten the viability of many of them.

The Plant Conservation Alliance (PCA) is a USA-based consortium of twelve federal government member agencies and over 300 non-federal cooperators representing various disciplines within the conservation field: biologists, botanists, habitat preservationists, horticulturists, resource management consultants, soil scientists, special interest clubs, non-profit organizations, concerned citizens, nature lovers, and gardeners. PCA members and cooperators work collectively on native plant conservation and habitat restoration.

Related resources

GSPC Toolkit: Target 5

<http://www.plants2020.net/target-5>

GSPC Toolkit: Target 8

<http://www.plants2020.net/target-8/>

Center for Plant Conservation Best Reintroduction Practice Guidelines

Pages 277-306 in: J. Maschinski and K.E. Haskins (eds).

Plant reintroduction in a changing climate: promise and perils.

Island Press. Also online at: <http://ncbg.unc.edu/uploads/files/CPCReintroductionPracticeGuidelines.pdf>

IUCN Guidelines for Reintroductions and Other Conservation Translocations

<https://portals.iucn.org/library/efiles/edocs/2013-009.pdf>

Plant Conservation Alliance

<http://www.nps.gov/plants/>

Plant Conservation Report 2014: A review of progress towards the Global Strategy for Plant Conservation

<http://www.bgci.org/policy/gspc-mid-term-review/>

Case Study 5: Restoration of rare orchids in the Southeastern USA through propagation and partnership

Jenny Cruse-Sanders, Atlanta Botanical Garden, Atlanta, Georgia, USA



For over twenty-five years, the Atlanta Botanical Garden has used botanical expertise and conservation horticulture to safeguard and propagate imperiled plant species of the southeastern United States. Garden staff work closely with land managers and conservation agencies to reintroduce rare plants into appropriate habitats. Through the

Center for Southeastern Conservation, launched in 2015, the Garden contributes to conservation in many complex ecosystems of the southeastern USA.

The Garden's tissue culture lab is an important resource for propagation and training. In this facility, orchids are propagated for conservation and restoration. Native orchid seeds are harvested from wild sites and raised in an environment designed to mimic natural conditions until they are ready to be outplanted. Hundreds of additional orchid species are stored as seed in the lab, available for future restoration efforts.

Urban habitats across metro Atlanta are home to the rare white fringeless orchid (*Platanthera integrilabia*). Fewer than 60 small populations remain for this species across its range from



Students from three high schools in Georgia help to outplant white fringeless orchids that were propagated at the Atlanta Botanical Garden. Students collected geographic and environmental data and measurements from the orchids as they planted them into the restored habitat. (Jenny Cruse-Sanders)



Above: Atlanta Botanical Garden Conservation Coordinator, Matt Richards, hand pollinating *Platanthera integrilabia*. Populations of this species are so small that natural pollination doesn't occur. Orchids have complex ecological relationships with pollinators and fungi and are sensitive to environmental change. (Jenny Cruse-Sanders)

Left: *Platanthera integrilabia* inflorescence. (Brad Wilson)

Kentucky and Virginia, south to Georgia, and west to Mississippi. Natural habitats for this native terrestrial orchid are forested bottomland seepage bogs, which are under constant pressure from development, illegal trash dumping, invasion of exotic species, closure of the forest canopy, and herbivory. As a result, the orchid is listed as a candidate for federal protection under the United States Endangered Species Act.

In 2013, the Atlanta Botanical Garden was awarded a grant from the National Fish and Wildlife Foundation's Five Star and Urban Waters Restoration Program. With this support, the Garden has worked with students and partners to plant out more than 100 white fringeless orchids in three restored habitats. Key partners include the Georgia Department of Natural Resources; U.S. Fish and Wildlife Service; Sawnee Mountain Preserve; and private land owners.



Platanthera integrilabia in its native habitat in Georgia. (Brad Wilson)

Target B4. Botanic gardens will contribute to the conservation and preservation of economically and culturally important plants, including crop wild relatives.

Subtarget 1: Botanic gardens will increase efforts to identify priorities, set targets and take action for preserving economically and culturally important plants in North America and other regions where they work.

Subtarget 2: Conservation programs for ornamental plant varieties will be developed, especially heirloom plants and plants of historical or cultural importance including those derived from non-native species.

Terms and supporting information

Target B4 of the North American Strategy is relevant to the GSPC Target 6 which calls for *at least 75 percent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity by 2020*. It also directly supports the GSPC Target 9 to *conserve 70 percent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species, while respecting, preserving, and maintaining associated indigenous and local knowledge*.

Agriculture is an area in which botanic gardens can provide considerable expertise, such as assessing the threat status of crop wild relatives, understanding evolutionary relationships of crop plants, developing resources related to under-utilized species of agronomic value, and more. According to data reported to BGCI's *GardenSearch* database as of 2015, at least 3% of North American botanic gardens maintain active programs in research and preservation of agriculturally important plants. North American botanic gardens also hold an extraordinary diversity of ornamental plant collections that include uncommon cultivars and important horticultural derivatives of globally threatened taxa. This horticultural asset is both genetically significant and a vital resource for plant conservation.

It should also be noted that land use development for agriculture has historically been the greatest driver of plant biodiversity loss as agricultural expansion has displaced native plant communities. Botanic gardens can help prevent loss of plant diversity by encouraging the agricultural community to reverse the trend of agricultural expansion into wild biodiverse areas. This can be done while also making sure the food system sustainably supplies enough caloric and nutritional resources to ensure equitable food security.

There are several ongoing projects that can guide the development of conservation programs at botanic gardens focused on economically and culturally important plants. The USDA and several other partners have compiled a *National*



Yucca queretaroensis (Queretaro yucca). Hidalgo, Guanajuato, and Querétaro, Mexico. Under special protection (NOM-059-SEMARNAT-2010). Recorded in 8 ex situ sites (BGCI PlantSearch). (Beatriz Maruri Aguilar)

Inventory of 4,600 native and non-native crop wild relative species found in the USA. Houry *et al.* (2010) present an analysis and potential priorities for the initial taxa list, which includes 285 native taxa and over 550 globally threatened taxa. The IUCN's Global Species Program (GSP) and Species Survival Commission (SSC) have launched the Plants for People initiative to assess the threat status of priority crop wild relatives, medicinal plants, timber trees, and palms. Resulting information will guide and set priorities for *in situ* and *ex situ* conservation strategies for these plant groups.

Related resources

FES Iztacala Banco de Semillas, Mexican Crop Seed Bank
http://ciencia.unam.mx/leer/65/Banco_de_semillas_una_apuest_a_contra_la_extincion
GSPC Toolkit: Target 6
<http://www.plants2020.net/target-6>
GSPC Toolkit: Target 9
<http://www.plants2020.net/target-9>
Houry et al. (2010) article "An Inventory of Crop Wild Relatives of the United States"
<https://dl.sciencesocieties.org/publications/cs/articles/53/4/1496>
IUCN Plants for People initiative
http://iucn.org/about/work/programmes/species/our_work/plants/plants_projects_initiatives/plants_for_people/
Plant Gene Resources of Canada
http://pgrc3.agr.gc.ca/about-propos_e.html
USDA Genetic Resources Information Network (GRIN)
<http://www.ars-grin.gov/>
USDA National Inventory of crop wild relatives
<https://cwroftheus.wordpress.com/national-inventory/>

Case Study 6: Promoting economic botany and food security

Diane Ragone, National Tropical Botanical Garden and Michael Maunder, The Kampong, National Tropical Botanical Garden, and Florida International University, Miami, Florida, USA



Breadfruit (Jim Wiseman)

The National Tropical Botanical Garden (NTBG) is partnering with Florida International University (FIU) to create the International Center for Tropical Botany (ICTB) with economic botany and food security as major research themes. The ICTB is headquartered at The Kampong, a NTBG garden in Miami and the home of the economic botanist Dr. David Fairchild (1869-1954). The Kampong is known for its historic collections of mango and avocado.

The ICTB builds on existing programs in both institutions. NTBG established the Breadfruit Institute (BFI) in 2003 to develop Breadfruit (*Artocarpus* spp.), a Pacific island heritage crop, as a crop that can improve food security in the tropics. Breadfruit is high in energy and carbohydrates and a good source of fiber, protein, minerals and vitamins. Breadfruit can provide novel food products such as gluten-free flour, chips, beer, and frozen breadfruit cubes that can be used as the primary starches in almost any recipe. It can be roasted, baked, boiled, fried, ground into flour, pickled, fermented, frozen, dried as a cereal or mashed into a puree for infants. The BFI holds more than 120 varieties from all over the Pacific and is working with a wide range of partners to develop Breadfruit as a crop in the Pacific, Caribbean, Africa and South America.

BFI is part of an overall NTBG commitment to conserve Pacific crop plant heritage, including important collections of *Colocasia* (Taro), *Alocasia* (Giant Taro or Ape), sweet potato and sugar cane. Other areas of ICTB crop work include FIU lead research on plant genetic resources (e.g. chickpea and mango), the impact of climate change on tropical agriculture, and outreach projects at The Kampong exploring the relationship between plants and human culture.

Target B5. Botanic gardens will increase their roles in the management and control of invasive species and in raising public awareness of invasive species issues.

Subtarget 1: All botanic gardens will develop an invasive species policy that is comprehensive and integrated into their plant collections management practices.

Subtarget 2: All botanic gardens will adopt relevant national strategies and voluntary codes of conduct, such as in the St. Louis Declaration on Invasive Plant Species.

Subtarget 3: The number of botanic garden staff serving on invasive species working groups will increase.

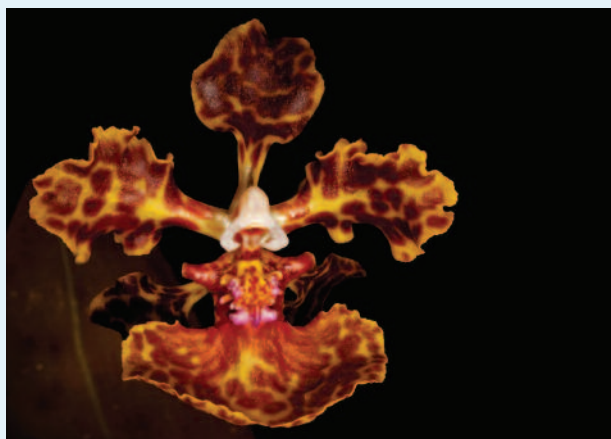
Subtarget 4: The number of botanic gardens providing the public with opportunities to engage in the prevention, reporting, and control of invasive species will increase.

Subtarget 5: All botanic gardens will implement awareness-raising programs for their visitors on the threats caused by invasive species.

Terms and supporting information

Target B5 of the *North American Strategy* supports progress toward the *GSPC Target 10* to have *effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded*.

Non-native invasive plants and other non-native biological invaders are among the greatest threats to natural ecosystems. Native plant species and plant communities are increasingly being degraded and displaced by invasive species, compounding the well-known threat of habitat destruction. There are several national invasive species initiatives in North



Trichocentrum undulatum (mule-ear). Florida, USA. Endangered (Plants in the Preservation of Native Flora of Florida Act). Recorded in 1 *ex situ* site (BGCI PlantSearch). (Mario Cisneros)

America, including Canada's *Invasive Alien Species* program, Mexico's *National Strategy for Invasive Species (Estrategia Nacional Sobre Especies Invasoras en México)*, and the USDA's *Introduced, Invasive, and Noxious Plants* resources for the USA.

The 2001 *St. Louis Declaration on Invasive Plant Species* resulted in the creation of *Voluntary Codes of Conduct for Botanic Gardens and Arboreta*. Now coordinated through the CPC, over 50 organizations have formally endorsed the Codes. According to data reported to BGCI's *GardenSearch* database as of 2015, at least 7% of botanic gardens in North America have an invasive species policy, 11% monitor their collections for known or potential invasive species, and 7% have research programs focused on invasive species biology and control.

Botanic gardens, often with collections of exotic plant taxa, have a particular and specific responsibility to minimize the risk of escape of invasive plants and pathogens in North America. Launched in 2011, the Sentinel Plant Network is a collaboration between the American Public Gardens Association and the National Plant Diagnostic Network (NPDN). They provide botanic garden professionals with training and diagnostic



Fraxinus americana (white ash). Eastern Canada and eastern and central USA. Locally threatened by the emerald ash borer, an invasive insect introduced from Asia. (Andrew Gapinski)

support to better monitor and protect their collections; facilitate greater collaboration about invasive pests and pathogens among botanic gardens and with other organizations through improved databases and communication protocols; and enhance garden outreach efforts to educate their communities on the impact of high-consequence plant pests and pathogens and engage individuals as "First Detectors".

BGCI's International Plant Sentinel Network (IPSN) is a collaboration among institutes around the world focused on linking botanic gardens, national plant protection organizations, and plant health scientists to form an early warning system of new and emerging pest and pathogen risks. IPSN member gardens help to provide scientific evidence regarding known quarantine organisms and potential new risks, to inform plant health activities and safeguard susceptible plant species worldwide.

Related resources

[Canada's Invasive Alien Species program](https://www.ec.gc.ca/eee-ias/default.asp?lang=En&n=1A81B051-1)

<https://www.ec.gc.ca/eee-ias/default.asp?lang=En&n=1A81B051-1>

[Center for Invasive Species and Ecosystem Health, University of Georgia](http://www.bugwood.org/)

<http://www.bugwood.org/>

[Estrategia Nacional Sobre Especies Invasoras en México \(National Strategy for Invasive Species in Mexico\)](http://www.biodiversidad.gob.mx/especies/Invasoras/estrategia.html)

<http://www.biodiversidad.gob.mx/especies/Invasoras/estrategia.html>

[Endorsers of the Voluntary Codes of Conduct](http://www.centerforplantconservation.org/invasives/endorsementN.asp)

<http://www.centerforplantconservation.org/invasives/endorsementN.asp>

[GSPC Toolkit: Target 10](http://www.plants2020.net/target-10)

<http://www.plants2020.net/target-10>

[International Plant Sentinel Network \(IPSN\)](http://www.plantsentinel.org/)

<http://www.plantsentinel.org/>

[National Plant Diagnostic Network \(NPDN\)](https://www.npdn.org/)

<https://www.npdn.org/>

[Sentinel Plant Network](https://publicgardens.org/programs/sentinel-plant-network/about-spn)

<https://publicgardens.org/programs/sentinel-plant-network/about-spn>

[St. Louis Declaration on Invasive Plant Species](http://www.centerforplantconservation.org/invasives/CodesN.asp)

<http://www.centerforplantconservation.org/invasives/CodesN.asp>

[Voluntary Codes of Conduct for Botanic Gardens and Arboreta \(2002\)](http://www.centerforplantconservation.org/invasives/DownloadPDF/bga.pdf)

<http://www.centerforplantconservation.org/invasives/DownloadPDF/bga.pdf>

Target B6. Botanic gardens and their networks will increase support and contributions to conservation biology research.

Subtarget 1: The number of botanic gardens conducting scientific research in relevant fields such as plant biology, ecology, and conservation genetics will increase.

Subtarget 2: The number of botanic gardens hosting research hubs and centers of expertise will increase.

Subtarget 3: The number of botanic gardens participating in formal research collaborations with other gardens, universities, government agencies, and non-governmental organizations will increase.

Subtarget 4: Results of botanic garden research projects will be disseminated not just in academic journals, but translated for broader audiences through channels such as industry newsletters, popular science media outlets, garden events and interpretation, and guidelines and resources for the general public.

Terms and supporting information

The botanic garden community has a distinguished history of scientific research that is fundamental to the knowledge and expertise needed for the conservation of plant diversity. All botanic gardens can play a role in scientific research. Those that currently lack the resources for major research initiatives can contribute by making their collections available to researchers and making various stakeholders and the public aware of the importance of research to meeting conservation goals (Havens, 2011).

In recent years there have been widely reported losses of organism-focused (i.e., botany and zoology) university degree programs, taxonomic professionals, natural historians, and other similar professionals (Affolter, 2003; Gropp, 2003; Sundburg, 2004; Kramer *et al.*, 2013). The 2010 Botanical Capacity Assessment showed major declines in education and training opportunities, communication and outreach, and research and management in the botanical field in the USA. Botanic gardens are urged to take the lead to address these needs in North America. Botanic gardens with relevant capacity can engage in and partner on research that directly contributes to the understanding of plant conservation goals and priorities. Botanic gardens can also educate stakeholders about the various networks and initiatives of federal and non-federal institutions' roles in researching and safeguarding plant biodiversity.



Consoulea corallicola (Florida semaphore cactus). Florida, USA. Critically imperiled (NatureServe); Critically endangered (IUCN Red List). Recorded in 4 ex situ sites (BGCI PlantSearch). (United States Botanic Garden)

Related resources

[Botanical Capacity Assessment](#)

Kramer, A.T., B. Zorn-Arnold, and K. Havens. 2010. Assessing botanical capacity to address grand challenges in the United States. 64 pp. plus appendices. Available at: www.bgci.org/usa/bcap <http://www.bgci.org/usa/bcap>

[How botanic gardens can play a role in scientific research](#)

Havens, K. 2011. Research at public gardens. In: *Public Garden Management: A complete Guide to the Planning and Administration of Botanical Gardens and Arboreta*, D. Rakow and S. Lee (eds.). John Wiley & Sons Inc., New Jersey. Pp. 272-283.

[Studies reporting losses in botanical capacity](#)

Affolter, James. 2003. Botanical gardens and the survival of traditional botany. *Public Garden* 18: 17-19, 22.

Gropp, R. E. 2003. Are university natural science collections going extinct? *BioScience* 53: 550.

Sundberg, Marshall D. 2004. Where is botany going? *Plant Science Bulletin* 50: 2-6.

Kramer, A., B. Zorn-Arnold, and K. Havens. 2013. Applying lessons from the U.S. Botanical Capacity Assessment Project to achieving the 2020 GSPC targets. *Annals of the Missouri Botanical Garden* 99:172-179.

OBJECTIVE C. Using plant diversity sustainably

Target C1. Botanic gardens and their networks will support and contribute to the sustainable use of plant resources.

Subtarget 1: Botanic gardens will help to develop a set of best practices to ensure that all plant-based products procured and used by botanic gardens are derived from sustainable sources.

Subtarget 2: All botanic gardens will comply with state, national, and international laws and regulations regarding the collection, acquisition, importation, distribution, sale, and use of plant material, and promote and encourage compliance among affiliated groups, including nurseries, members, plant societies, and the general public.

Terms and supporting information

Target C1 of the *North American Strategy* supports the *GSPC Target 11* that *no species of wild flora [is] endangered by international trade*, and the *GSPC Target 12* that *all wild harvested plant-based products [be] sourced sustainably*.

Sustaining the long-term future of plants and plant-based products is as much a good business practice as it is a good conservation ethic for the botanical garden community. The sustainable use of plants should imbue all aspects of a botanic garden's operations, from administration and public education to horticultural displays and retail outlets. Particular attention should be paid to the ethical and sustainable procurement of timber products for use in botanic garden construction and landscape projects.



Pinus torreyana (Torrey pine). California, USA. Critically imperiled (NatureServe); Critically endangered (IUCN Red List). Recorded in 37 ex situ sites (BGCI PlantSearch). (Andrea Kramer)



Stylophorum diphyllum (wood-poppy). Ontario, Canada and central/eastern USA. Endangered (SARA); Critically imperiled in Canada (NatureServe). Recorded in 89 ex situ sites (BGCI PlantSearch). Royal Botanical Gardens (Canada)

The AMJB is preparing a code of conduct and good practice guide for access to goods and services from biodiversity involving the botanic gardens of Mexico.

Among the key national and international laws, regulations, and agreements concerning plant conservation and sustainable use are the *Convention on Biological Diversity* (CBD); *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES); the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC); the USA's *Endangered Species Act* (ESA); the *NOM-059-SEMARNAT-2010* threatened species list of Mexico, the 2000 *General Wildlife Law of Mexico*; and the 2014 *Nagoya Protocol on Access and Benefit-sharing*. The *Nagoya Protocol* is an international agreement that aims at sharing the benefits arising from the utilization of genetic resources fairly and equitably. According to data reported to BGCI's *GardenSearch* database as of 2015, at least 3% of botanic gardens in North America have an access and benefit sharing policy.

Related resources

[Committee on the Status of Endangered Wildlife in Canada \(COSEWIC\)](#)

<http://www.cosewic.gc.ca/>

[Convention on Biological Diversity \(CBD\)](#)

<http://www.cbd.int/>

[Convention on International Trade in Endangered Species of Wild Fauna and Flora \(CITES\)](#)

<http://www.cites.org/>

[General Wildlife Law \(Mexico\)](#)

<http://www.fws.gov/endangered/news/bulletin-spring2010/two-nations-one-goal.html>

[GSPC Toolkit: Target 11](#)

<http://www.plants2020.net/target-11>

[GSPC Toolkit: Target 12](#)

<http://www.plants2020.net/target-12>

[Nagoya Protocol on Access and Benefit-sharing](#)

<http://www.cbd.int/abs/>

[NOM-059-SEMARNAT-2010 Mexican Threatened Species List](#)

http://www.profepa.gob.mx/innovaportal/file/435/1/NOM_059_SEMARNAT_2010.pdf

[United States Endangered Species Act \(ESA\)](#)

<http://www.fws.gov/endangered>

Case Study 7: Conservation of agrobiodiversity in Mexico

Robert Bye and Edelmira Linares, Jardín Botánico, Instituto de Biología, National Autonomous University of Mexico (UNAM), Mexico City, Mexico

In the face of climate change and acculturation, the UNAM Botanical Garden is working with communities throughout Mexico to conserve indigenous plant knowledge and traditions. After many years of interactions with indigenous communities, residents have expressed concerns about loss of traditional knowledge, practices and plants. The UNAM Botanical Garden offers capacity building workshops to assess these issues and suggest elective actions that may be adapted individually or collectively if appropriate to a community's cultural values. As part of these activities, we rely on valuable collaboration with volunteers, local NGOs, governmental agencies, and international organizations.

For example, following three years of extreme drought for the Sierra Tarahumara community in Chihuahua, local maize seed reserves were nearly depleted. The Botanical Garden helped to produce bulk seed and distribute seed stock of five native races of maize. This emergency action was accompanied with workshops to document and fortify the agrobiodiversity of the "milpa", the traditional maize-beans-squash cultivated fields (with 100+ associated edible and medicinal plants including crop wild relatives) and adjoining forests that are the basis of the food security and alimentary sovereignty of the Rarámuri people.



Capacity building workshops for conservation of agrobiodiversity in Sierra Tarahumara, Chihuahua, Mexico. Left: Workshops bring representatives from various Rarámuri communities together to document and exchange experiences, plants and practices. Center: A Rarámuri leader explains how he applied the principles from an earlier conservation workshop to start the community's seed bank of cultivated and useful spontaneous plants from the milpa. Right: A satellite workshop at an isolated ranch allows a Rarámuri elder (who could not travel) to demonstrate the painless technique for preparing stinging nettles (*Urtica* sp.) as an edible green to younger women who are unfamiliar with this practice. (Robert Bye and Edelmira Linares)

Target C2. Botanic gardens will contribute to the awareness and protection of ethnobotanical knowledge, and cultural and indigenous uses of plants.

Subtarget 1: Targets for protection of cultural and indigenous knowledge will be set, current levels of local, national, regional, and international activity determined, and appropriate partners identified.

Terms and supporting information

Target C2 of the *North American Strategy* directly supports the *GSPC Target 13* that *indigenous and local knowledge, innovations and practices associated with plant resources, [are] maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care.*

As the natural world is increasingly impacted by environmental change, climate change, and development, among other factors, local cultures and indigenous groups are being directly and negatively impacted and displaced. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) estimates that 50% of the world's languages (surrogate for cultures) are at risk of extinction, a rate that far exceeds risks to plants and animals.

Botanic gardens can play an important role by helping to ensure that traditional knowledge and ways of life are safeguarded within local communities. Such activities include engaging local and indigenous communities in documenting traditional knowledge of local plants, anticipating impacts of climate change on culturally significant plants, and raising awareness through interpretation and public programs. Acknowledging that erosion of biological diversity is directly impacting human cultural diversity enables botanic gardens to

engage more with cultural practitioners ethnobotanists, cultural anthropologists and geographers, linguists, and those in the humanities to build robust “biocultural conservation” programs that explicitly include the human element of conservation.

There are already significant ethnobotanical and biocultural activities and programs at botanic gardens, and even more that can be done. According to data reported to BGCI’s *GardenSearch* database as of 2015, at least 5% of North American botanic gardens maintain active research and outreach programs and public events that explicitly educate and promote ethnobotanical knowledge. Some botanic gardens (e.g., the Lyon Arboretum of the University of Hawai’i) are also involved in developing curricula on biocultural diversity and conservation, which is a new frontier for gardens. Preserving cultures through preserving biodiversity supports a number of international agendas and programs of the IUCN, *Article 8(j) of the CBD*, the *GSPC Target 13*, the People and Plants International program, the World Health Organization (WHO), and the Food and Agriculture Organization (FAO) of the UN, among others.

Related resources

[Conventional on Biological Diversity Article 8\(j\) - Traditional Knowledge, Innovations and Practices](https://www.cbd.int/traditional)

<https://www.cbd.int/traditional>

[GSPC Toolkit: Target 13](http://www.plants2020.net/target-13)

<http://www.plants2020.net/target-13>

[People and Plants International](http://peopleandplants.org/)

<http://peopleandplants.org/>

[Sacred Seeds Program](http://www.sacredseedssanctuary.org/)

<http://www.sacredseedssanctuary.org/>

[United Nations Educational, Scientific, and Cultural Organization \(UNESCO\)](http://en.unesco.org/)

<http://en.unesco.org/>

[World Health Organization \(WHO\)](http://www.who.int/en/)

<http://www.who.int/en/>

[Food and Agriculture Organization \(FAO\) of the United Nations](http://www.fao.org/home/en/)

<http://www.fao.org/home/en/>

Case Study 8: Promoting Plants and Culture at the Queens Botanical Garden

Gennadyi Gurman and Rebecca Wolf, Queens Botanical Garden, Queens, New York, USA



High school volunteers show off harvested plants. (QBG Staff)

The mission of Queens Botanical Garden (QBG) is to be an urban oasis where people, plants and cultures are celebrated. Located in the third most diverse county in the United States, QBG welcomes more than 210,000 visitors a year, and serves a community comprising 100 ethnicities that speak at least 138 languages. Our plant collections, education, and outreach programs underscore the importance of plants in the lives of people from all cultures. As such, QBG employs strategic approaches for engaging its visitors in ethnobotany. For the casual visitor, interpretive signage and printed brochures in four languages (English, Spanish, Chinese, and Korean) make our message more accessible.

Many gardens, in particular the Herb Garden, Tropical Displays, and Annual and Perennial Beds exhibit plants that are familiar touchstones for people from a variety of cultures. Throughout the year, we produce events that honor traditions from around the globe, like Lunar New Year, Black History Month, Colombian Festival de las Flores, and Taiwan: A World of Orchids. These programs welcome the public and highlight culturally important plants as well as the people, traditions, and customs surrounding them. QBG’s school programs have a focus on ethnobotany, including our “Growing Together” workshop that demonstrates how plants and cultures have intersected as people move around the world. Kids’ gardening programs offer opportunities to grow and use culturally significant edible plants. These programs provide a venue for parents and children to share traditional connections their families have with plants of their culture.



QBG Farm and Compost Volunteers show off their newly seeded gardening bed. (QBG Staff)

OBJECTIVE D. Promoting public awareness about the importance of biodiversity and the wise use of resources

Target D1. Botanic gardens will educate their visitors, community members, partners, staff, volunteers, and other stakeholders about the importance of plant diversity such that its irreplaceable value to human and ecosystem well-being is recognized.

Subtarget 1: Botanic gardens will incorporate conservation and ethnobotanical messages in interpretation, outreach, and formal and informal educational programs directed to all ages and audiences.

Subtarget 2: All botanic gardens will promote the importance of plant diversity in supporting human well-being, livelihoods, health and in addressing poverty, as well as highlighting the need for the sustainable use of plant resources.

Terms and supporting information

Target C2 of the *North American Strategy* directly supports the *GSPC Target 14* that *the importance of plant diversity and the need for its conservation [be] incorporated into communication, education and public awareness programs.*

Case Study 9: *Communicating our work and collections to visitors*



Martin Nicholson and Erin Riggs, The Hoyt Arboretum, Portland, Oregon, USA

The challenge for all gardens is how to interpret the work we do and the plants we curate to the visitor. At Hoyt we have no central gate and are free and open to the public all year. Outreach is crucial to our mission and broader plant conservation strategies. As such, we explore many options balancing time requirements, impact potential and cost to find solutions that work for our staff and visitors. Our visitors range from daily regular visitors to out of town and

out of country tourists, so outreach takes on many forms to connect with this diverse audience.

Our major collections have interpretive signs which introduce plant family groups. These signs are an investment in time and money to produce. For individual plant interpretation we looked

Botanic gardens have tremendous credibility and influence when interpreting the importance of plants within their communities. More than 200 million people annually visit North American botanic gardens according to data reported to BGCI's *GardenSearch* database as of 2015. Public education programs are key communication tools for disseminating critical information about the value of plant conservation to human well-being.

Example campaigns and events include (2016 dates):

- National Forest Conservation Day, January 14
- National Invasive Species Awareness Week, February 21-27
- Earth Day, April 22
- Arbor Day, April 29
- National Wildflower Week, May 2-8
- National Public Gardens Day, May 6
- Plant Conservation Day, May 18
- Endangered Species Day, May 20
- International Day for Biological Diversity, May 22
- National Public Lands Day, September 24



Above: Citizen science projects offered by the Hoyt Arboretum provide a unique interface between staff, volunteers, and the public. (Martin Nicholson)

Left: Wollemi pine (Wollemia nobilis) in the Hoyt Arboretum with an interpretive Care for the Rare sign which explains the species' conservation issues to visitors. (Martin Nicholson)

for an off-the-shelf solution, which we found with BGCI-US's Care for the Rare signage. The free templates allow quick production of professional signs and the color printed laminated signage has been durable and eye catching. We also plan to contribute digital copies of our signs to the Care for the Rare Sign Library so other gardens can download and interpret the same species.

Citizen science projects are another outreach tool we use to engage the enthusiastic volunteer in further work, while also providing visitor interaction opportunities. One of our projects works with a locally rare terrestrial orchid and our scientists are empowered to talk with the public while conducting their field work.

Related resources

Arbor Day

<http://www.arborday.org/celebrate/dates.cfm>

Endangered Species Day

<http://www.endangered.org/campaigns/endangered-species-day/>

Earth Day

<http://www.earthday.org/>

GSPC Toolkit: Target 14

<http://www.plants2020.net/target-14>

International Day for Biological Diversity

<http://www.cbd.int/idb/>

National Forest Conservation Day

<http://anydayguide.com/calendar/1714>

National Invasive Species Awareness Week

<http://www.nisaw.org/>

National Public Gardens Day

<http://www.nationalpublicgardensday.org/>

National Public Lands Day

<http://www.publiclandsday.org/>

National Wildflower Week

<http://www.wildflower.org/nww/>

Plant Conservation Day

<http://www.bgci.org/plantconservationday/>

Project BudBurst

<http://budburst.org/>

USA National Phenology Network

<https://www.usanpn.org/>

Target D2. Botanic gardens will be leaders in operational sustainability practices and provide guidance to fellow institutions and others.

Subtarget 1: Botanic gardens will improve the sustainability of their institutional operations with measurable success recognized by performance metrics established by such entities as LEED, SITES, the Public Garden Sustainability Index, and Veriflora.

Terms and supporting information

Target D2 of the *North American Strategy* supports the achievement of the *GSPC Target 12* that *all wild harvested plant-based products* [be] *sourced sustainably*. According to data reported to BGCI's *GardenSearch* database as of 2015, at least 6% of North American botanic gardens contribute to research related to sustainability.

Several important resources and programs have been developed since the publication of the 2006 *North American Strategy*. The United States Botanic Garden, the American Society of Landscape Architects, and the Lady Bird Wildflower Center at the University of Texas at Austin have developed the Sustainable SITES initiative, which provides landscape and garden designers with best management practices and certification schemes for

sustainable landscapes and gardens. This program is now administered by the U.S. Green Business Council. Through the American Public Gardens Association's Climate and Sustainability Alliance, a Public Garden Sustainability Index provides an assessment tool for measuring environmental, social, and financial sustainability. It describes key practices to increase a garden's sustainability performances and provide data to support its sustainability claims. Another example of a botanic garden providing regional guidance on greening their operations is the Missouri Botanical Garden and its role in the Green Business Challenge in St. Louis.

Related resources

Climate and Sustainability Alliance

<http://publicgardens.org/programs/climate-change-sustainability-program/about-climate-sustainability-alliance>

Green Business Challenge in St Louis

<http://stlouisgreenchallenge.com/about.html>

GSPC Toolkit: Target 12

<http://www.plants2020.net/target-12>

Leadership in Energy & Environmental Design (LEED) Certification

<http://www.usgbc.org/leed>

Public Garden Sustainability Index

<http://publicgardens.org/sustainability-index>

Sustainable SITES initiative

<http://www.sustainablesites.org>

U.S. Green Business Council

<http://www.usgbc.org/>

Veriflora, Certified Sustainably Grown

<http://www.veriflora.com/>



Populus tremuloides (quaking aspen). Throughout Canada and USA. Secure; Imperiled locally (NatureServe). Recorded in 82 ex situ sites (BGCI PlantSearch). (Andrea Kramer)

OBJECTIVE E. Building capacity for conservation of plant diversity

Target E1. Botanic gardens will build national and international capacity for conservation and sustainable use of plant diversity.

Subtarget 1: All appropriate certificate, diploma, and degree programs offered by botanic gardens in North America will include conservation components.

Subtarget 2: Botanic gardens will support and promote existing regional, national, and international programs by providing professional training in plant conservation best practices and through the development of new programs as needed.

Subtarget 3: Botanic gardens will support and promote the training of professional horticulturists, recognizing that the conservation role of a botanic garden is dependent upon an ability to successfully propagate and cultivate threatened species.

Terms and supporting information

Target E1 of the *North American Strategy* supports the achievement of the *GSPC Target 15* that the *number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.*

According to data reported to BGCI's *GardenSearch* database as of 2015, at least 20% of North American botanic gardens offer or support formal school or university courses. The 2010 *Botanical Capacity Assessment* showed major declines in education and training opportunities, communication and outreach, and research and management in the botanical field in the USA. The GSPC estimates that the number of trained plant conservation professionals worldwide will need to double by 2020. Increasing the number of trained professionals and citizen scientists is a critical need for meeting the challenges of plant conservation.

Individual botanic gardens can provide much-needed training opportunities for the next generation, such as the Fairchild Challenge at the Fairchild Tropical Botanical Garden; the Science First and College First programs at the Chicago Botanic Garden; the Botany in Action Fellowship at the Phipps Conservatory; international fellowships and training opportunities at the Missouri Botanical Garden, and the Public Garden Leadership Fellows Program at Cornell Plantations. Also, the American Public Gardens Association is one of six founding partner associations in the Seed Your Future program established by Longwood Gardens, the American Society for Horticultural Science (ASHS), Fleishmann-Hillard, Scholastic, and Marts and Lundy. It promotes and enhances the perception and relevance of careers in horticulture.



Torreya taxifolia (Florida Torreya). Florida and Georgia, USA. Critically imperiled (NatureServe); Critically endangered (IUCN Red List). Recorded in 51 ex situ sites (BGCI PlantSearch). (Atlanta Botanical Garden)

Related resources

[Botanical Capacity Assessment](http://www.bgci.org/usa/bcap)

<http://www.bgci.org/usa/bcap>

[Botany in Action Fellowship program at the Phipps Conservatory](http://phipps.conservatory.org/green-innovation/for-the-world/botany-in-action)

<http://phipps.conservatory.org/green-innovation/for-the-world/botany-in-action>

[Fairchild Challenge at the Fairchild Tropical Botanical Garden](http://www.fairchildgarden.org/education/the-fairchild-challenge)

<http://www.fairchildgarden.org/education/the-fairchild-challenge>

[GSPC Toolkit: Target 15](http://www.plants2020.net/target-15)

<http://www.plants2020.net/target-15>

[International fellowships and training opportunities at the Missouri Botanical Garden](http://www.missouribotanicalgarden.org/learn-discover.aspx)

<http://www.missouribotanicalgarden.org/learn-discover.aspx>

[Public Garden Leadership Fellows Program at Cornell Plantations](http://www.cornellplantations.org/learning/graduate-fellowships)

<http://www.cornellplantations.org/learning/graduate-fellowships>

[Science First and College First programs at the Chicago Botanic Garden](http://www.chicagobotanic.org/education/teachers_students)

http://www.chicagobotanic.org/education/teachers_students

[Seed Your Future program](http://www.ashs.org/?page=promotinghort)

<http://www.ashs.org/?page=promotinghort>

Case Study 10: The *Global Strategy for Plant Conservation* as a guiding framework for conservation activities

Jennifer Ramp Neale, Denver Botanic Gardens, Denver, Colorado, USA

At Denver Botanic Gardens, our plant conservation efforts have global impact through a regional focus. To direct and prioritize all our conservation activities, Denver Botanic Gardens utilizes the *Global Strategy for Plant Conservation* (GSPC) as a guiding framework. While we have been actively documenting and conserving plants of the Rocky Mountain Region for decades, unifying our efforts under the GSPC has allowed for ease of reporting and communicating to a broader

audience. In 2014, the Gardens and Conservation committee of our Board of Trustees, evaluated current programs and identified new activities related to each of the five objectives and 16 targets of the GSPC. Through our core conservation programs and the Center for Global Initiatives, we contribute toward the achievement of each objective. We do not aim to cover all targets, but rather continue to build our programs in areas of expertise that contribute widely to the GSPC.

GSPC Target	Denver Botanic Gardens supporting activity
Objective I: Plant diversity is well understood, documented and recognized	
1	Conduct inventories of understudied areas such as private lands in the Arkansas Valley of Colorado.
2	Long-term monitoring of <i>Astragalus microcymbus</i> has contributed to its addition to the federal Endangered Species Act list of threatened species as a candidate species.
3	Produce plant conservation best management practices, manuals, and national publications.
Objective II: Plant diversity is urgently and effectively conserved	
4	Restore riparian habitat within the Denver urban corridor.
5	Support the establishment of Important Plant Areas of Colorado via the <i>Colorado Rare Plant Conservation Strategy</i> .
6	Run a Community Supported Agriculture program at our Chatfield Farms satellite location.
7	Conduct long-term monitoring studies of four rare Colorado species involving statistically rigorous, annual sampling of marked individuals in situ. These data guide management strategies.
8	Collect seed of more than 70 Center for Plant Conservation National Collection species; representatives of more than 300 IUCN Red Listed threatened species maintained in our living plant collection.
9	Contributed data from 65 years of plant collections to the 'Adapting Agriculture to Climate Change: Collecting, Protecting and Preparing Crop Wild Relatives' project led by the Global Crop Diversity Trust.
10	Coordinate an invasive species management and research program.
Objective III: Plant diversity is used in a sustainable and equitable manner	
11	Identify and curate CITES listed species in living plant collection.
12	-
13	Provide assistance to the M.S. Swaminathan Botanical Garden in Wayanad, India to develop a master plan which includes preservation of over 500 endemic plants of the southern Western Ghats region, as part of the Gardens' Center for Global Initiatives.
Objective IV: Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on Earth is promoted	
14	Offer interactive displays and 'science chats' with staff and docents in our on-site Science Pyramid; organize citizen science activities through Project Budburst and the USA National Phenology Network.
Objective V: The capacities and public engagement necessary to implement the Strategy have been developed	
15	Conduct volunteer citizen science and graduate training programs.
16	Co-lead the Colorado Rare Plant Conservation Initiative and co-authored the <i>Colorado Rare Plant Strategy</i> .

Examples of how Denver Botanic Gardens supports the *Global Strategy for Plant Conservation* (GSPC).

Target E2. Botanic gardens will work with appropriate stakeholders to develop tools and methodologies to support policy formation and implementation and obtain resources to affect plant conservation activities.

Subtarget 1: Botanic garden and their associations will work at national and international levels to increase the resources available for plant conservation activities based on scientifically derived priorities.

Subtarget 2: Botanic gardens will contribute to, inform, and provide expertise for public policy at the local, regional, national, and international levels to increase understanding, funding, and other resources available for plant conservation.

Terms and supporting information

Botanic gardens have tremendous power to inspire and inform community leaders and policy makers to support plant conservation. Policy makers need reliable, credible sources of information on plant conservation issues so they are able to enact legislation that ensures plant and ecosystem health. Botanic garden staff have an important role to play as information resources for legislators. To do so requires development of trusting relationships between botanic garden staff and local, state, and national representatives. Botanic gardens can do this on their own or in collaboration with other conservation groups, such as the PCA.

The Non-Federal Cooperators Committee of the PCA (PCA-NFCC) is a group of state agencies and independent institutions interested in native plant conservation. The PCA-NFCC include botanic gardens, universities, state agencies, professional and trade associations, native plant societies, and garden clubs. This group works together with the federal agencies in the PCA to ensure the protection, restoration, and maintenance of native plant communities in the U.S. The PCA-NFCC provides outreach and education and informs policy makers about the underlying science and the importance of native plant conservation.

The PCA Non-Federal Cooperators Committee (PCA-NFCC), helped draft a national strategy for native seed conservation in the United States, promoting cross-sector collaboration for native plant conservation in the USA. The final Strategy document was released by the United States Department of Interior in August of 2015.

Related resources

Plant Conservation Alliance Non-Federal Cooperators Committee (PCA-NFCC)

<http://www.plantconservationalliance.org/>

Target E3. Botanic gardens and their associations will identify and create partnerships to improve plant conservation within botanic gardens and the broader conservation community.

Subtarget 1: All botanic gardens will work to establish strategic partnerships to enhance the delivery of plant and habitat conservation at national and international levels.

Subtarget 2: Botanic gardens, recognizing that they can have an important role in the conservation of essential plant symbionts such as fungi and pollinators, will work to actively engage in national and international conservation initiatives.

Terms and supporting information

Target E3 of the *North American Strategy* supports the achievement of the *GSPC Target 16* that *institutions, networks and partnerships for plant conservation [are] established or strengthened at national, regional and international levels to achieve the targets of this Strategy*.

Many associations and partnerships have been formed in recent years to increase the awareness and effectiveness of, and participation in, plant conservation. These groups include the sponsoring networks of the *North American Strategy*: the AMJB, American Public Gardens Association, BGCI, CPC, and PCA-NFCC. This group will be coordinating the North American Plant Conservation Initiative, encouraging all botanic gardens to participate in the many ways to support the conservation of plant diversity. For more information on these botanic garden networks, see Appendix A.



Brighamia insignis (Alula). Hawai'i, USA. Critically imperiled (NatureServe); Critically endangered (IUCN Red List). Recorded in 55 ex situ sites (BGCI PlantSearch). (*United States Botanic Garden*)



Dasyliion acrotriche (green sotol). Central Mexico. Threatened (NOM-059-SEMARNAT-2010). Recorded in 14 ex situ sites (BGCI PlantSearch). (Kirsty Shaw)

A few plant group-focused organizations have emerged in recent years, e.g. for trees and orchids. One of these is ArbNet, an international network of tree-focused professionals and arboreta. ArbNet provides its programs and resources to advance the planting, study, and conservation of trees. ArbNet is sponsored and coordinated by The Morton Arboretum in cooperation with the American Public Gardens Association and BGCI. Best practice advice and support are provided to help foster professionalism in arboreta and to enable accreditation by ArbNet.

Another of these is the North American Orchid Conservation Center (NAOCC), which was established by the U.S. Botanic Garden and the Smithsonian Institute to ensure the survival of North American native orchid species. The NAOCC will focus on establishing protocols for the propagation and restoration of native orchids. NAOCC will also be developing a website to share information on native orchids with the public.

In addition, many regional partnerships are now in place to exchange information and collaborate on the protection and restoration of regionally native plants and habitats. These include but are not limited to the Georgia Plant Conservation Alliance, Colorado's Rare Plant Conservation Initiative, and the *Hawai'i Strategy for Plant Conservation*.

Related resources

Appendix A organizations

See page 39

ArbNet

<http://www.arbnet.org>

Colorado Rare Plant Conservation Initiative

https://cpw.state.co.us/Documents/CNAP/RPCI_general_intro_20090318.pdf

Georgia Plant Conservation Alliance

<http://gpca.uga.edu>

Hawai'i Strategy for Plant Conservation

<http://laukahi.org/hawaii-strategy-for-plant-conservation/>

North American Orchid Conservation Center

<http://northamericanorchidcenter.org/>

Target E4. Botanic gardens and their networks will better share and promote existing information and resources on how to achieve plant conservation objectives.

Subtarget 1: All botanic gardens will work to join, support, and participate in conservation networks to effectively share information and expertise.

Terms and supporting information

Target E4 of the *North American Strategy* supports the achievement of the *GSPC Target 3* that *information, research and associated outputs, and methods necessary to implement the Strategy developed and shared*.

The scale and complexity of plant conservation requires that botanic gardens develop strategic partnerships with a variety of agencies, institutions, and communities. Recognizing that, in most cases, plant conservation will be conducted and delivered on land outside of botanic gardens, a primary relationship must be with land management agencies holding wild populations of target species and habitats. Partnerships with organizations such as museums, universities, zoos, and aquaria will also bring valuable and necessary resources to plant conservation activities.

Other networks and resources available to help institutions achieve *ex situ* plant conservation objectives include those sponsoring the *North American Strategy* (see Appendix A for more details). In the USA (and including Canada): the American Public Gardens Association, BGCI, CPC, and the PCA-NFCC; and in Mexico the AMJB. Additional networks providing plant conservation resources include ArbNet and the NAOCC (see Target E3 for more details on these networks). Another related network, the Association of Zoological Horticulture (AZH), includes zoological institutions and similar organizations with some of the top plant collections and plant conservation programs on the continent. As annual attendance at zoos is over 180 million people in the USA alone, the AZH enables its members to communicate the value of plants to visitors and provide critical support for plant conservation, locally and around the world.

Related resources

ArbNet

<http://www.arbnet.org>

Association of Zoological Horticulture (AZH)

<http://www.azh.org>

GSPC Toolkit: Target 3

<http://www.plants2020.net/target-3>

National Seed Strategy for Rehabilitation and Restoration

<http://www.blm.gov/seedstrategy>

North American Orchid Conservation Center

<http://northamericanorchidcenter.org>

OBJECTIVE F. Supporting the North American Strategy

Target E1. Botanic gardens will demonstrate their support by inclusion of plant and habitat conservation in their institutional priorities and plans.

Subtarget 1: All botanic gardens will educate their governing bodies about the importance of plant conservation and the need to deliver the North American Strategy.

Subtarget 2: All botanic gardens will update their missions and strategic plans to include a declaration of their institutional commitment to plant and habitat conservation.

Subtarget 3: Botanic gardens will report and assess the proportion of their annual budgets committed to direct plant and habitat conservation and benchmark these allocations against similar North American institutions.

Subtarget 4: Botanic gardens will make institutional conservation investments using existing local, national and global priorities.

Subtarget 5: Botanic gardens will implement communication plans describing and updating plant and habitat conservation activities for their leadership, stakeholders, and communities.



Dioon edule (*palma de Dolores*). Sierra Madre Oriental, Mexico. At risk of extinction (NOM-059-SEMARNAT-2010); Near threatened (IUCN Red List). Recorded in 2 ex situ sites (BGCI PlantSearch). (Missouri Botanical Garden)



Potentilla robbinsiana (*Robbins' cinquefoil*). New Hampshire, USA. Critically imperiled (NatureServe). Recorded in 2 ex situ sites (BGCI PlantSearch). (Doug Weihrauch)

Terms and supporting information

Target F1 of the *North American Strategy* supports the achievement of the institutional goals of the GSPC Target 16 that institutions, networks and partnerships for plant conservation [are] established or strengthened at national, regional and international levels to achieve the targets of this Strategy.

Each botanic garden is encouraged to consider specific and relevant actions that demonstrate and publicize support for the *North American Strategy*. The North American botanic garden organizations that sponsored this document (see Appendix A for more details) will encourage their members to take action on targets for which gardens can take a leadership role and make significant strides toward achieving these objectives.

Related resources

BGCI's *GardenSearch* database

http://www.bgci.org/garden_search.php

BGCI's *PlantSearch* database

http://www.bgci.org/plant_search.php

BGJournal article '*The role of Mexican botanic gardens in the implementation of the GSPC*'

<https://www.bgci.org/resources/article/0685/>

GSPC Toolkit

<http://www.plants2020.net>

Darwin Technical Manual for Botanic Gardens (updated version to be published by BGCI starting in 2016)

http://www.bgci.org/resources/darwin_manual/

Public Gardens Benchmarking Studies from the American Public Gardens Association

<http://publicgardens.org/benchmarking-studies>

Case Study 11: The *Global Strategy for Plant Conservation* as an institutional priority for the Missouri Botanical Garden

Peter Wyse Jackson, Missouri Botanical Garden, St. Louis, Missouri, USA

The *Global Strategy for Plant Conservation* (GSPC) has been adopted as an essential over-arching policy document guiding much of the research, conservation, horticulture and education priorities and activities of the Missouri Botanical Garden. It has been incorporated in a fundamental way into strategic plans and is taken in account in the Garden's research programs throughout the world. We believe that botanic gardens can play meaningful roles in the achievement of most GSPC targets.

Particular emphasis is given by the Garden to documenting and understanding plant diversity, achieved through plant discovery, floristics, systematics and research. Conservation action undertaken by the Garden includes species conservation activities, conservation

status surveys and habitat restoration projects. Work on the sustainable use of plant diversity is particularly focused on documenting, conserving, and repatriating traditional ethnobotanical knowledge. In several countries the Garden works to support community-based plant conservation initiatives closely integrated with community and socio-economic development. The Garden's extensive international activities also support institution strengthening, as well as professional training of botanical scientists, ecologists and plant conservationists at undergraduate, post-graduate and other levels. Underpinning the Garden's work in support of the GSPC, the development of close collaborative partnerships with in-country partners is a fundamental principle and practice that runs through all the Garden's programs.

GSPC Target	Missouri Botanical Garden supporting activity
Objective I: Plant diversity is well understood, documented and recognized	
1	Founding partner of the World Flora Online project, and leadership of the <i>Flora Mesoamericana</i> , <i>Flora of North America</i> , <i>Flora of China</i> and several national projects.
2	Red List projects including the <i>Red Book of Endemic Plants of the Caucasus</i>
3	Establishment of a plant conservation genetics program and new molecular laboratory at the Garden in 2013 offers new research tools for our conservation work.
Objective II: Plant diversity is urgently and effectively conserved	
4	Implementing community-based nature reserve projects in Madagascar; and restoration of local plant communities in the Garden's 2,500 acre Shaw Nature Reserve.
5	Leading projects to identify, evaluate and manage 79 nature reserves in Madagascar, and three national parks (totaling c. 5 million acres) in Peru, Ecuador and Bolivia.
6	In Madagascar, ethnobotanical inventories support 30-40,000 local people, timber species production in local nurseries, and conservation of 300-400 medicinal plants.
7	Species discovery, documentation and inventory projects in several countries, particularly in protected areas of Bolivia, Madagascar and Peru.
8	Maintain c. 700 native species in the Garden's Shaw Nature Reserve; building seed bank of regionally threatened flora; and support <i>ex situ</i> collections in Madagascar, Mauritius, Nicaragua and Vietnam.
9	Extensive research on the sustainable use of medicinal plants in Latin America, the Himalayas, the Caucasus and Vietnam is undertaken by the Garden's research staff.
10	The Garden researches and develops practical methodologies for the control of invasive plants in the U.S. Midwest.
Objective III: Plant diversity is used in a sustainable and equitable manner	
11	Advocate with partners against illegal international trade in ebony (<i>Diospyros</i> spp.) timber in Madagascar.
12	Implementing community-based conservation programs in Bolivia, Peru and Madagascar.
13	Repatriation of local and indigenous knowledge is a major research focus of the Garden, especially in Bolivia, Georgia, Madagascar and Peru.
Objective IV: Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on Earth is promoted	
14	Annually host an average of 100,000 local students and teachers; increase basic scientific/environmental literacy and action for conservation and sustainable living via capacity-building efforts in St. Louis and around the world.
Objective V: The capacities and public engagement necessary to implement the Strategy have been developed	
15	Offer International Professional Development Fellowships and training courses on sustainable development; recent ethnobotanical training in Georgia, Madagascar, Peru and Bolivia for plant conservationists and botanic gardens
16	Active in networks including the Global Partnership for Plant Conservation, BGCI, the CPC, the CBD's Consortium of Scientific Partners, the Encyclopedia of Life, the Global Plants Initiative and the Biodiversity Heritage Library.

Examples of activities at the Missouri Botanical Garden supporting the Global Strategy for Plant Conservation (GSPC)

Appendix A: Sponsoring Networks of the North American Botanic Garden Strategy for Plant Conservation



American Public Gardens Association

American Public Gardens Association
351 Longwood Road
Kennett Square, Pennsylvania 19348 USA
+1 610-708-3010
www.publicgardens.org

The **American Public Gardens Association** serves public gardens in North America and advances them as leaders, advocates, and innovators. It provides conferences, resources and training on a variety of topics and facilitates communication and resource sharing among members. Coordinates professional development for public gardens regarding exhibitions, design and planning, horticulture, green buildings and landscapes, fund raising, plant collections and more. Association resources include:

- Plant Collections Network
- Plant Protection Program
- Climate & Sustainability Alliance
- Tree conservation partnership with USDA Forest Service
- Newsletters, Public Garden magazine
- Pollinators Challenge
- National conferences, symposia, webinars



**ASOCIACIÓN
MEXICANA
DE JARDINES
BOTÁNICOS**
2016 - 2018

Asociación Mexicana de Jardines Botánicos, A. C.

Luis Pasteur Sur 36, Centro
Querétaro, Querétaro, México C.P. 76000
+52 441-276-0647
<http://concyteq.edu.mx/amjb/>

The **Asociación Mexicana de Jardines Botánicos (AMJB)** is a network of botanic gardens dedicated to promoting investigation, distribution, conservation, and education using Mexican plant diversity. The main objectives of the AMJB are:

- To integrate all Mexican botanic gardens, promoting the creation of academic links and collaboration, for the conservation of Mexico's plant diversity
- To promote the creation of new botanic gardens across the nation, so they can serve as germplasm repositories
- To promote study, *in situ*, and *ex situ* conservation and sustainable use of Mexican plant diversity and traditional knowledge linked to it
- To create information resources and environmental education programs, for sharing of scientific knowledge and promotion of public awareness of the relevance of plant diversity and its conservation
- To relate with other national and international associations and to serve as the link between botanic gardens and national authorities on the subject



BGCI

Plants for the Planet

Botanic Gardens Conservation International, US

c/o Chicago Botanic Garden
1000 Lake Cook Road
Glencoe, Illinois 60022 USA
+1 847-835-6928
www.bgci.org/usa

Botanic Garden Conservation International (BGCI) is a global voice for all botanic gardens and the world's largest plant conservation network, open to all. BGCI-US provides global resources to empower gardens in North America to protect threatened plants. BGCI-US led and published the 2011 North American Collections Assessment, updated annually, and conducts collections assessments for individual gardens. BGCI resources include:

- Conservation: community-based conservation projects around the world
- Databases: PlantSearch, the only global database of plant species in botanic gardens and similar organizations; and GardenSearch, the only global source of information on the world's botanical institutions.
- Global plant conservation networks: Ecological Restoration Alliance, Global Seed Conservation Challenge, International Plant Sentinel Network, Global Trees Campaign
- Connections: congresses, courses, manuals, newsletters, BGjournal
- Knowledge: Red Lists, *ex situ* surveys, GSPC toolkit, climate change & educational tools
- Policy Support: Reports to the UN on progress toward the GSPC



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The Plant Conservation Alliance
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The Center for Plant Conservation works to ensure that all plants in North America and beyond are secure from extinction. CPC operates the only coordinated national program of *ex situ* conservation of rare plant material and works in research, restoration, technical assistance, education and advocacy of plant conservation. CPC resources include:

- National Collection of Endangered Plants: largest living collection of rare plants in the world
- Network of 39 (and growing) Participating Institutions, including major botanic gardens and arboreta
- Technical books, guidelines, Web and print information
- Annual meetings, training workshops and symposia

The Non-Federal Cooperators Committee of the Plant Conservation Alliance (PCA-NFCC) advances plant conservation, promotes native plant community restoration, and conducts plant conservation research. It represents the interests and ideas of Cooperator organizations and agencies, including botanic gardens, universities, educational groups, state agencies, businesses, professional societies, trade associations, native plant societies, and garden clubs. The PCA-NFCC activities include:

- Developing a National Seed Strategy
- Educating governmental agencies and representatives on ecological issues
- Providing scientific expertise on native plant restoration and conservation to national leaders and decision makers



Ferocactus wislizeni (southwestern barrel cactus). Chihuahua and Sonora, Mexico; Southwestern USA. Critically imperiled locally (NatureServe); Vulnerable (IUCN Red List). Recorded in 55 *ex situ* sites (BGCI PlantSearch). (Missouri Botanical Garden)



Echinacea laevigata (smooth purple coneflower). Southeast USA. Imperiled (NatureServe). Recorded in 13 *ex situ* sites (BGCI PlantSearch). (United States Botanic Garden)

