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Access and Benefit Sharing: botanic garden responses

BOTANIC GARDENS CONSERVATION INTERNATIONAL

Cover Photo: Learning how to prepare a herbarium specimen in Mexico (Suzanne Sharrock)

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United Nations Decade on Biodiversity 2011-2020

IN THIS ISSUE...

EDITORIAL:
ACCESS AND BENEFIT SHARING: BOTANIC GARDEN RESPONSES

The theme of this issue of *BGjournal* is Access and Benefit Sharing (ABS), one of the three central tenets of the Convention on Biological Diversity. As Kate Davis points out in her overview article (page 14), acquiring and sharing plants has become increasingly complicated. There are now a raft of international and national laws and regulations that gardens must follow related to the Nagoya Protocol and ABS, and these can be difficult for gardens to understand and comply with. Her article is an extremely useful summary of what is covered by the Nagoya Protocol, what isn't and where there is still uncertainty. It also provides a useful summary of what botanic gardens should do to ensure basic ABS implementation (p.17).

On pages 18-21, Suzanne Sharrock and Kate Davis present an overview of a Darwin Initiative project led by BGCI in Ethiopia that aimed to identify and address bottlenecks and capacity gaps related to ABS and the use of plant resources in non-commercial research in Ethiopia. Although project participants from institutions holding *ex situ* botanical collections had a good general knowledge of Ethiopian laws and regulations relating to ABS, some parts of the process did not work well, including, reporting back the results of research, tracking material and data management.

Documentation and tracking of material used in research is the focus of an excellent article by the team at the Botanic Garden and Botanical Museum in Berlin (pages 22-25), who closely follow the best practice guidelines developed by CETAF, IPEN and GGBN (see Box 1 on page 17). BGBM shares useful learning experiences from its long involvement with these initiatives, including integrated data management for different kinds of genetic material, development of a common Collection Data Format tool, and the digitisation and management of all formal compliance documentation. Another example of a northern garden following ABS best practice comes from Oxford Botanic Garden (pages 33-36). This case study includes managing interactions with third party suppliers who are non-compliant.

Given the amount of time, money and effort that goes into ABS implementation, working collectively within national networks is a good idea. In this spirit, the Mexican Association of Botanic Gardens has developed a code of conduct to support ABS implementation by its member gardens (pages 26-29). This code of conduct, described on page 28, includes a compendium of good practice examples of ABS implementation by Mexican gardens, which are also outlined in this article.

An important, and often challenging, component of the Nagoya Protocol is working collaboratively with indigenous communities, ensuring that their traditional knowledge is acknowledged and respected, and ensuring that they share any benefits arising from the work. An excellent case study is presented by Montreal Botanic Garden (MBG) on pages 30-32. The thing that strikes me most about MBG's work with the Cree community, is how Cree elders have put the common good above their personal interests. If only this were true of broader society!

Last, but definitely not least, if ABS and the Nagoya Protocol is not really your thing then we have plenty in our regular features to keep you entertained. These include News from BGCI (pages 4-6); a plant-hunting tale from China, which includes an exciting re-discovery (pages 7-9); our featured garden from Ethiopia (pages 10-11), and; an interview with the wonderful Professor Sebsebe Demissew, Director of Gullele – our featured garden - in Addis Ababa (page 12).

I hope that you enjoy this edition of *BGjournal*. If you have any comments you would like to make, I encourage you to email us at info@bgci.org. We would also like to hear from you with suggestions and ideas about future editions of the journal.

Dr Paul Smith
BGCI Secretary General

FEATURES

NEWS FROM BGCI

PLANT HUNTING TALES:
PROTECTING *SALVIA* IN CHINA

FEATURED GARDEN:
GULLELE BOTANIC GARDEN, ADDIS ABABA, ETHIOPIA

TALKING PLANTS: INTERVIEW WITH SEBSEBE DEMISSEW

NEWS FROM BGCI

BGCI'S EDUCATION CONGRESS

The 10th International Congress on Education in Botanic Gardens took place at the University of Warsaw Botanic Garden from 9-14 September 2018. The theme of the Congress was "Bringing nature to the city" and coincided with the 200th anniversary of the University of Warsaw Botanic Garden.

The event was a great success with around 300 registered delegates from 50 countries. The week saw 65 posters and 65 sessions presented focusing on the congress' themes: City Gardens, New Educational Tools, Working Together, Supporting Formal Education, Reaching New Audiences, Measuring Impact and Education in Polish Botanic Gardens.

MARSH AWARDS

The winners of the Marsh awards for international plant conservation and education in botanic gardens 2018 were announced at the Education Congress. The winners were:

Christian Torres-Santana from Arboreto Parque Doña Inés was awarded the Marsh Award for International Plant Conservation 2018. He was nominated by Marcos Caraballo for his work in conserving the flora of Puerto Rico.

Clemmie Borgstein from the Kawasan Wisata Pendidikan Lingkungan Hidup (KWPLH) environmental education centre in Indonesia was awarded the Marsh Award for Education in Botanic Gardens 2018. She was nominated by Gabriella Fredriksson for her work in planning and constructing an ethnobotanical garden based on medicinal plant use in East Kalimantan, Borneo.

Congratulations to both winners for their exceptional work.

GLOBAL STRATEGY FOR PLANT CONSERVATION

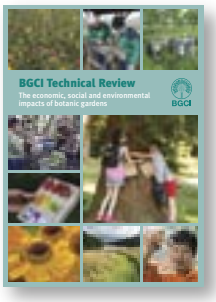
A conference of the Global Partnership for Plant Conservation (GPPC) was held from 28-30 August in Cape Town, South Africa, hosted by the South African National Biodiversity Institute (SANBI), in association with the Secretariat of the Convention on Biological Diversity (CBD) and BGCI. The conference, entitled '*Supporting the worldwide implementation of the Global Strategy for Plant Conservation*' was attended by over 120 participants from 35 countries. The programme included 42 oral presentations and 6 parallel workshops, as well as 21 poster presentations. Oral presentations provided information on GSPC implementation at the national level

as well as reports on progress towards individual targets at the global level. The parallel workshops provided opportunities for discussion around specific targets and issues related to the GSPC. A report of the workshop is available for download at: www.plants2020.net/global-implementation/

A meeting of the GSPC Liaison Group was convened by the CBD Secretariat on 31 August in Cape Town, following the GPPC meeting. This group discussed the future of the GSPC post-2020 and made recommendations for the continued inclusion of specific plant conservation targets and milestones in the CBD's post-2020 biodiversity framework.

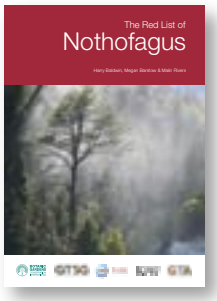
ERA SYMPOSIUM

The 4th public symposium and annual meeting of the Ecological Restoration Alliance of Botanic Gardens was held from 3-5 October in Ontario, Canada. Hosted by Royal Botanical Gardens, the symposium, which had the theme '*Ecological Restoration in Urban Areas*', attracted 100 participants. It was co-hosted by SER Ontario chapter and had 10 presentations from ERA representatives about the restoration work they are doing around the world. Presentations from the symposium will be posted on the ERA website (www.erabg.org).



BGCI'S SECOND TECHNICAL REVIEW

As part of our work as an advocate for botanic gardens, BGCI produced a **Technical Review on the Economic, Social and Environmental Impacts of Botanic Gardens**. This study includes 28 case studies of the impacts of the work of botanic gardens in these areas, demonstrating excellent return on investment for funders of the institutions concerned. We hope that such studies can be replicated by other gardens seeking to demonstrate that they are good value for money. The Technical Review can be downloaded at: www.bgci.org/news-and-events/news/1505/



RED LISTING TOWARDS THE GLOBAL TREE ASSESSMENT

BGCI continued to make impressive progress in tree red listing during 2018. During the year, BGCI and Global Tree Assessment partners submitted over 5,300 species conservation assessments to the IUCN Red List, and over 820 have already been published online. Key projects implemented during the year included red listing national endemics of Brazil, Madagascar, Malaysia and Indonesia, as well as important taxonomic groups such as Annonaceae, Sapotaceae, *Eucalyptus* and *Nothofagus*.

In November, a week-long red list training and assessment course took place in Nassau at the Bahamas National Trust. This training was run by BGCI and the Leon Levy Native Plant Preserve. There were over 20 participants from across the Caribbean region and the workshop included training in the IUCN Red List Categories and Criteria, GIS mapping and discussions on the next steps to achieve the Global Tree Assessment in the region.

GLOBAL SEED CONSERVATION CHALLENGE – VIDEO COMPETITION

Throughout 2018 BGCI has been collecting seed conservation resources including videos from our members. Carlos Thays Botanic Garden, Argentina won the prize for the best video submitted during the year. Their prize was free registration to BGCI's Education Congress. The seed conservation videos, as well as a series of advanced seed conservation modules, can be seen at: www.bgci.org/plant-conservation/seedconservation/.

CONSERVATION OF FAGACEAE IN INDOCHINA

A training workshop focusing on the integrated conservation of rare Fagaceae species was held at Pha Tad Ke Botanical Garden (PTK) in Laos in September. The workshop, co-organized by BGCI, The Morton Arboretum, FFI and PTK was attended by 15 participants from botanic gardens and research institutions from 5 Southeast Asian Countries. During the workshop participants gained valuable knowledge in key characteristics for identification of Fagaceae specimens to genus level and names were confirmed or added to over 100 specimens from the region.

Participants also received training in the IUCN Red List Process and completed or reviewed over 90 Fagaceae and other tree species, making a valuable regional contribution to the Global Tree Assessment.

LEARNTOENGAGE

LearnToEngage is a suite of professional development modules for botanic garden staff and museum educators in the UK, Portugal and Italy. In addition to the modules run in 2018 a module on Interpretation was developed and run in 2017 and, in 2019, a further module will be developed for Evaluation and Research.

As part of the outputs of the project, participant and tutor handbooks are being developed to support other organisations to deliver similar training. Currently handbooks related to the "Interpretation" and "Working with Diverse Audiences" modules can be found on the LearnToEngage website: www.learntoengage.eu/en/more/intellectual-outputs

Magnolia pallescens (Scott Zona)

DEVELOPING A CONSERVATION ACTION PLAN FOR THE DOMINICAN REPUBLIC'S THREATENED MAGNOLIAS

The Dominican Republic's cloud forest magnolias – *Magnolia domingensis* (CR), *M. hamorii* (EN) and *M. pallescens* (EN) are at risk of extinction, primarily as a result of indiscriminate felling for timber exploitation, forest fires and construction, as well as conversion of native forests to land for agriculture and livestock grazing. To address these threats, BGCI has been collaborating with Fundación PROGESSIO, an NGO working for conservation and sustainable development, and Jardín Botánico Nacional Dr. Rafael M. Moscoso in Santo Domingo, to develop an integrated conservation plan for the three magnolias. Based on extensive field surveys to establish the species' distribution, the action plan was successfully prepared and launched at a public event at the National Botanic Garden on 11 December 2018, attended by over 40 participants. Practical *ex* and *in situ* conservation action is already underway and BGCI will continue to support the conservation work in 2019.

Magnolia domingensis

BGCI ACCREDITATION SCHEME

BGCI's Accreditation Scheme distinguishes botanic gardens from non-botanic gardens and recognises achievements in plant conservation.

BGCI Botanic Garden Accreditation is aimed at botanical institutions wishing to establish their credentials as botanic gardens. Organisations applying for accreditation will be assessed on criteria encompassing leadership, collections management, horticulture, public education, community/cultural activities, conservation actions, scientific research, staff, networking and sustainability.

BGCI Conservation Practitioner Accreditation recognises botanic gardens with a conservation-oriented approach. **BGCI Advanced Conservation Practitioner Accreditation** recognises botanic gardens with a focus on conservation actions that support local, national or global conservation goals. Institutions may apply for more than one accreditation.

BGCI Botanic Garden accreditation is open to BGCI members and non-members. For BGCI members there is no charge. For non-members a fee of US$65 is required to cover administration costs. BGCI's Conservation Practitioner accreditation is only open to BGCI members, and there is no fee. Advanced Conservation Practitioner Accreditation is only open to BGCI members and a fee, to be determined at a later date, will be charged for a BGCI Conservation Assessment on a cost recovery basis.

Botanic gardens that achieve any of the three accreditations will be recognised by BGCI in later issues of *BGjournal*. Find out more at: www.bgci.org/accreditation

The following botanic gardens achieved BGCI Botanic Garden Accreditation since the last issue of *BGjournal*:

Botanic Garden of the Natural History Museum of Denmark, Denmark
Ghent University Botanic Garden, Belgium
Jardín Botánico Carlos Thays, Argentina
National Botanic Garden of Wales, United Kingdom
Oklahoma City Zoo and Botanical Garden, USA

The following botanic gardens achieved BGCI Conservation Practitioner Accreditation since the last issue of *BGjournal*:

Denver Botanic Gardens, United States
The Eden Project, United Kingdom
Ghent University Botanic Garden, Belgium
Hortis Botanicus Leiden, Netherlands
Huntington Library, Art Collections and Botanical Gardens, United States
Jardin Botánico de la Universidad Autonoma de Puebla, Mexico
Montgomery Botanical Center, United States
National Botanic Garden of Wales, United Kingdom
North Carolina Botanical Garden, United States
University Botanic Gardens Ljubljana, Slovenia
Stellenbosch University Botanical Garden, South Africa
Wollongong Botanic Garden, Australia

Authors: Yukun wei, Colin A. Pendry and Binjie Ge

PLANT HUNTING TALES

PROTECTING *SALVIA* IN CHINA: THE NEED FOR COMPREHENSIVE COLLECTION AND CONSERVATION PROGRAMMES

Salvia *species are well adapted to the hot, dry climate of valleys in the Hengduan Mountains (Yanbo Huang)*

Introduction

Mt. Yulong (also known as Yulong Snow Mountain and Jade Dragon Snow Mountain) is located in the southern part of the Hengduan Mountains, the southeastern extension of the Qinghai-Tibet Plateau/Himalayas. Mt. Yulong is the lowest latitude mountain in China which maintains permanent snow cover, and one of the lowest latitude such mountains in Eurasia. It has been designated as a provincial Nature Reserve and National Scenic Area. We have been studying the species of *Salvia* (family Lamiaceae), a key group for the area's ecology since 2010, surveying populations, collecting live plants for cultivation and reintroduction, and studying pollination. We believe that comprehensive conservation measures are much needed in order to protect these species and their genetic diversity.

Key species

Over 80 species of the genus *Salvia* are found in China, among which 70 are native to China and 44 are found in the Hengduan Mountains. Eleven *Salvia* species have asympatric distribution patterns in the core area of Mt. Yulong and they occupy a range of habitats from meadows and abandoned fields, to forest margins and understorey. In some conditions, *Salvia* species are dominant or flagship species, and therefore they have a particularly important role in Mt. Yulong's ecosystem. There is high diversity of *Salvia* at the species and genetic level, and reproductive isolation is maintained in various ways including differences in elevational ranges, phenology and pollinator groups. *Salvia* is an excellent study group for examining the ecology of alpine ecosystems and the processes of species diversification within these areas, and these studies can inform a comprehensive conservation strategy for their protection.

Conservation of Salvia *spp. (Yanbo Huang)*

The Hengduan Mountains (Yanbo Huang)

Pollinators and their networks

Complex plant-pollinator networks maintain the stability of plant communities and ecosystems. The genus *Salvia* has a flower structure that is highly adapted to animal pollination. The repeated lever movement of the stamen ensures the gradual and complete release of pollen from the pollen sac, increasing male fitness and the out-crossing rate. The precision of this pollination process also leads to the reproductive isolation of species and the coexistence of sympatric species, and is a key trait for adaptive radiation. It is almost certain that reproductive isolation in *Salvia* is a primarily prezygotic mechanism. The genetic distance between species is therefore small and hybrid offspring could be generated by artificial fertilization. Our observations over three successive years (2014-2016) revealed that the pollinators of *S. castanea* varied according to weather conditions. Furthermore, we found that *S. castanea* and the sympatric species *S. aerea* have similar pollinators and maintain their reproductive isolation by the phenology of their flowering. These results imply that minute environmental perturbations resulting from climate change or human interference have the potential to induce large changes in plant-pollinator interactions, and further affect ecosystem stability.

Climate change

Global climate change has the potential to affect many aspects of ecology and species distributions, especially for low latitude alpine regions, which will experience the greatest impacts beyond the polar regions. Firstly, global warming causes elevation of the snow line on Mt. Yulong which will have effects on soil water content, local temperatures, micro habitats and community structure etc., influencing plant-plant and plant-animal relationships, especially for pollinators. Secondly, changes in seasonality may bring forward or postpone flowering times, further impacting pollinator-plant relationships. Such changes could reduce reproductive isolation, promoting the emergence of hybrids or even the loss of species.

Salvia *pollinators (Yanbo Huang)*

Human interference

Lijiang is one of China's tourist hotspots and every year it receives over 9,000,000 visitors. Mt. Yulong is a prominent scenic attraction and, if not properly managed, large numbers of visitors to the Nature Reserve and National Scenic Area could cause environmental degradation. Tourist trails allow increased access to sensitive habitats where human activities can pollute the environment and disturb its ecology, directly impacting biodiversity. Tourism development leads to wider regional changes, such as increasing urbanisation, expansion of agriculture into undeveloped forests, transformation of river systems etc. Such impacts can affect plant populations and their community structure, and ultimately change the whole ecosystem. Over-collection of plants for ethnic medicine is another cause of environmental degradation. For example, 7 *Salvia* species can be used either in their own right or as substitutes for *S. miltiorrhiza* (Danshen), a well-known Chinese medicine that is included in the Chinese Pharmacopoeia. These species have often been over collected by ethnic minorities, causing fluctuations in the numbers of mature individuals. These activities would further destabilize pollination networks.

Collection and conservation

Ex situ collection and conservation programmes can be effective approaches in response to the challenge of species extinction. We have extensively collected *Salvia* species from populations on Mt. Yulong and successfully introduced them into cultivation at Shanghai Chenshan Botanical Garden (CSBG) and Kunming Botanical Garden (KUN). First, we study the *Salvia* populations as much as possible across the entire reserve, acquiring complete information about plant distribution and populations. This is a basis for drafting a collection and introduction strategy. Secondly, we survey how the *Salvias* are performing over time, and introduce new seedlings to increase survival *in situ*. Special attention is given to those populations which grow in areas of intense anthropogenic interference or could be progenies of natural hybrids. Collections are made from at least 20 individual plants to ensure their genetic representativeness and diversity. In addition, pollinators of *Salvia* species have been collected and identified for further

research, and soil samples taken to generate more comprehensive data to inform future conservation activities. A nursery and germplasm bank has been built at CSBG for expanding propagation, cultivation and domestication work, and *ex situ* collections and a conservation nursery have been developed at KUN. Today, populations of all species of *Salvia* on Mt. Yulong are being conserved at the two botanical gardens where they are being studied systematically and their phenology recorded.

Collecting stories

Field rediscovery of the biggest Chinese *Salvia - S. grandifolia* W. W. Smith

Salvia grandifolia was first collected by George Forrest in Sept. 1913 from NE of the Yangtze bend, Yunnan. This species is distinguished from its Chinese allies by its height of 1.5 m, its huge leaves and broad, much-branched inflorescence. In recognition of these characters, Smith W.W. named this species '*Salvia grandifolia*' in 1916. Only a single specimen has been found since 1959 and we have been unable to acquire any up-to-date information about the conditions in which this species grows. During our collecting trip in May 2016 we were excited to rediscover this remarkable plant, but we were very concerned to see that its habitat is extremely vulnerable to human interference. *Salvia grandifolia* grows on sunny slopes in cultivated land or along country roads, and is clearly well adapted to the hot, dry climate of valleys in the Hengduan Mountains. Although we found the remains of a dried inflorescence, no seeds were present. However, numerous seedlings were growing in its vicinity and we were able to bring several back to our nursery where they are now growing strongly. This Chinese endemic species has now been successfully introduced into cultivation at Shanghai Chenshan Botanical Garden (CSBG), and we will be able to propagate it by artificial pollination to further augment its numbers. This will enable us to further study this amazing species and gain new insights into its conservation. However, our most urgent concern is how to protect the wild populations of *S. grandifolia* from human interference and environmental disruption.

Salvia *flowers (Yanbo Huang)*

A new *Salvia* species, rare valuable germplasm

In China, karst regions are hotspots of biodiversity and are a particular focus of our collection programme. In one trip in October 2011 to Zhangjiajie, a well-known National Geological Park, we were greatly helped by Zhang Daigui, an experienced plant hunter who helped us learn more about the *Salvia* species of this mysterious area. One day we collected a *Salvia* plant which was found along stream-sides, growing in cracks in the rocks, and apparently well adapted to intermittent floods. It was initially identified as *Salvia cavaleriei* Levl., but further investigations in the field and comparison with herbarium material of *S. cavaleriei* and the morphologically similar *S. prionitis* Hance have demonstrated that this collection represented a new species which we are naming *S. daiguii* Y.K. Wei & Y.B. Huang in honour of Mr Daigui. We made extensive searches of the area during 2011, 2012, and 2015, but found that this species only exists at two separate locations, with each population comprising about two hundred mature individuals in an area of 2 km^2 and subject to extreme fluctuations in numbers from year to year. The habitat is vulnerable to degradation caused by increasing tourism and human disturbance. We therefore classify *Salvia daiguiias* 'Critically Endangered' (CR) according to IUCN guidelines and suggest that immediate measures should be taken to ensure the long-term survival of this species in its natural habitat.*Salvia daiguii* is clearly adapted to a wide range of environmental stresses in its natural habitat, and plants growing at the Chenshan nursery are tolerant of high temperatures, drought, salinity and acid rain. Although we were not able to obtain many seeds in the field, asexual reproduction is very easy and a large population has been established in the nursery. We have begun experiments in artificial hybridization using *S. daiguii* to see if some of its qualities can be transferred to other species.

Conclusion

Alpine ecosystems, with their many endemic or narrowly distributed species, are particularly sensitive to climate change and human interference. Therefore, increased emphasis on *in situ* conservation and integrated protection approaches should be considered, including maintenance of species diversity and pollination systems, protection of habitats and ecosystems, reduction of human interference such as controlling the number of tourists and their behaviors, prohibiting the use of virgin forest for cultivation and reducing the collection of medicinal plants from Nature Reserves. Collection, introduction and *ex situ* conservation aim to maintain stable populations that can be used for research and education and are protected from environmental fluctuations. International cooperation for capacity building is important, and conservation experts from world-class botanic gardens can contribute to the training of local people to maximize income from plant resources while minimizing impacts on wild populations, in line with sustainable development goals.

Author: Suzanne Sharrock

FEATURED GARDEN
GULLELE BOTANIC GARDEN, ADDIS ABABA, ETHIOPIA

The first botanic garden in Ethiopia

The Gullele Botanic Garden was the first botanic garden to be developed in Ethiopia, being officially established in Addis Ababa in 2009, following several years of effort on the part of the Addis Ababa City Government in joint collaboration with Addis Ababa University. The garden was established on a 705 hectare plot, most of which was planted with eucalyptus trees, located on the outskirts of the rapidly expanding city.

Initial activities at the garden focused on developing the basic infrastructure and clearing the eucalyptus trees from part of the site to allow the native vegetation, which is dominated by *Juniperus procera* (Abyssinian cedar) to re-establish.

Building access roads and an 8 km jogging track were among the first construction projects undertaken by the garden, together with the development of a nursery and associated installation of a greenhouse to support the propagation and conservation work of the garden. A visitor centre, in the form of a traditional house has been completed, and work is ongoing to construct a complex of further amenities, including providing space for local retail outlets, restaurants and educational facilities. The installation of irrigation systems and terracing of the garden has also been completed in some areas to support the planting of a series of thematic and conservation gardens.

Education programmes are offered to students from various levels (Elementary, High School and University) on a regular basis. Over 15,000 students visit the garden annually and participate in a range of activities. Programmes include modules such as “Plants and People” where students learn about the uses of indigenous plants for many everyday products. The medicinal, ecological, aesthetic and economic importance of Ethiopian plants are discussed as well as issues around sustainable use and the importance of conserving indigenous knowledge of plants and their uses. Other courses address topics such as *Plants and Climate Change; Habitats and Adaptations, Plant Taxonomy* and *Plant Reproduction and Propagation*.

Teaching sustainable gardening and landscape design at Gullele Botanic Garden

This programme aims to provide trainees with the knowledge, awareness and skills for planning, designing and establishing eco-friendly appropriate plant nurseries and sustainable gardening. Learners become familiar with a variety of techniques related to sustainable landscaping, including: garden types; garden features; horticultural techniques; sustainable landscape/garden design; site selection; garden development and maintenance; organic gardening and the use of native plants for gardening. It also includes: sustainable nursery establishment and management; using appropriate plants; managing soils; managing waste; proper use of water; how to protect, restore and enhance landscapes to provide ecosystem services that benefit humans and other organisms; understanding the use of 'green' ecologically sensitive design, construction and maintenance techniques and promotes a variety of innovative methods to apply and promote sustainable design.

BGCI - accredited garden

In 2018, Gullele Botanic Garden was amongst the first botanic gardens to be accredited by BGCI. Accreditation allows botanic gardens to be distinguished from non-botanic gardens and recognises achievements in plant conservation. The scheme aims to raise awareness and recognition of the activities that botanic gardens do exceptionally well to policymakers and funders.

"The accreditation of the Gullele Botanic Garden creates an opportunity to introduce ourselves to the family of botanic gardens worldwide and develop partnerships with other BGCI members. It allows us to contribute our share to the conservation of plants in botanic gardens for the sustainable future for ourselves and for our children both nationally and globally,"
Prof. Sebsebe Demissew, Executive Director of Gullele Botanic Garden.

Plant collections

Ethiopia has a very diverse topography, ranging from 4,620 MASL to the world's lowest point at Dalol Depression, and includes a broad spectrum of climatic zones, from desert to frost, making it home to a very diverse flora and fauna. The flora of Ethiopia consists of about 6,000 plant species, and Gullele Botanic Garden has a strong focus on display and conservation of these native species. It's plant collections currently include around 1,000 such species. The focus on native and threatened species means that even in this early stage of its development, the garden already includes 60 species which are found in no other botanic garden collection worldwide and 29 species that are threatened in the wild.

Bidens prestinaria

Working with local medicinal healers

Eighty percent of the population of Ethiopia is dependent on traditional medicine. As a result, a number of medicinal plants are now under threat through over-collection in the wild. Gullele Botanic Garden is playing an active role in conserving these species.

Display areas have been developed within the garden where plants are grown together based on various categories. These include evolutionary relationships between species and agro-ecological zones across Ethiopia. Of particular importance in this context is the medicinal plant garden, which has been developed in collaboration with 24 key traditional healers living in and around Addis Ababa.

The strong relationships and trust that has been developed between the garden and the traditional healers, means that the garden now knows which species are most in demand. By cultivating and multiplying the species the healers use regularly and supplying plants back to the traditional healers, there is less need for the healers to collect these plants directly from the wild.

Furthermore, as well as conserving and cultivating medicinal plant species in its collections, Gullele is also playing an important role in documenting the traditional knowledge related to the use of these plants. Following the signing of a specific memorandum of understanding, the traditional healers are now prepared to share their accumulated knowledge on medicinal plants. Through discussion and documentation, their knowledge on the use, preparation and administration of medicinal plants can be passed on to future generations.

TALKING PLANTS

For this issue of BGjournal, we interviewed **Sebsebe Demissew**, Professor of Plant Systematics and Biodiversity at Addis Ababa University and Executive Director of the Gullele Botanic Garden in Addis Ababa, Ethiopia. In 2016, Sebsebe was awarded the Kew International Medal[1], and in 2018 he was elected a Foreign Member of the Royal Society for "outstanding contributions to research and innovation".

We know that you are a renowned botanist and expert in the flora of Ethiopia and Eritrea, but can you tell us what first stimulated your interest in botany?

Due to my upbringing in the countryside in the highlands in central part of Ethiopia, I developed an interest in natural resources and a knowledge of the local flora and fauna. My interest in botany was deepened when, in 1974, I was assigned by the Military Government as a student campaigner to the Gambella region in western Ethiopia bordering South Sudan. Here the vegetation type was different from the highland areas where I grew up. Appreciating the uniqueness of the vegetation in the different parts of the country stimulated me to pursue my interest in botany.

You have worked on so many different plants over the course of your career. I wonder if you have an absolute favourite plant – and if so, why is it your favourite?

Among the various groups of plants that I have worked with, my favourite plant group is the aloe. This is due to the fact that the genus *Aloe* is represented by over 45 species in Ethiopia with 80% of endemics; occupying different landscapes from lowlands (300 masl) to Afroalpine areas (ca. 3,700 masl) and habit varying from stemless to with stems over 2 m long and the beautiful flower colours ranging from pink to yellow to orange.

As well as studying the flora of Ethiopia and Eritrea, your work has taken you to many countries around the world – which have you found most interesting and why?

I find the flora of South Africa as the most interesting. The Cape Region in South Africa is one of the richest and most diverse floristic regions in in Africa with unique endemics. What intrigued me most was, despite the unique flora in the Cape Region, I was able to see some species that occur both in Ethiopia and in the Cape Region such as *Podocarpus falcatus* to mention one.

You have recently taken over as Director of the Gullele Botanic Garden in Addis Ababa. How do you see the garden developing in the future and what role do you think it should play in relation to the rapidly growing city of Addis?

Gullele Botanic Garden is the first botanic garden established in Ethiopia in the North-western part of Ethiopia on 750 ha. When it was established, most of the garden was covered by eucalypt plantations. Over the years there has been a successful removal of the eucalypt and currently about 420 ha is now covered by indigenous species mainly *Juniperus procera* (Abyssinian cedar).

The garden includes research, conservation, education and eco-tourism as its core mission. Addis Ababa being not only the Capital City of Ethiopia, but the seat of the African Union. The garden is ready to serve about 5 million residents and visitors to the city to enjoy the beauty of the Garden and its ecosystem services (such as fresh air).

There are presently very few botanic gardens in Ethiopia, but I know there are plans to establish more. How do you think botanic gardens can help support growth in a rapidly developing country such as Ethiopia?

The Gullele Botanic Garden is ready to provide guidance to the new gardens being established and to be established in the future from the experience gained by the garden. We would like to share with the new gardens to avoid mistakes and benefit from our successful experiences.

Aloe elegans *(Sebsebe Demissew)*

[1]The Kew International Medal is an annual award given to individuals for distinguished, internationally recognised work aligned with the mission of the Royal Botanic Gardens, Kew: to be the global resource for plant and fungal knowledge, building an understanding of the world's plants and fungi upon which all our lives depend.

ARTICLES

Barney Wilczak

Author: Kate Davis

ACCESS AND BENEFIT SHARING – WHAT IS IT AND HOW ARE BOTANIC GARDENS RESPONDING?

Barney Wilczak

Introduction

Much of the conservation and research work of botanic gardens relies on the acquisition and exchange of plant species. Whether it be collecting plants from the wild for identification and taxonomic purposes, or exchanging materials with other gardens as part of collaborative research projects, the movement of plant material is a key activity for many gardens.

However, in recent years, acquiring and sharing plants has become increasingly complicated. Multiple concerns and issues, from plant and human health to overexploitation to invasive species, have resulted in a raft of international and national laws, regulations and other measures that gardens must follow to keep their activities on track and their relationships and reputations in good standing.

One of the societal concerns arising in the last thirty years has been that of misappropriation, or 'biopiracy': the situation when biological resources are illegally taken and used (generally for profit, perhaps involving intellectual property rights such as patents) without permission of or benefit to the countries or communities where they originated.

This concern is linked to the paradigm shift in the 1980s towards recognising the sovereign rights of countries to control and exploit their own natural resources, but also the common concerns countries share regarding biodiversity conservation and climate change.

Fair sharing to support biodiversity conservation and sustainable use

Recognising that biodiversity, financial wealth and scientific capacity are distributed unequally among countries, the third objective of the 1992 Convention on Biological Diversity (CBD) is benefit-sharing. The fair and equitable sharing of benefits that arise from utilisation of genetic resources is intended to provide an incentive for biodiversity conservation and sustainable use, the CBD's first and second objectives.

The CBD recognises the sovereign right of each country to decide who may 'access' its genetic resources, and how; unless a country decides otherwise, access should be with the country's 'prior informed consent' (PIC). Users of genetic resources are expected to share the benefits from use (monetary and/or non-monetary) fairly and equitably, as mutually agreed with the provider.

This whole arrangement is termed 'access and benefit-sharing' (ABS).

Countries have taken diverse approaches to ABS: government structures vary, as does the recognition of the rights and roles of Indigenous peoples, local communities and private landowners, so obtaining PIC may involve very different processes and people in different countries. Countries also interpret key ABS terms such as 'access' and 'genetic resources' differently[1]. Many are now updating their ABS laws and policies to comply with the new Nagoya Protocol, a supplementary, legally binding agreement under the CBD.

The Nagoya Protocol: a short overview

The *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization* provides an international framework to clarify access procedures and help countries to ensure that users are complying with such procedures and their obligations to share benefits. It was adopted by the Parties to the CBD in October 2010 and entered into force on 12 October 2014. To date, 114 countries are, or are about to become, Parties to the Protocol.

The Protocol advances the CBD's third objective by providing a strong basis for greater legal certainty and transparency for both providers and users of genetic resources. It applies to:

- Genetic resources within the scope of Article 15 of the CBD[2];
- Traditional knowledge (TK) associated with those genetic resources;
- Benefits arising from the utilisation of genetic resources and associated TK.

Benefit-sharing is triggered by 'utilisation of genetic resources', defined as conducting research and development on the genetic and/or biochemical composition of genetic resources. The Protocol does not apply to commodity uses – for example it is not relevant to a fruit sold for eating, but might be relevant when a fruit is acquired for biochemical research on its tissues. Neither the CBD nor the Protocol covers human genetic resources, or biological resources outside national jurisdiction (e.g. in the high seas).

In addition, the Protocol does not apply when another specialised ABS instrument 'that is consistent with and does not run counter to the objectives' of the CBD and the Protocol would apply. Countries are currently fiercely debating how this is decided, but most agree the Protocol should not apply to genetic resources from a species listed on Annex 1 of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) when, and only when, they are being used for food or agriculture purposes by a user in a Party to the ITPGRFA[3].

The Nagoya Protocol is much clearer than the CBD about the rights of Indigenous peoples and local communities to grant access to (with PIC or approval and involvement), and share benefits from use of, the traditional knowledge and genetic resources they hold, although such rights may be affected by countries' domestic laws.

The Protocol requires Parties to designate National Focal Points (to provide information on ABS measures), Competent National Authorities (to grant access, or issue evidence that access requirements have been met) and checkpoints (to receive information relevant to monitoring the utilisation of resources). It establishes the ABS Clearing House[4], which shares information on national ABS measures and authorities, plays a central role in monitoring utilisation of genetic resources (see below) and provides a platform for general information exchange on ABS actions and resources.

The basics of the Nagoya Protocol are frequently summarised as 'the ABCs of ABS':

A for access
Parties to the Protocol decide whether or not to require PIC for access to genetic resources within their national boundaries (this is also the case for CBD Parties that are not Nagoya Parties). Those that do require PIC must develop measures to provide for legal certainty and transparency of access processes and decisions. For example, they must provide information on how to obtain PIC, and must issue a permit or equivalent as evidence of the decision to grant consent and the establishment of 'mutually agreed terms' (MAT).

Because much biodiversity research underpins conservation and sustainable use, the Protocol also requires countries to develop simplified access measures for non-commercial research – but it flags the need to address any change of intent if the research moves towards commercial purposes.

B for benefit-sharing
Benefits arising from the utilisation of genetic resources as well as subsequent applications and commercialisation are to be shared:

- fairly and equitably with the provider Party (the country where plants are accessed);
- according to MAT, set out in writing (essentially a contract);
- and with Indigenous peoples and local communities where appropriate.

An indicative list of some benefits is provided in an annex to the Protocol; non-monetary examples include sharing of research results, collaboration, training and capacity building. The Protocol follows the CBD's bilateral user-provider approach, but also creates space for consideration of a global multilateral benefit-sharing mechanism to enable benefits to be shared when it has not been possible to grant or obtain PIC.

If Parties agree (they are currently debating), such a mechanism might eventually harness and share some benefits arising from utilisation of transboundary resources or older, pre-CBD specimens.

C for compliance
Compliance by users of genetic resources is at the core of the Nagoya Protocol. Parties to the Protocol must introduce measures at a national level:

- to ensure genetic resources and associated traditional knowledge utilised within their jurisdiction have been legally accessed;
- to address situations of non-compliance with domestic laws;
- to ensure opportunities to seek legal recourse for disputes and access to justice regarding non-compliance with MAT (i.e. contract terms);
- to monitor utilisation, through designating one or more checkpoints to collect or receive information on PIC, MAT, the source of the genetic resources and/or utilisation.


Barney Wilczak

At the international level, the ABS Clearing-House generates an 'Internationally Recognised Certificate of Compliance' when a provider country submits its national access permit (or equivalent) to the system. These international certificates have trackable unique identifiers, which must accompany specimens as they are transferred from provider to user to user, and can be reported to user country checkpoints as proof of legal access, and back to provider country ABS authorities.

Different sectors vary in how they acquire and use genetic resources, and so different practical actions may be needed to address ABS. The Protocol acknowledges this by requiring its Parties to encourage the development of sectoral and cross-sectoral model contractual clauses and voluntary codes of conduct, guidelines and best practices and/or standards. The botanic gardens community has developed several such tools to guide ABS-compliant plant exchange and build trust with governments and partners, first as a response to the CBD and now to respond to the Nagoya Protocol (Box 1).

The Nagoya Protocol provides a more detailed framework for national actions, and adds compliance provisions to ensure countries' national laws will be respected even when genetic resources are used abroad. However, each country ultimately makes its own interpretations, decisions and laws. To date, many countries' ABS laws focus on access to their own resources, but increasingly some countries are now developing measures to address compliance with other countries' access laws, as the Protocol requires. Gardens in the European Union may already be aware of EU Regulation 511/2014, on compliance with the access laws of countries that are Parties to the Protocol, which requires people utilising certain genetic resources in EU Member States to ensure that the resources were legally acquired and to make declarations at certain stages of research or product development[5].

Practical ABS implementation by botanic gardens

Since the coming into force of the CBD and more recently the Nagoya Protocol, gardens have been facing the challenge of working in line with new, changing

and diverse ABS laws and regulations. In essence, to comply with all these instruments, botanic gardens need to acquire new material legally, do their part to comply with and keep track of any terms and conditions on the material, and share benefits from their use of material fairly and equitably with its providers.

For basic ABS implementation, a botanic garden should:

- Find out about national ABS measures and relevant stakeholders in the garden's country and in any other countries where it works;
- Where traditional communities are involved, find out about and adhere to relevant customary laws, codes of ethics and community protocols (including any regarding collection and dissemination of traditional knowledge), and in the absence of specific measures, follow ethical best practices;
- Develop an institutional ABS policy and/or adhere to a shared code of conduct (see Box 1), and address ABS in relevant workflows;
- Obtain PIC where necessary and establish MAT detailing how the material will be used at the garden (never assuming permits can be shared between institutions);
- Use written agreements to record PIC and MAT (e.g. permits, agreements, Internationally Recognised Certificates of Compliance, Material Transfer Agreements);
- Use and transfer material only as those terms allow (requesting new consent if the original terms do not cover a new use or new user);
- Train staff, associates and volunteers, and assign ABS responsibilities;
- Share benefits as agreed;
- Keep track of terms and, as far as possible, use, transfer and benefit-sharing, using a sound data management system.

By following such measures, botanic gardens can build the trust of governments, communities and other providers, and strengthen relationships for plant conservation.

The articles on the following pages of this journal provide some insights into how botanic gardens, individually and through their networks, are working ethically and collaboratively, following both the letter and the spirit of the Nagoya Protocol.

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Ottawa, Canada

Box 1: Botanic Gardens sectoral ABS tools

Botanic gardens were ahead of most other sectors in responding to ABS: soon after the CBD came into force, they started working out how their practices and partnerships might need to be adjusted. Key initiatives and guidance tools include:

The International Plant Exchange Network (IPEN) facilitates ABS-compliant non-commercial use and transfer of plant genetic resources by its members. To join IPEN, botanic gardens must sign and implement the IPEN Code of Conduct, a harmonised policy that clearly defines the rules for acquisition, maintenance and supply of plant genetic resources and benefit-sharing. IPEN was developed by European gardens and is well-suited to smaller gardens with few staff to handle policy and documentation. When acquiring new material from outside IPEN, an IPEN garden assigns to each accession an 'IPEN number' that encodes information on the country of origin and any restrictions, replacing the need for material transfer agreements (MTAs) within the network. For transfer of material in other circumstances (e.g. outside IPEN), IPEN gardens use the CETAF model MTAs for transfer (see below).

The Principles on Access to Genetic Resources and Benefit-Sharing were developed by an international group of 28 botanic gardens and herbaria from 21 countries to guide all aspects of botanical institutions' work related to accessing, using and exchanging material, and sharing benefits. An individual institution can use this one-page framework to design its own policy on the CBD, taking into account the particular work that the garden does, and the particular national laws that apply. The Principles have not been updated to reflect the Nagoya Protocol, but their guidance remains relevant and they were a major input for the development of the CETAF Code of Conduct.

The Consortium of European Taxonomic Facilities (CETAF) Code of Conduct and Best Practices provide post-Nagoya guidance that is particularly applicable to large gardens and museums conducting international work. Like the Principles, it emphasises the need for individual institutional policies, but provides in-depth guidance on policy development and workflow considerations including data management. The CETAF package also includes a model Statement of Use for institutions to describe their uses of material when seeking PIC, model MTAs and a data use statement. It was developed for use in the European context, to help CETAF member institutions comply with the EU Regulation on compliance, but has relevance for other institutions globally.

The Global Genome Biodiversity Network (GGBN), which includes several major botanic gardens, has also developed a Code of Conduct and Best Practices and suite of documents, developed in close collaboration with CETAF, but aimed at a more diverse set of institutions.

More information is available at www.bgci.org/policy/abs/, and practical examples of how gardens are using these tools and other trust-building measures are available at www.bgci.org/policy/abscasestudies/.

[1]Although all are likely to agree that 'genetic resources' include living plants, seeds, herbarium specimens, tissue cultures and DNA samples.

[2]I.e., genetic resources that have been provided by Parties that are the countries of origin of the resources or by Parties that acquired the resources in accordance with the CBD, with PIC (if required) and under MAT, since the coming into force of the CBD on 29 Dec. 1993 – note that some countries interpret 'access' to include use, so their laws may cover newer uses of old material.

[3]More information about the ITPGRFA is available here: http://www.fao.org/plant-treaty/en/

[4]The ABS Clearing House can be accessed at https://absch.cbd.int

[5]This is a simplification: more detail on what the Regulation does and does not cover is available from the guidance document: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016XC0827(01)&from=EN

Authors: Suzanne Sharrock and Kate Davis

PROMOTING THE ABS - COMPLIANT USE OF PLANT RESOURCES IN RESEARCH AND DEVELOPMENT

A Darwin Initiative Project implemented in Ethiopia by BGCI and the Ethiopian Biodiversity Institute

Introduction

Over recent decades, issues such as global environmental change, population growth and economic development have resulted in an increasing demand for plant resources, both for direct exploitation by local communities and also by scientists for research and development. Research and development often involves national or international collaboration and the movement of genetic resources between different in-country actors and facilities or from the country of origin to research laboratories in other countries.

The issues of accessing and utilising plant genetic material and associated traditional knowledge, as well as sharing the benefits from such utilisation (access to genetic resources and benefit sharing – ABS) are chiefly governed by the Convention on Biological Diversity and its Nagoya Protocol (NP), which operate on a bilateral basis between providers and users through individually negotiated contracts, and the International Treaty on Plant Genetic Resources of Food and Agriculture (ITPGRFA), which takes a multilateral approach.

Since 2006, Ethiopia has had a national ABS framework in place, with laws, policies and procedures to guide how Ethiopian plant resources and community knowledge can be accessed for research purposes. Of particular note is the current prohibition on export of endemic, economically important, or crop wild relative species for any research outside Ethiopia. Furthermore, other plant materials can only be exported from Ethiopia for research when that research cannot be conducted within Ethiopia.

At the time of project implementation, the national ABS law was in the process of being revised to comply with the NP. *Ex situ* collection holders, such as botanic gardens, are key players in the chain of custody of plant resources. They act as intermediaries, collecting plant materials from the wild, or from local communities, and supplying these materials to researchers and other users. In Ethiopia, there are a growing number of botanic gardens, but many of these have limited knowledge and understanding of ABS issues and their implementation in Ethiopia.

In 2016, BGCI and the Ethiopian Biodiversity Institute (EBI)[1], with funding from the UK's Darwin Initiative, initiated a project that aimed to identify and address current bottlenecks and capacity gaps related to ABS and the use of plant resources in non-commercial research in Ethiopia. In particular, the project aimed to build the capacity of plant collection holders to act as trusted intermediaries between the providers and users of plant resources.

Stakeholder consultations

In order to understand the current situation, as well as raise awareness of ABS issues, BGCI and EBI organised a series of stakeholder consultations involving *ex situ* collection holders and researchers. 89 individuals from *ex situ* collections and 72 researchers from a range of universities and research institutes participated in these consultations. The consultations also provided important opportunities for awareness-raising.

Each 2-day stakeholder consultation followed a similar format:

- Participants were asked to complete an initial questionnaire to assess their baseline level of knowledge, understanding of and attitudes towards ABS issues.
- Trainers from BGCI and EBI provided formal presentations on the NP, the ITPGRFA and the Ethiopian ABS framework. This was followed by a general question and answer session.
- Participants were divided into working groups for information gathering and exchange sessions – this formed the main part of the consultation.

- Before departing, all participants completed a post-consultation questionnaire to capture information from the working group sessions in a format suitable for analysis. This questionnaire also provided additional opportunities for participants to provide comments and input to the consultation.

Working groups

The participatory discussions in the working groups aimed to generate information about plant materials in collections and/or those used by researchers. Guided by the trainers, participants discussed the following topics:

- Stakeholders involved in the chains of custody and use of plant resources;
- Sources of plant material held in collections and used by researchers;
- Users of plant material supplied by collections;
- Uses and utilisation of plant materials;
- Experiences of working internationally and exporting plant material from Ethiopia using the current Ethiopian processes;
- Data management;
- Benefits received / shared, between providers, collections and users.

Discussing and sharing knowledge and insights in a participatory manner, working in small groups then sharing outcomes with the wider audience was a novel and enjoyable experience for many of the participants. It was considered to be a very useful approach, and one that EBI has now adopted for further consultations and workshops. The consultations also represented the first attempt in Ethiopia to gather baseline information on the *ex situ* collections in the country. Although the opinions expressed might have been tempered by the active participation of EBI in the discussions, there was no doubt that the researchers and collections personnel appreciated the opportunity to communicate directly and constructively with their EBI colleagues about processes that affect their research and collaborations.

Some results

Awareness and attitudes

The pre-consultation questionnaire revealed that many of the participants had a reasonable level of (self-assessed) awareness of the laws and regulations that govern access to and/or use of genetic resources from Ethiopia (Fig. 1).

There is also good support for current ABS processes both for carrying out research in Ethiopia (Fig. 2) and for exporting material for research outside the country (Fig. 3), but in general, there is a lack of internal ABS guidelines and policies for collection holders and researchers.

Ex situ collections

The discussions around the materials held by institutions with *ex situ* collections revealed that these institutions frequently hold plant material in a range of different forms – including living plants, seeds, herbarium specimens, ethnobotany specimens and plant extracts (Fig. 4). *Ex situ* collections include both native Ethiopian species and introduced species and material comes from a wide range of sources, including directly from the wild, from local communities, from markets and from other national and international collections.

The plants in collections are used for a range of purposes, including direct use in agriculture, forestry etc. as well as for research purposes (Fig. 5). In the majority of cases, research also includes collecting and investigating traditional knowledge of useful plant characteristics.

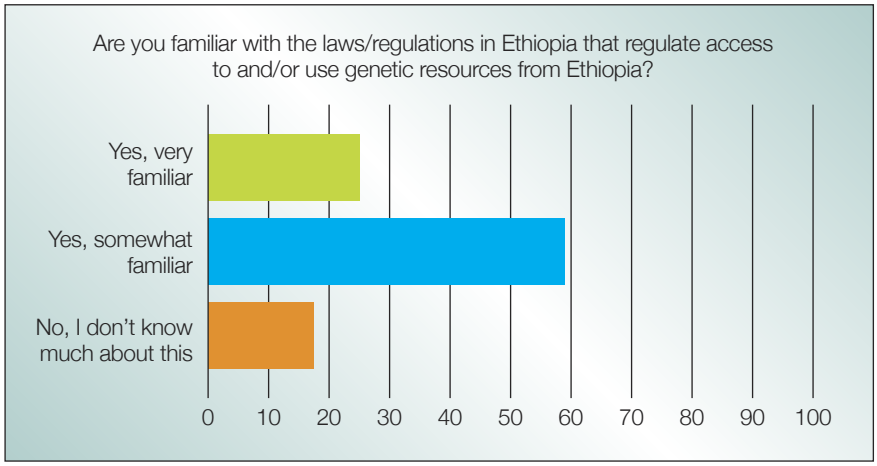

Fig. 1: Results from a pre-consultation questionnaire (N=53)

Ex situ collections supply plant material to many different users, including local communities, government agencies, NGOs, universities and the private sector. In the majority of cases, this supply is for users within Ethiopia, with few collections sending material overseas.

Research collaboration

The consultations revealed that there are significant levels of collaboration between researchers within and outside Ethiopia (Fig. 6) and some researchers are also working with the private sector, both nationally and internationally. Researchers shared encouraging information about the ABS awareness of their colleagues in foreign institutions, although they were also concerned about potential misuse.

The researchers involved in the consultations were familiar with the process for exporting plant materials for non-commercial research out of Ethiopia, although many of them admitted to not having reported their research results back to EBI, a key condition of the export agreement. Sharing research results is an important form of non-monetary benefit-sharing that would help to add scientific value to the EBI collections that researchers rely upon. A number of bottlenecks in the system were identified and potential solutions were discussed further with EBI.

Data management

When asked about the tools used to maintain records about plants in collections, including information about acquisition, use and supply of such material, the majority of participants reported that they use paper logbooks or Excel spreadsheets. Very few collections or researchers use databases to track the material they are working with. Indeed data management was identified as a key capacity gap for both collection holders and researchers.

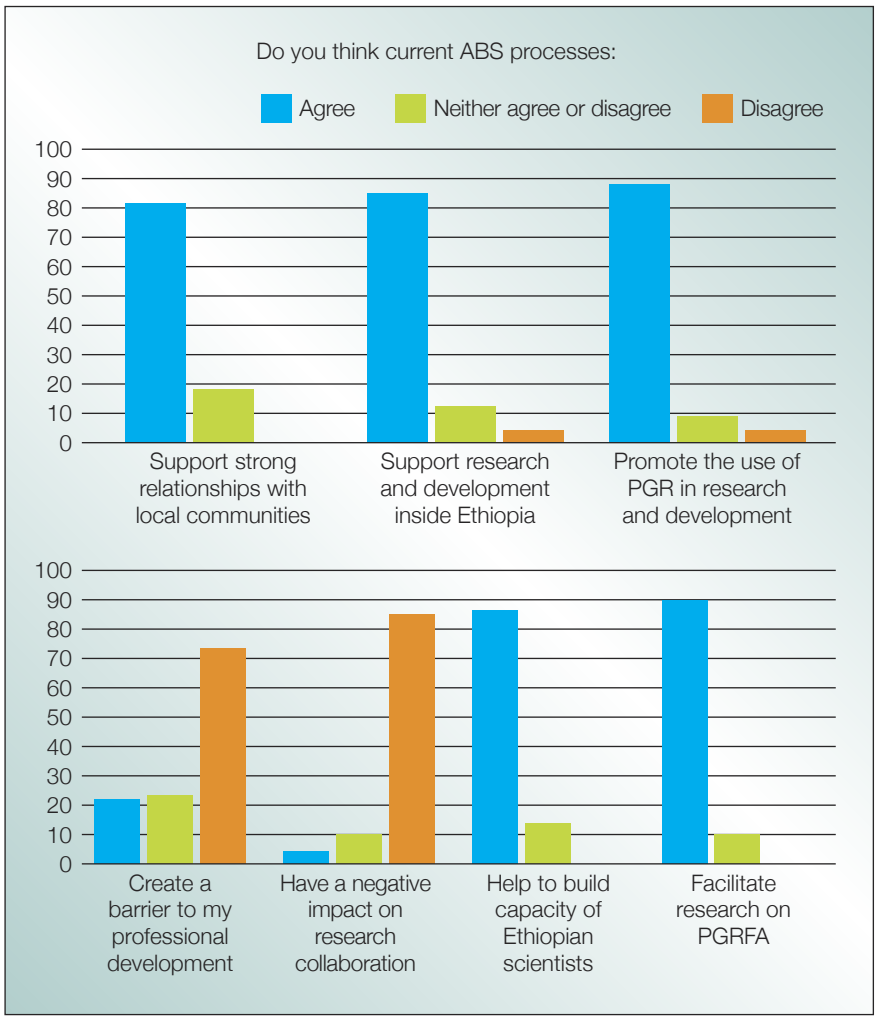

Fig. 2 and 3: Responses to the post-consultations questionnaire (answered on an institutional rather than an individual basis. N=34)

Lack of good data management makes it difficult to track the movement of plant materials from their original sources, through maintenance in collections and onward to final users. It also hinders the sharing of information about plants in collections, including valuable passport data, research results and traditional knowledge related to particular species. This results in duplication of research and the wasting of resources and can limit opportunities to understand Ethiopian biodiversity.

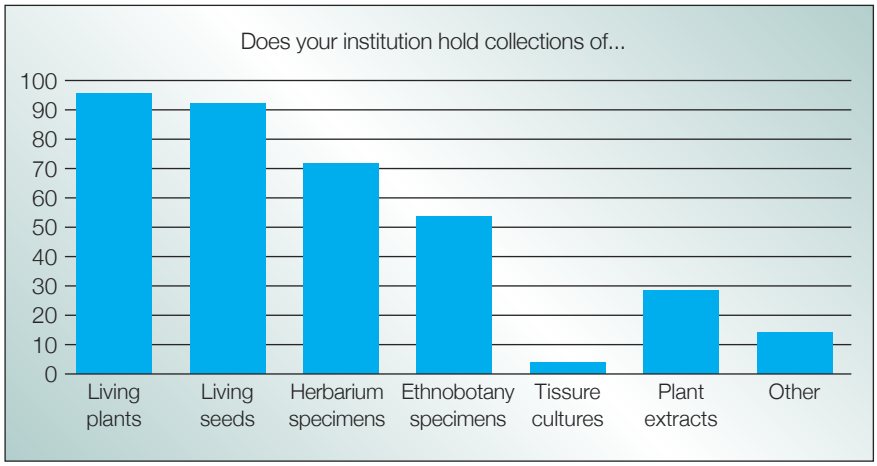

Fig. 4: Material held in ex situ *collections in Ethiopia – responses from 24* ex situ *collection holders)*

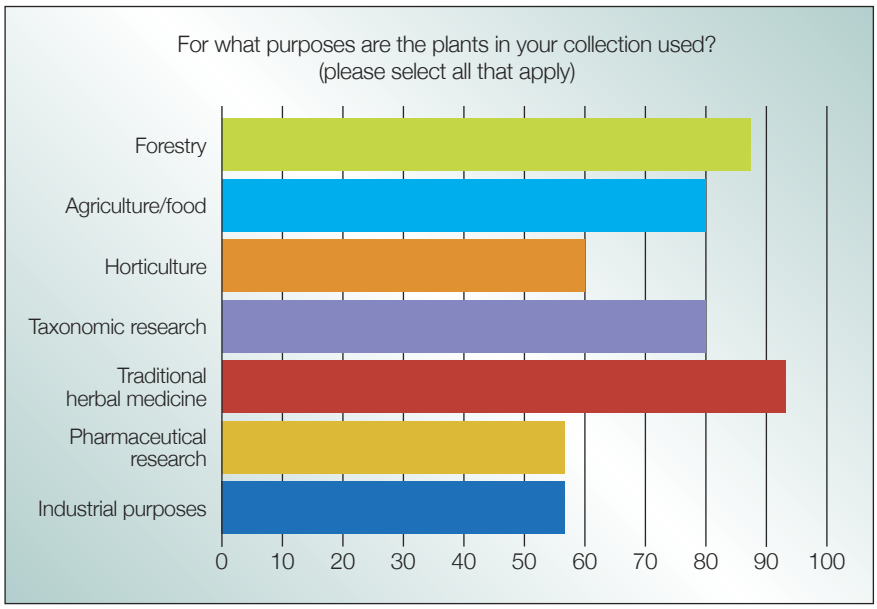

Fig. 5: Review of the uses of plants held in 24 ex situ *collections across Ethiopia*

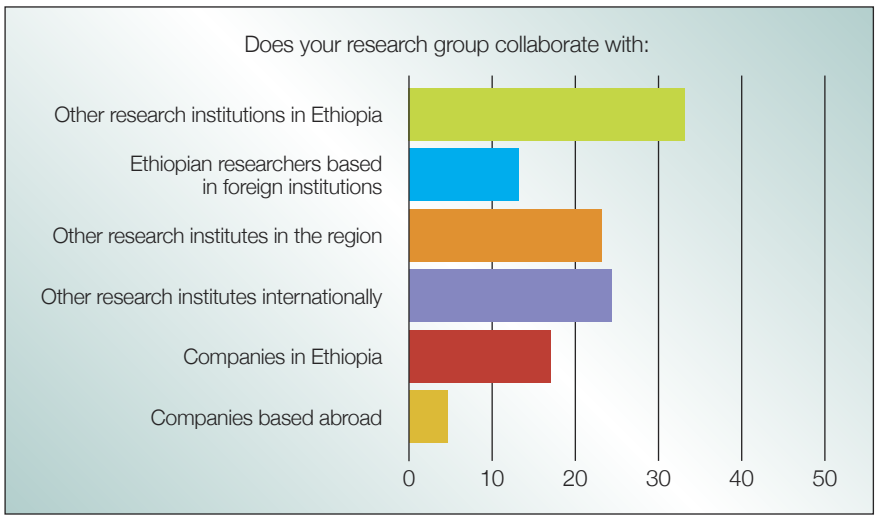

Fig. 6: Research collaboration within and outside Ethiopia (n=15)

In relation to ABS, good data management is essential to ensure that permits and agreements related to the acquisition and use of plant materials are kept with the relevant plants so that benefit sharing agreements can be honoured and any restrictions on use adhered to.

Conclusions

The series of stakeholder consultations conducted in Ethiopia has helped to raise awareness amongst *ex situ* collection holders and researchers of ABS issues and highlighted the important role of *ex situ* collections as intermediaries between providers and users of plant materials. The consultations have revealed the wide range of stakeholders that collections interact with and the diverse nature of the collections themselves.

Discussions with researchers have highlighted some of the research bottlenecks, and revealed the need for improved data management systems across the system as whole. The last training course of the project will accordingly focus on data management capacity, the project's tools for ABS training will include content on management of ABS-relevant metadata, and many of the implementation examples collected on BGCI's website[2] focus on how institutions in other countries are managing ABS data.

The Darwin project will conclude with the provision of detailed policy and guidance recommendations based on these consultations that we hope will be of practical use to Ethiopia as it begins to implement its post-Nagoya ABS framework.

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[1]EBI is a government body with the mandate for conservation and sustainable utilisation of all Ethiopia's biological resources and associated Indigenous knowledge; it holds national collections of plants, animals and microbes, conducts research, and is also responsible for granting access to genetic resources.

[2]http://www.bgci.org/policy/abscasestudies/

Authors: Stevens, A.-D., Droege, G., Zippel, E., Häffner, E. & Borsch, T.

In the Dahlem Seed Bank seeds of endangered wild plant species can be conserved for tens or even hundreds of years (André Obermüller)

DOCUMENTATION OF SPECIMENS AT THE BOTANIC GARDEN AND BOTANICAL MUSEUM BERLIN WITH REGARD TO ABS

Background

As an institution holding genetic resources as living collections (including seeds), herbarium specimens and DNA- and tissue samples as well as a wealth of associated data the Botanic Garden and Botanical Museum Berlin (BGBM) aims at creating transparency on the processes associated with the handling of these materials and data. Transparency as well as complete and sustainable documentation are prerequisites to comply with laws and regulations associated with genetic resources and to build trust among users, suppliers and collaborators.

BGBM acts in accordance with the national laws, the EU regulations, and international agreements on genetic resources[1]. As a member of CETAF (Consortium of European Taxonomic Facilities), IPEN (International Plant Exchange Network), and GGBN (Global Genome Biodiversity Network) the workflows and documentation of our biological collections are in compliance with CETAF's, IPEN's and GGBN's codes of conduct (CoC)[2]. CETAF CoC and Best Practices are currently under review for official recognition by the European Commission as a best practice example. The document provides a thorough treatment of all aspects of access- and benefit-sharing and compliance with the Nagoya Protocol in biological collections, especially issues associated with material acquisition, curation, use, benefit-sharing and transfer to third parties.

The BGBM DNA bank contains samples which are made available via the Global Genome Biodiversity Network (BGBM)

Its annexes contain a detailed description of best practices alongside practical advice, a glossary, model material transfer agreements and a model data use statement. GGBN's CoC is the result of reviewing a variety of existing codes and material transfer agreements in order to address the diversity of GGBN member collections, ranging from natural history and culture collections to zoos, gene banks and environmental sample collections worldwide and to provide its members with a ready to use tool to implement ABS. It has been developed in close collaboration with CETAF. For the living plant collections including seeds, BGBM follows the rules of the International Plant Exchange Network (IPEN), in which BGBM has been a member since 2001. IPEN was founded by botanic gardens in 1997 as a response to the CBD, long before the Nagoya Protocol was agreed in 2010. IPEN has been recognized as a best practice model for implementing ABS regulations of the CBD by the CBD-Secretariat. Meanwhile, 203 botanic gardens are members of IPEN. Important constituents of the IPEN best practices are the IPEN Code of Conduct[3], the IPEN number for unique identification of accessions, and the IPEN Material Transfer Agreement. Within IPEN, all members have agreed to follow the Code of Conduct, which allows exchange of material among the IPEN members and at the same time guarantees compliance with the CBD and the Nagoya Protocol. IPEN institutions acquire only legal material accompanied with the ABS documents PIC and MAT where necessary.
The IPEN MTA regulates the transfer to third parties for basic research and teaching purposes only. If third parties intend to commit commercial research and development with genetic resources from IPEN institutions, they are required to negotiate PIC and MAT with the country of origin and show these documents to the IPEN institution.

A main obstacle to compliance with all the requirements coming from these different sources that we have encountered was to guarantee the comprehensive, transparent, and traceable documentation along our internal workflows evolving with the development of a manifold of protocols.

For the purpose of basic taxonomic and biodiversity research, education, and conservation we receive genetic resources as living plants, seeds, tissue samples (for DNA-extraction), environmental samples and herbarium specimens from sources all over the world and through our own collecting activities. As a result, our herbarium collections grow by approximately 35,000 new specimens per year; thousands of samples, culture strains and seeds enrich the other collections and also a few hundred living plants are exchanged with other botanical gardens each year. We receive the very heterogeneous material from many different countries worldwide and accordingly the use, storage and distribution are subject to very different conditions and restrictions. It is important to ensure that material or associated data which are blocked for e.g. transfer to third parties or detailed publication, are not published via public databases (GGBN, Index Seminum, GBIF).

With about 20,000 living plant species, the BGBM living collection is among the most species-rich in the world (Nils Köster)

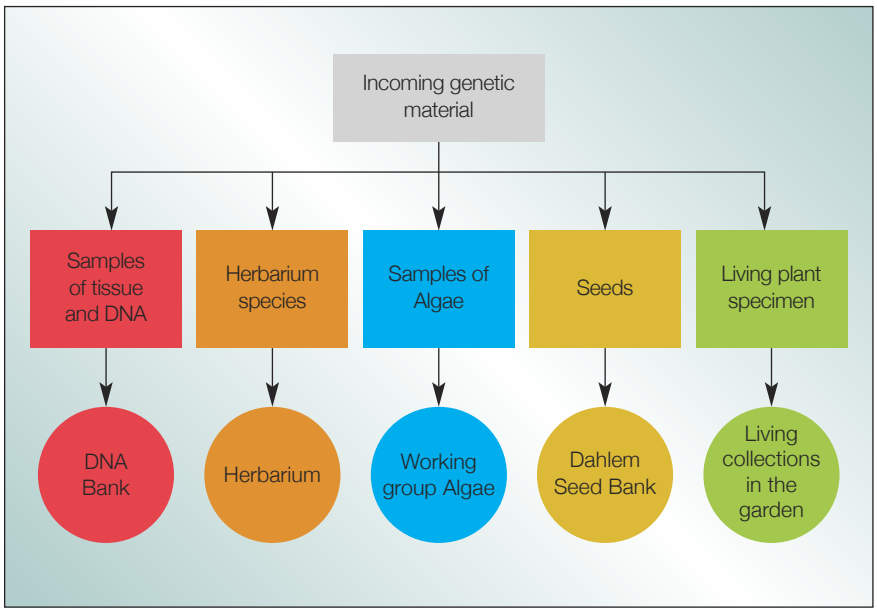


Fig. 1. Overview of different types of incoming material into the BGBM and the units that handle the samples and specimens and the respective formal documentation i.e. legal documents.

As we decided to adopt and adapt a new network based database solution for our herbarium collections (called JACQ) we also decided to formally establish a common specimen and data workflow that considers and integrates all our biological collections. This includes the documentation of DNA samples and plant tissue collections within the GGBN network software solutions which at that time in 2013 was under rapid development, too. We also, of course, had to integrate the existing database routines of our living collections and the Dahlem Seed Bank database.

Process

These challenges presented the opportunity to develop protocols to cover the handling, collecting, and processing of the specimens that had accumulated over the long history of our collections and databases. Basically, we developed a common Collection Data Format (CDF) tool to guarantee all necessary documentation. This CDF tool is obligatory for all collecting activities of our staff and all material entering our collections needs to be accompanied with these mandatory data. Before we accept external collections (mostly older collections from public or private sources), we require, at minimum, documentation which includes the origin of the material and copies of the accompanying documents, or the confirmation that the material is legally collected and free of use restrictions.

The latest version of the CDF as well as other information about BGBM's collection and data workflows can be found at https://wiki.bgbm.org/collection workflows/. This site was created in late 2018 to be used by everyone to explore our routines and examples. We aim to document processes related to our collections and collection databases here. As a next step our best practices with respect to ABS and our DNA Bank will be added soon.

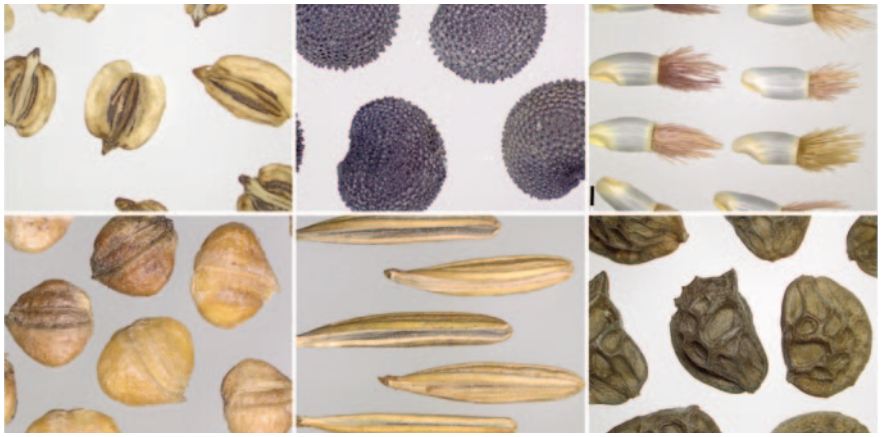
Fig. 2. Permit Management at BGBM with Alfresco. Each accession lot and field excursion is related to a registration number, e.g. "PRN2016_004", containing all required documents. The url to this folder is stored in our collection databases. The registration number will be published through GBIF and GGBN using GGBN's permit vocabulary (https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN_Permit_Vocabulary), but not the documents. As tags German translations of GGBN's controlled vocabulary are used.

All legal and formal documents (e.g. collecting permits, PIC, CITES documentation, phytosanitary documents, MTA, long term agreements with partner institutions, project agreements etc.) are digitized and managed using a digital asset management software (we use Alfresco, an open source document management system (www.alfresco.com)).

All of our collections (tissue and DNA-samples as well as living plants, seeds and diatom cultures) must have, if possible, a herbarium specimen that can be permanently stored and allows for correct identification of the material. All of these voucher specimens shall be digitized. Therefore, all data and all documentation can be traced back to identifiers referring to a herbarium specimen and all of the other collections (samples, probes and specimens) also get unique identifiers that are cross-referenced with the herbarium specimen identifiers.

However, as the activities and pathways of incoming material differ quite a lot (e.g. living plants from other gardens and seeds via *Index Seminum* vs tissue samples for DNA extraction and herbarium collections) and are located at different places and treated by different staff, we decided to have two locations where incoming material is checked for appropriate documentation. These are the central documentation office for living material (plants and seeds in the seed bank) and the central documentation office of the herbarium (for herbarium specimens and tissue samples). In both places, according to the main purpose for accessioning the new material, all relevant documents are digitized or received digitally and are assigned a unique identifier in order to link the documents to the specific genetic material collected. It is the responsibility of the collectors or the donators of plant material to link the documents to the plant material covered by the documents. If collected by our staff, this linking of identifiers is done using the CDF mentioned above. The documentation offices do check the data and documents but the collectors hold full responsibility for obtaining the correct documents, according to their authorization and depending on the specific requirements of the national laws for collecting/exporting etc. The documentation offices assign permit registration numbers for each collecting event or exchange lot. All permit documents belong to one or multiple registration numbers.

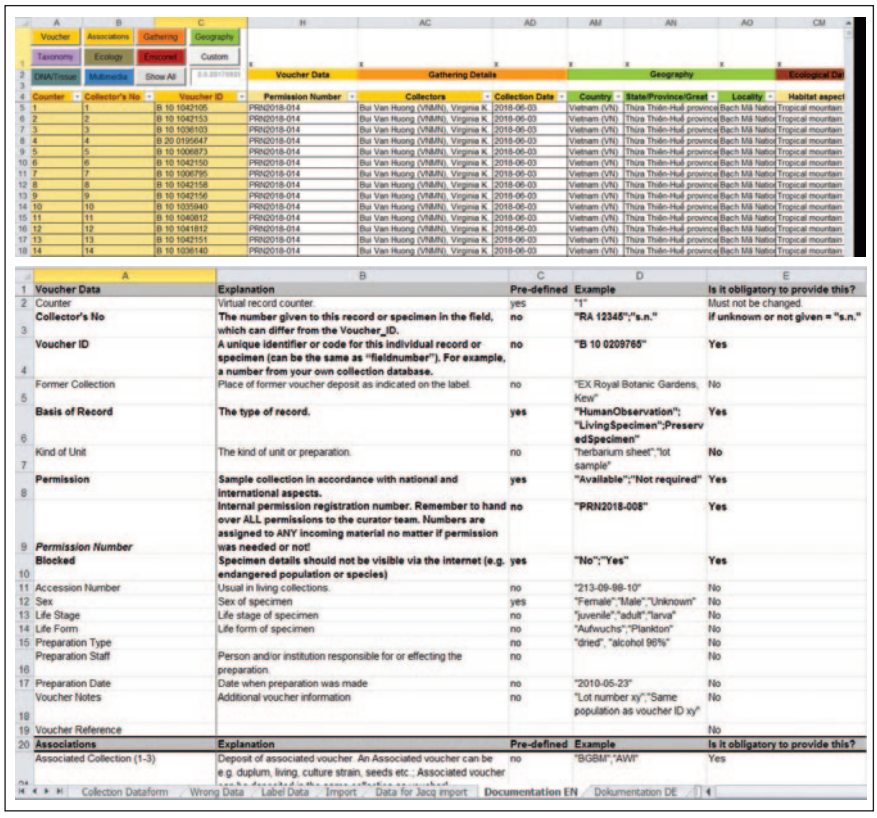
The BGBM herbarium contains about 4 million specimens (André Obermüller)



Seeds in the Dahlem Seed Bank: From left to right, top row: Selinum carvifolia, Silene dioica, Centaurea cyanus*; bottom row:* Valerianella locusta, Chaerophyllum aureum, Onobrychis viciifolia *(Marion Cubr)*

By this process we ensure that genetic material is identified by collecting number (assigned by the collector), by accession number (assigned by BGBM according to type of material e.g. plant tissue, DNA, sample, seed lot, plant accession number of living plants, environmental sample, culture strain or herbarium specimen), and, most importantly in this regard, the document number/identifier of the legal or formal documents issued by the national legal entity or signed by a partner institution (assigned by the documentation office at BGBM when digitized). All these identifiers or numbers must refer to the respective material and as such allow BGBM to trace back the material at all stages of processing and also when genetic material is exchanged with partners.

If there are any restrictions or any requirements for the further processing, use or exchange of plant material this is documented and flagged in all database modules and accession numbers. In the living collections of the botanic garden for example we apply the IPEN protocol (www.bgci.org/policy/ipen_documents) where the IPEN-number (0 or 1) indicates if there is any restriction to the accession.



Voucher Data	Explanation	Pre-defined	Example	Is it obligatory to provide this?
Counter	Virtual record counter.	yes	"1"	Must not be changed.
Collector's No	**The number given to this record or specimen in the field, which can differ from the Voucher_ID.**	**no**	**"RA 12345";"s.n."**	**If unknown or not given = "s.n."**
Voucher ID	**A unique identifier or code for this individual record or specimen (can be the same as "fieldnumber"). For example, a number from your own collection database.**	**no**	**"B 10 0209765"**	**Yes**
Former Collection	Place of former voucher deposit as indicated on the label.	no	"EX Royal Botanic Gardens, Kew"	No
Basis of Record	**The type of record.**	**yes**	**"HumanObservation"; "LivingSpecimen";"PreservedSpecimen"**	**Yes**
Kind of Unit	The kind of unit or preparation.	no	"herbarium sheet","lot sample"	**No**
Permission	**Sample collection in accordance with national and international aspects.**	**yes**	**"Available";"Not required"**	**Yes**
Permission Number	**Internal permission registration number. Remember to hand over ALL permissions to the curator team. Numbers are assigned to ANY incoming material no matter if permission was needed or not!**	**no**	**"PRN2018-008"**	**Yes**
Blocked	**Specimen details should not be visible via the internet (e.g. endangered population or species)**	**yes**	**"No";"Yes"**	**Yes**
Accession Number	Usual in living collections.	no	"213-09-98-10"	No
Sex	Sex of specimen	yes	"Female","Male","Unknown"	No
Life Stage	Life stage of specimen	no	"juvenile","adult","larva"	No
Life Form	Life form of specimen	no	"Aufwuchs","Plankton"	No
Preparation Type		no	"dried", "alcohol 96%"	No
Preparation Staff	Person and/or institution responsible for or effecting the preparation.	no		No
Preparation Date	Date when preparation was made	no	"2010-05-23"	No
Voucher Notes	Additional voucher information	no	"Lot number xy","Same population as voucher ID xy"	No
Voucher Reference				No
Associations	**Explanation**	**Pre-defined**	**Example**	**Is it obligatory to provide this?**
Associated Collection (1-3)	Deposit of associated voucher. An Associated voucher can be e.g. duplum, living, culture strain, seeds etc.; Associated voucher	no	"BGBM","AWI"	Yes

Fig. 3. Sections from the Collection Data Format Tool (CDF) that accompanies all material that enters our collections. The buttons on the top left allow switching between different views and customizing the CDF. As it is used by other institutions as well, it also contains specific columns and examples for zoological collections. Customized label printing is also part of the CDF and can be easily adapted. For BGBM four different label types are in use.

Plant collections at BGBM (Nils Köster)

The collection data sheet has been used for several years and is constantly adapted to new challenges. In combination with the digital safekeeping of all collection-relevant documents and the institute's own databases, we have created a structure that ensures the documentation of our collection in a comprehensible and long-term manner in compliance with the CBD and the Nagoya Protocol.

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[1]www.bfn.de/themen/nagoya-protokoll-nutzung-genetischer-ressourcen.html; http://ec.europa.eu/environment/nature/biodiversity/international/abs/legislation_en.htm; https://www.cbd.int/abs/

[2]https://cetaf.org/sites/default/files/final_cetaf_abs_coc.pdf; http://www.bgci.org/policy/ipen/; https://library.ggbn.org/share/s/UM5JietQR9aevtYDymHbjw

[3]https://www.bgci.org/policy/ipen_code_of_conduct

Authors: Kate Davis, Beatriz Maruri Aguilar and Emiliano Sánchez Martínez

A CODE OF CONDUCT TO PROMOTE BENEFIT-SHARING AND PLANT CONSERVATION

Presentation of the Prior Informed Consent for the inclusion of recipes in the book: "Quelites: sabores y saberes del sureste del Estado de México" (Robert Bye)

The Mexican Association of Botanic Gardens is the first botanic garden network to develop a Code of Conduct to support ABS implementation by its member gardens

Introduction

Mexico is a country rich in biological and cultural diversity, and its botanic gardens play a critical role in conservation and public awareness-raising. Their effectiveness is increased by their coordination in a national network (Vovides *et al*., 2013), the Mexican Association of Botanic Gardens (Asociación Mexicana de Jardines Botánicos, AMJB). The network represents nearly 40 botanic gardens and has a mission to promote their effective collaboration, and capacity building to promote study and conservation of Mexican plant diversity. The AMJB also works towards the targets of the strategies for plant conservation at global (Global Strategy for Plant Conservation – CBD, 2012) and domestic (Estrategia Mexicana para la Conservación Vegetal - 2012) levels.

Botanic gardens collect, study, conserve and exchange plant resources, and consequently need to interact with communities, landowners and government bodies with rights or authority over those resources. The AMJB responded early to the CBD's provisions on access to genetic resources and benefit-sharing (ABS): following active participation by several AMJB representatives in the 1998-2000 international Pilot Project for Botanic Gardens (Latorre Garcia *et al*., 2001). The AMJB developed the Oaxaca Declaration (De Ávila *et al.*, 2003) to affirm the commitment of AMJB-affiliated institutions and personnel to the '*Principles on ABS*' that emerged from that project. The Declaration adapted the Principles to the Mexican context, focusing on study of Mexican plants and associated traditional knowledge and compliance with Mexican legislation.

However, many members of the AMJB were never involved in the Declaration's development or implementation, and knowledge of ABS in general and Mexico's legal requirements was uneven. ABS uncertainty is understandable,

in part because Mexico does not yet have a specific legal instrument or framework for its implementation. Instead, several different general laws and norms cover ABS-relevant activities and issues. Following Mexico's 2012 ratification of the Nagoya Protocol, an ABS instrument is under development (Gobierno de la República de México, 2017), pieces of the ABS governance puzzle are dropping into place, and stakeholder groups are considering how their activities relate to Nagoya and the developing national framework.

Discussions at the Oaxaca workshop

Developing a new code for gardens

In response to this changing post-Nagoya landscape, the AMJB initiated a collaborative project in 2014 to support ABS implementation by Mexican gardens. The Regional Botanical Garden of Cadereyta led the effort, which was sponsored by the '*Governance of Biodiversity: Fair and Equitable Sharing of Benefits Arising from Use and Handling of Biological Diversity*' project from the National Commission for the Knowledge and Use of Biodiversity (CONABIO) and the German Agency for Technical Cooperation (GIZ).

The original plan was to create (1) a code of conduct and (2) a model agreement, with the aim of helping gardens and the holders of plant resources – communities and landowners – to collaborate towards the conservation of Mexican flora and benefit from knowledge generated from it. The core project team developed a draft that was explored at a consultation workshop in Bernal, Queretaro (April 2015) by a team of specialists from the AMJB, GIZ, CONABIO, the Ministry of Environment and Natural Resources (SEMARNAT), the National Seed Inspection and Certification Service (SNICS), the National Commission of Natural Protected Areas (CONANP) and the Technical Institute of Oaxaca Valley (ITVO).

This group concluded that Mexican gardens do not access genetic resources according to Mexico's interpretation of ABS and the Nagoya Protocol. In Mexico the concept of access to genetic resources can be broadly understood as '*access to the molecule*', for purposes of investigation or bioprospection. Mexican botanic gardens see themselves as primarily users of biological resources in activities focused towards conservation of plant diversity, and do not conduct commercial research. In many cases, they play a role as intermediaries between communities and academia. The Bernal group supported this view. The project team thus decided against developing a model agreement for gardens and resource owners, and instead chose to provide a guide to good practices, featuring a compendium of examples from a range of Mexican gardens, based on the essence of the Nagoya Protocol: access with prior informed consent and (non-monetary) benefit-sharing according to mutually agreed terms. The aim is to encourage and highlight gardens' social commitment and foster collaborative plant conservation through dialogue between academics and local people.

The project team gathered examples, added a glossary, and circulated the package to AMJB members, to SEMARNAT for the review of its legal aspects and terms, and to an international ABS expert (KD), who joined the team to help finalise the document and co-organise a participatory workshop to familiarise AMJB members with the new tool.

The Oaxaca workshop (October 2015) gathered 69 people from 29 gardens across Mexico. The agenda included talks from government representatives and the international expert to raise awareness and provide context on Mexico's existing laws and a range of international codes of conduct and other guidance measures. Participants then worked in groups through case studies to explore their understanding of the relevant laws and procedures, and determine how they could apply the new code and good practices. The response to the workshop was positive, and the project team received specific suggestions, which then were incorporated into the final draft.

Participants at the Bernal workshop

Code of Conduct

The code begins with five declaratory clauses describing the AMJB's commitment towards collaborative conservation and environmental education, its compliance with international principles on rights and benefit-sharing, and the role gardens play in conservation through the maintenance of living collections. Ten principles follow, whose synthesis sets out that:

1. AMJB and members' will promote their activities as an enhancing factor of local sustainable development, in accordance with communities' uses, traditions and systems;
2. Academic research conducted in/around communities will respect the local context and their right to protect cultural heritage and traditional knowledge;
3. Gardens will follow Mexican legislation regarding scientific collection, propagation, access to genetic resources and to traditional knowledge associated with the flora, and comply with the principle of prior informed consent of resource-holders;
4. Precautionary principles will be applied to prevent negative biological or cultural impacts from inappropriate collection;
5. Gardens will obtain permits and prior informed consent by identifying and communicating at an early stage with those who have authority for the possession of plant resources and access to the area concerned, and will provide enough information about the project;

Workshop registration where participants are asked for their informed prior permission to use pictures and videos for education programs (Robert Bye)

6. Information provided by the community will be safeguarded, taking into account equity, justice and cultural values; and informing the locals about the relevance of cooperation to sustain ecosystem balance;
7. Mutual consent agreements will be developed where necessary;
8. Benefits from academic research will be shared as mutually agreed;
9. Gardens will share results of their research with communities where they conduct their work and promote awareness of the value and conservation of plant diversity;
10. *Ex situ* material will be exchanged for reintroduction according to legislation in force.

The code distinguishes three scenarios of interaction between botanic gardens and communities, regarding ABS requirements: (1) those not involving access or acquisition of biological/genetic resources, where permits should suffice; (2) cases where plants are collected and placed in *ex situ* conditions for botanic garden activities such as non-commercial research, education and exchange, which are subject to applicable legislation and prior informed consent; and (3) long term research, where gardens and resource holders should together explore mutual long-lasting benefits that contribute to sustainable livelihoods.

The code finally describes intangible and tangible benefits that gardens could share with communities, ranging from promotion of respect for the value of biodiversity, to training and capacity-building for conservation and restoration, to creation of value chains that help the local economy and avoid destruction of the flora, among others.

Compendium of good practices

The best practices section shares advice and ideas on how botanic gardens can conduct fieldwork responsibly and work with communities to develop and share mutual benefits. This section sets out an indicative list of good practices, and includes practical examples provided by Mexican botanic gardens:

- The Benemérita Autonomous University of Puebla Herbarium and Botanic Garden offers an overview of its procedures for fieldwork and curation;

Discussions at the Oaxaca workshop

- The Dr. Faustino Miranda Botanic Garden describes its process for a project on conservation of useful plants in the Zoque area of Chiapas. It is worth mentioning that the state of Chiapas developed a bill for the protection of traditional knowledge of indigenous peoples and communities with the support of the Dr. Faustino Miranda Botanical Garden;
- The Francisco Javier Clavijero Botanic Garden shares information on the approaches it takes for short collecting trips and medium and long-term research projects;
- The Alfredo Barrera Marín Botanic Garden describes three steps that the scientific team follows during their field trips, to inform local communities and conduct a successful expedition;
- The National Autonomous University of Mexico sets out the sequence of steps followed to work closely with a community. Two senior researchers with more than 30 years of experience describe this collaboration.

The good practice guidance notes that when a garden's research does involve utilisation *sensu* Nagoya (research and development on the genetic and/or biochemical composition of genetic resources), it is necessary to 'apply measures that are established in the applicable legislation'. Mexican gardens will thus need to keep in touch with national authorities and follow ABS legal and policy developments in Mexico and elsewhere; we must still wait for domestic legislation to develop and to assess its implications.

It is increasingly likely that new material and information may arrive with restrictions and obligations to track their use, and research using new technologies may require additional permissions. The good news for Mexican gardens is that communication with government is strong and news and advice can be effectively shared via their network – and ultimately they will always be on solid ground when they communicate transparently and share benefits with communities.

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The Good Practices (condensed)

1.	Formulate the project **taking into consideration local circumstances**.
2.	Complete the necessary formalities for the **governmental authorities**.
3.	Consider that when the research involves genetic resources for the purpose of utilization *sensu* the Nagoya Protocol, it will be necessary to apply measures established in the applicable legislation.
4.	Establish **communication with the municipal authorities**, either with the municipal president or with the person responsible for environmental matters.
5.	Before initiating the project, identify, and establish **communication with, the competent local authorities**, both official and traditional.
6.	**Provide the contact details** for each of the responsible researchers or the institution.
7.	**Do not force** the implementation of the project if the inhabitants of the area are not in agreement.
8.	**Obtain consent** from the local authorities, both official and traditional, for the concluding of agreements.
9.	**Encourage the participation** in fieldwork of local inhabitants.
10.	**Communicate the progress and problems** encountered in the development of the project to the respective local authorities.
11.	**Provide non-monetary benefits** to the communities.
12.	**Share the products** of the investigation with the communities.
13.	**Link the community with potential markets**.

The practical exercise at the Oaxaca workshop

	The exercise: Three hypothetical examples were distributed to the working groups, for them to analyse, and, using the Code of Conduct, address the following questions:
1.	In accordance with applicable Mexican regulations, what are the **minimum requirements** that the Botanical Garden must meet before accessing these biological resources?
2.	Identify the official, local and traditional authorities with whom you would have to communicate.
3.	How would you **request prior, free and informed** consent?
4.	Propose some examples of the **precautionary principle** to be applied in this case.
5.	What are the **fundamental rights and obligations of the parties**, according to the code of conduct?
6.	**What benefits** can the Botanical Garden bring to the community of the area, considering non-monetary benefits, and if applicable, monetary benefits? Give 3 examples, including the concrete name of the action, general approach for its realization and time to use in its execution.
7.	**Write an example letter / introductory file**, no longer than ten lines, to present the project and its intention to the inhabitants of the area.
8.	In this case, **would it be useful to integrate contractual clauses**, make prototype contracts or establish models of reciprocal linkage, to consolidate the conditions of mutual agreement? Why?
9.	What are the main strengths/advantages of Botanical Gardens for the application of the code of conduct, and what are the disadvantages?

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PARTNERING WITH INDIGENOUS COMMUNITIES

Assessing the impact of harvesting on Labrador Tea following a request from the community Elders

The Montreal Botanic Garden has developed strong relationships with Indigenous communities in Canada through adopting a respectful and ethical approach, sustained over many years.

Introduction

Very few people know that the Montreal Botanical Garden (Jardin botanique de Montréal (JBM) had planned, since its inception in 1931, to create a First-Nations Garden (FNG). Such an addition finally came to fruition in 2001. The elaboration of the FNG itself, as well as its name, were discussed respectfully with the eleven Nations in Québec. Also, with the creation of the FNG, the JBM established a position in ethnobotany to foster research with First Nations living in Québec and potentially abroad.

Ethnobotany at JBM

Ethnobotany was not new at the JBM and work done by the late Marcel Raymond and especially Jacques Rousseau starting in the mid-1940's paved the way for more work. In 2001, staff from the garden flew to Kangiqsujuaq, Nunavik to collect plants for the tundra area at the FNG at the base of the inuksuk, a cairn built by Inuit. Although the plants did not do well under the high temperatures of our summers in Montreal, we came across a surprising fact: very little was known about the use of plants in the Eastern Canadian Arctic.

The Canadian Arctic is rich in plants with multiple uses and it was clear that whenever the Inuit diet and medicine was discussed, plants must be included. Yet despite this, writers were not giving due credit to plants in Inuit life.

The initiation of new projects at the garden also highlighted the importance of developing respectful and ethical procesess with Indigenous collaborators. While the JBM had already built some connections with Indigenous organisations, such as the Avataq Cultural Institute, over the years our further collaboration resulted in a number of books aimed at the different communities involved (Cuerrier and Elders of Kangiqsualujjaq, 2012). Leaving a legacy behind came to be one of the building blocks of working closely with First Nations and Inuit. Most books were translated into Inuktitut and were supervised by Avataq. It became mandatory to ask for such publications and wait for their approval.

While books and other legacies for communities are a great way to acknowledge their traditional knowledge, this is not sufficient. In the ethical space of initiating projects with Indigenous partners, we also need to listen to their

A community consultation in Mistissini

concerns. We remember well when in Nain, Labrador, we asked Inuit Elders about their concerns, they spoke about the fact that few if any researchers came back to their community. Once a project was completed, the Elders never heard back from the researchers, nor did they receive a copy of their publications.

Partnering with Indigenous communities – medicinal plant research

JBM has been partnering with the Inuit community since 2001. We regularly visit our partners (as we would with friends) in order to build and maintain trust. Our work with the Inuit has also helped our team to start working with the Cree people of Eeyou Itschee (Quebec).

In 2003, a new research project was initiated, bringing together researchers from different scientific institutions (University of Montreal, McGill University, University of Ottawa, Montreal Botanical Garden). The Cree Nation of Eeyou Itschee was central, in particular their Elders and knowledge holders. We first met with the Cree Board of Health and Social Services of James Bay (CBHSSJB) to ensure that the project was acceptable and targeted a problem identified by the Cree people. This new team, funded by the Canadian Institutes of Health Research, brought science and traditional knowledge together in order to help the Cree population better cope with diabetes[1]. Starting with a novel ethnobotanical approach, the team aimed to carry out a rigorous scientific examination of the antidiabetic activities of Cree medicinal plants used by Elders and knowledge holders. Diabetes is a new ailment that arose in this area in the 1980's. During the project we conducted interviews focused on 15 symptoms linked to type 2 diabetes. Among the 50 or so plants mentioned to us through over 140 interviews, we were able to prioritise plants and conducted phytochemistry and pharmacological assays on 17 species.

The process for developing the project was somewhat lengthy. Once the funding was secured and after meetings with CBHSSJB to establish their general approval of the project, we wrote a first draft of what the ethics of working together would entail. There was no ABS legislation in place setting out requirements, but our research agreement went beyond the provisions of the original 1998 Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans, and met those of the (later) revised 2010 edition (Canadian Institutes of Health Research, *et al*., 2010). The agreement was reviewed by lawyers and although this legal process was long and was not finalized until 2009, from the start all researchers abided with the draft as if it was fully in place.

We felt it was critical to establish such an agreement because the project had traditional medicine as its core element, and medicinal plants are a highly sensitive subject matter amongst Indigenous peoples in Canada and elsewhere. The research team and the CBHSSJB agreed on a path forward. We described the project and its purpose, and made clear that Cree communities could at any time 1) withdraw from parts of the project they did not agree with, and 2) keep any information confidential. All team members had to sign a confidentiality form in which each member affirmed that he/she could not share information from the project with the media, within congresses, or through any form of publication without the explicit approval of the Cree community with their Elders and knowledge holders. A review process was designed to support decision-making on whether or not publications (via scientific journal or congress presentation/poster) should proceed. More details on the working procedure can be found here[2]. This decision-making process can take up to 3 months, with the first step being to sit down with Elders and knowledge holders to discuss the research results, and welcome their feedback. Such input has been acknowledged and incorporated in some of our published papers. This process has also been described in a paper (Cuerrier *et al*., 2012).

Since the project involved phytochemistry and pharmacology, the agreement included terms on intellectual property rights (IPRs). A patent could only be issued if the Cree decided to go forward with such an endeavour. Indeed, the participating Cree First Nations would own the majority of the patent and thus be the pilot steering the future of the IPRs wherever they felt was appropriate. New molecules were indeed discovered during the project. Our research group sat down with community members and together discussed the meaning and implications of patenting and other avenues. Cree people felt that patenting was culturally inappropriate and, in the spirit of helping as many diabetics as possible, indicated that a publication would be best, which the team did. Through that publication, and in respect to the Awashish family that was very supportive of the project and also in memory of the late Sam Awashish, the new molecule received their name, awashishnic acid. The community and family were consulted before we named the molecule.

The First-Nations Garden at JBM

Another element of importance was how to recognise the participation of community members. Should they be authors or just thanked in the acknowledgement section? And how should they be thanked? The Cree of Eeyou Itschee felt that Elders and knowledge holders should voice their own preference. We followed their advice and had Cree people as authors, or named in the acknowledgement section. Sometimes, Elders preferred to remain anonymous. This is the text that we usually used:

"Very special thanks are due to [names of Elders and healers who wish to be named in publication] as well as to [number of Elders and healers who do not want to be named] other Iiyiyiu Elders of Mistissini and Whapmagoostui who kindly agreed to be interviewed. They made this article possible by allowing us to use, for the purposes of this research, their knowledge relating to medicinal plants, transmitted to them by their Elders. Their trust has also enabled a useful exchange between Indigenous knowledge and Western science."

Not only did we establish this research agreement, but our team has been and is still committed to maintaining a strong relationship with the participating Cree communities. First, regular meetings either by phone or *de visu* were initiated to ensure that communities would be consulted over the progress of the project. Were they happy with the initial draft of the project? How could the project better address their needs? A steering committee met each month and regular visits took place to maintain a respectful relationship. Two big meetings, one in Montreal and the other in Mistissini, were organised every year. All communities were welcomed and researchers with their students attended as well. On the first day, results were shared, and on the second day, someone outside the team would give a talk about ethics or other important themes linked to the project or to research in an Indigenous environment.

Trust among people of different backgrounds can only be attained through meetings in person where space can be made for more informal conversation and activities. At the project meetings, a lay language booklet summarising all the new findings was left behind for Cree people to consult. The booklet was translated into southern and northern Cree dialects. Besides the agreement and all the meetings that went on, our team also invested in workshops bringing Cree youth together with the Elders in order to bridge the gap between generations. Another outcome or legacy will be the upcoming book on Cree antidiabetic medicines. This book has received approval by all the communities involved and is undergoing translation into local languages.

The inuksuk in the FNG

Plant collections at JBM

With these projects came new voucher specimens to the Marie-Victorin Herbarium and also living specimens added to the exterior gardens at the JBM. Early on we realised the need to update the guide that addresses the management of our plant collections. We had meetings with horticulturists to emphasise the importance of keeping all genetic resources within our garden and not to make any exchanges, despite the fact that this has long been a common practice of botanic gardens around the world, (usually involving *Indices Seminum*). The plants introduced into our collections through our projects should not be viewed as genetic resource accessible to anyone, especially to those with the intent of commercialising products (ornamentals, drugs, etc.). Not that we wanted to stop such a process, but we want to honour our research agreement.

The collection management guide is available on the JBM's website[3]. This sets out how we manage our collections including a First-Nations Garden, containing some of the plants mentioned to us by the Cree Elders and knowledge holders. The JBM, especially through the FNG, has become a great place to advocate ethical behaviour and we have been welcomed through multiple media to talk about how to partner respectfully with the Indigenous people.

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Listening is key to partnering with indigenous people

[1]Find out more about the Cree antidiabetic project: http://www.taam-emaad.umontreal.ca/index.htm

[2]Working Procedure for Review of Publications and similar documents:

[3]Managing plant collections at the MBG: http://espacepourlavie.ca/en/managing-plant-collections

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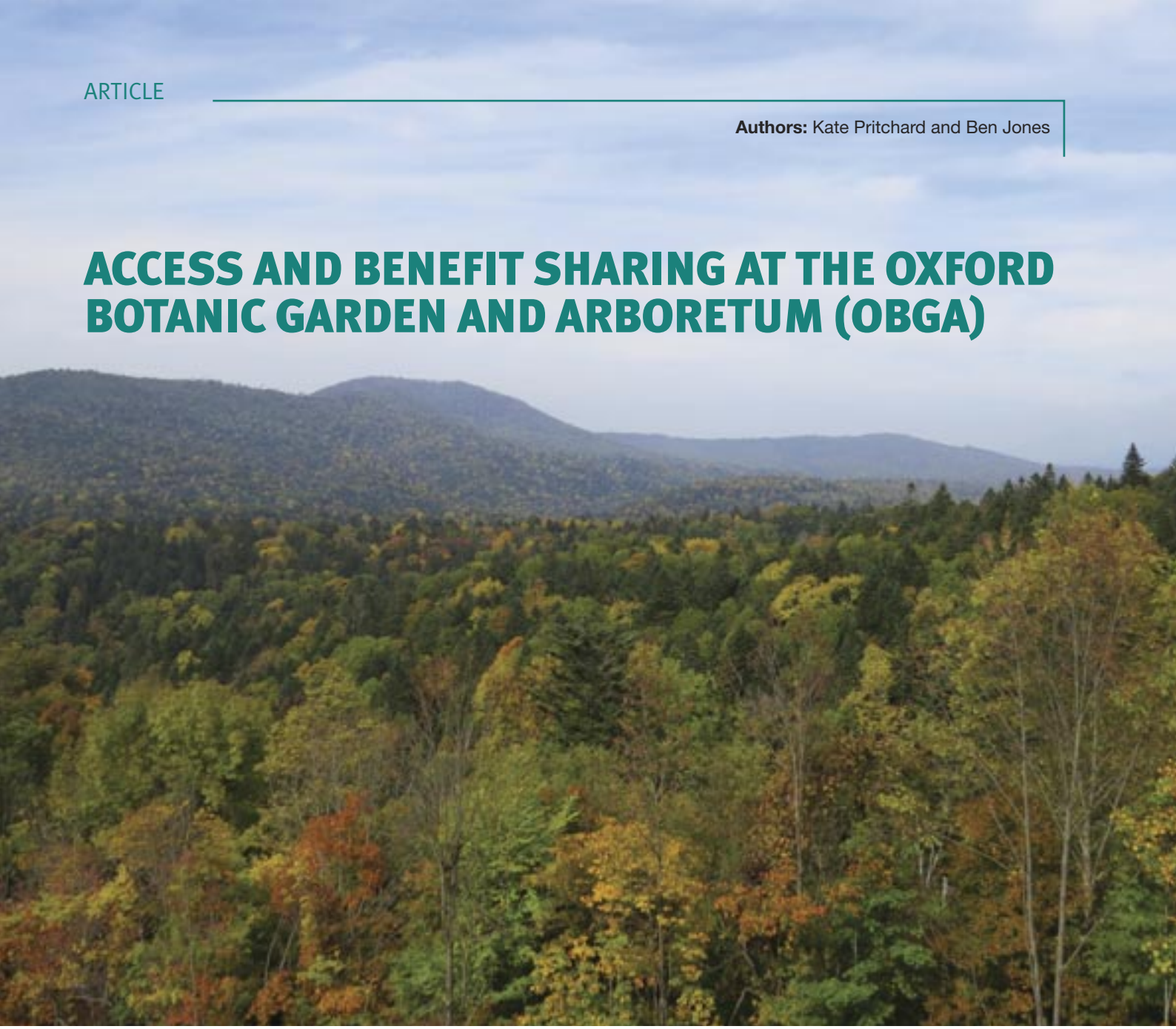
ACCESS AND BENEFIT SHARING AT THE OXFORD BOTANIC GARDEN AND ARBORETUM (OBGA)



Mixed forest on Hokkaido (Ben Jones)

The UK's oldest botanic garden has a large and important plant collection that supports its work in research, education, conservation and public outreach.

Introduction

As the first botanic garden in the UK (founded in 1621), at the UK's oldest University, Oxford Botanic Garden occupies a world-class position in terms of its history and academic location. Harcourt Arboretum (acquired by the University in 1947) contains some of the finest conifer collections in the UK set within 130 acres of historic Capability Brown landscape. Together, the Garden and Arboretum are an incredible and inspirational resource for research, education and conservation.

Our vision is to transform Oxford Botanic Garden and Arboretum (OBGA) into a world-class 21st century university botanic garden and arboretum: outstanding in research, education, conservation and public engagement. The living collections are central to this being achieved, and are being developed and enhanced around four key themes, each underpinned by science. These four key themes are:

1. Taxonomy & evolution
2. Heritage & landscape
3. Conservation & biodiversity
4. Plants & people

Access and benefit sharing at OBGA

OBGA honours both the letter and spirit of the Nagoya Protocol (NP). In response to the NP coming into force in 2014, OBGA and Oxford University Herbaria jointly produced a statement of compliance with the terms of the Nagoya Protocol.

Staff awareness

Staff awareness is key to implementation and demonstrating due diligence under the terms of Nagoya. It is essential that staff working with and using the collections have an understanding of OBGA's activities, partnerships and procedures. Nagoya awareness training has been provided for those members of the University whose work is likely to be affected by the NP. This has been delivered by University colleagues and external facilitators to enable staff to understand how the agreement affects their work. Staff working with and using the collections are made aware of OBGA's compliance and the consequences of not adhering to the terms of the NP.

Mt Tateyama, Toyama Prefecture, Japan (Ben Jones)

Plant exchange

OBGA regularly exchanges plant material with other botanic institutions. Transactions can be for donating and receiving plant material in various forms, from propagation material to grown plants. An important activity at OBGA is the taxonomic verification process to determine the correct identification of material held in collections.

When receiving and providing material, the accompanying documentation is checked. This is to ensure OBGA is providing or receiving material under the terms of the NP, and as stipulated in the terms of any original donor agreements. Documents may include material donor agreements, material transfer agreements and CITES certificates. As OBGA is a member of IPEN, the material exchanged may also have a unique identifying number[1].

A copy of OBGA's NP compliance statement is given to prospective collaborators and partners, plant donors and those receiving material. This statement accompanies all exchanges, including purchases from commercial suppliers.

Verifying samples from botanical survey work with staff at Toyama BG, OBGA & BGCI (Ben Jones)

Experience of sourcing material commercially

Lack of NP awareness is quite widespread in the commercial trade. Whenever possible collections staff at OBGA will visit a commercial nursery, particularly if it is a new supplier or if there has been a change in ownership or management. It is an invaluable way of assessing issues such as plant health and biosecurity, and discussing matters such as CITES and the NP. OBGA staff have found they often need to provide information for commercial suppliers. This can include web links to government information, BGCI resources and coverage in national media. Staff have also encouraged contact amongst suppliers to promote awareness.

OBGA requests commercial suppliers to complete a supplier compliance form. This has been a fairly straightforward process, providing the request is accompanied by a clear explanation of what the NP is and what it affects. OBGA positively endorses compliant commercial suppliers.

Issues of non-compliance

Staff's understanding of the NP should ensure OBGA is acquiring material legally. Where a supplier is unable to fulfil this request, OBGA works with the Oxford University Herbaria to address situations of non-compliance. Response to non-compliance varies according to the circumstances.

To date OBGA has only once found it can no longer use a commercial supplier. In this case, NP information was provided to this supplier and a compliance form was completed. In spite of the precautions taken, this commercial supplier was later found to have benefited commercially from plant material that had not been sourced legally.

Had OBGA needed to demonstrate due diligence under the terms of Nagoya this would have been possible - the completed supplier compliance form had been archived and linked to the records for the material purchased. In this instance the material OBGA had purchased was of cultivated varieties and was widely available in the horticultural trade. It was not of wild origin and was not subject to illegal collection. OBGA chose to re-source from a reputable supplier.

Collection data

An essential component of compliance with the NP is recording collection data accurately and comprehensively. The Oxford University Herbaria and OBGA's collection data is integrated and accessible via the BRAHMS database system. https://herbaria.plants.ox.ac.uk/bol/

Whether plant material has been accessed to the collection –pre- or –post-1993, OBGA strives to treat all material in the same way. Material accessed to the collections prior to 1993 is traced to source wherever possible. Staff's ability to do so is dependent on available records, which unfortunately can be difficult to access. Much of the record archive pre-dates digitisation. The information included can be sparse, also pre-dating an understanding of the fair and equitable sharing of benefits arising from the use of genetic resources.

Survey work in Japan (Ben Jones)

Magnolia stellate, *Mt Tateyama, Toyama Prefecture, Japan (Ben Jones)*

Historic *ex situ* collections are assessed on a case by case basis, taking into consideration the intended non-commercial use and the records available. In these circumstances a due diligence assessment may be carried out.

Current activities

As part of OBGA's strategic development, research activities are under review. This includes reviewing non-commercial research access agreements to ensure this work honours the letter and spirit of the NP. It also addresses research funded by the EC, to meet the 'the European Commission's requirements for researchers to state whether their research comes within the scope of the NP.

Collecting samples in Japan (Ben Jones)

Overseas collaboration – working in Japan

Oxford Botanic Garden and Arboretum (OBGA), in collaboration with partner organisations such as the Millennium Seed Bank and Forestry Commission, has led an international plant collection and conservation programme in Japan since 2012. This work has seen the collection and *ex situ* conservation of 359 woody and non-woody plant species, some of which are Endangered or Critically Endangered in the wild. The project has also generated 3,500 herbarium specimens, and 39 rapid botanic surveys of the flora, which will help inform the setting of conservation priorities. Importantly, this work has led to flourishing collaborative relationships with partner organisations in Japan. Most notably OBGA has worked closely with Toyama Botanic Gardens. A key aim of our most recent trip was to ratify this particular successful working relationship, by signing a Memorandum of Understanding between our two institutions.

The project is now focussed on expanding our internationally important conservation collection of Japanese species at Oxford, supported by our international collaboration network, and Toyama Botanic Gardens in particular. We are surveying plant communities and collecting plant material from the southern islands, which are very poorly represented in international *ex situ* collections. Specifically, we will be augmenting our Japanese plant collection with threatened tree species, and basal angiosperms and parasitic plants, which will form part of OBGA's conservation, research and teaching collections.

This work has been carried out in partnership with colleagues in Japan, and it is these working relationships that have enabled OBGA to negotiate and secure the required level of permission. In 2012, the sole focus for visiting Japan was to meet potential partners, discuss aims & objectives of the project and visit a range of different habitats where future botanical surveys and collections might take place.

This approach has significantly benefited our work, in particular the acquisition of permits, and has enabled OBGA to work across a broad range of sites with multiple partners, whilst being compliant within the NP framework.

Experience at OBGA of implementing the NP

OBGA collection staff have developed a heightened awareness of key issues such as access and benefit sharing. This has fostered a responsible approach to sourcing for the collections. Initially it has taken longer to implement collection development objectives, but this is done now in the knowledge that all the material sourced should be Nagoya compliant.

Implementation of the NP has required a more focused approach to sourcing. It has resulted in greater collaboration with commercial suppliers and international colleagues. The experience at OBGA is that the NP encourages communication and networking amongst the botanic garden community. These opportunities have been particularly valuable amongst horticultural staff, with evident benefits for plant conservation, education and plant science research.

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[1]http://www.bgci.org/policy/ipen/

BENEFITS OF BGCI MEMBERSHIP

Established in 1987, BGCI currently links more than 500 botanic gardens and conservation organizations in over 100 countries, working together to secure plant diversity for the well-being of people and the planet.

MEMBERSHIP BENEFITS INCLUDE

By joining BGCI you will be part of the largest network of botanic gardens in conservation, and have access to a range of dedicated services:

- Grants through the Global Botanic Garden Fund
- The Botanic Garden Accreditation Scheme: www.bgci.org/accreditation
- Botanic Garden technical support and advisory services
- Subsidized training courses
- Discounted Congress attendance (BGCI Global, Education, and Horticulture Congresses)
- Prizes and awards
- BGCI's electronic publications, including BGjournal (conservation) and Roots (education)
- Members' Area Website and extra features to our global database resources: PlantSearch, ThreatSearch and GlobalTreeSearch.
- BGCI's upcoming redesigned website
  - Use of the new BGCI website to promote your events, news, and job listings
- Permission to use BGCI's logo and name
- A membership pack and Certificate of Membership

Changes to BGCI Membership Fees 2019

BGCI's Institutional Membership Fees were last updated in 2015. Since this update, exchange rates between the US Dollar, Pound Sterling, and the Euro have fluctuated. This has left BGCI with inequitable membership fees across the three accepted currencies.

In an effort to create equity across the three currencies, BGCI has updated its membership fees for 2019. In addition, BGCI has removed the category of Principal Member.

Please see below for the updated BGCI Institutional Membership Fees for 2019.

How did we come up with the new membership fees?

The changes to membership fees are not a price increase, but rather aim to achieve equity for members paying in different currencies. To determine the new fee:

- We converted all current fees to US Dollars using the UN Currency Exchange Rates for December 2018.
- We took an average across each grade.
- We converted back to the individual currencies using the UN Currency Exchange Rates for December 2018.
- We rounded to simple whole numbers. **The overall effect is a slight reduction in membership fees coming to BGCI but equity across the currencies**.

2019 Membership Categories

Category		GBP	USD	EUR
F	Institution Member (budget below USD 100,000)	£ 125	$ 150	€ 135
E	Institution Member (budget USD 100,000 - 750,000)	£ 270	$ 350	€ 325
D	Institution Member (budget USD 750,000 - 1,500,000)	£ 500	$ 650	€ 575
C	Institution Member (budget USD 1,500,000 - 2,250,000)	£ 675	$ 900	€ 800
B	Institution Member (budget more than USD 2,250,000)	£ 1,250	$ 1,500	€ 1,375

What about Patron Member fees?

BGCI will discuss the fee for Patron Membership with each individual Patron Member. If you are interested in becoming a Patron Member, please contact Paul Smith or Brian Lainoff.

Dr Paul P. Smith, Secretary General, Botanic Gardens Conservation International, paul.smith@bgci.org
Mr. Brian Lainoff, Head of Membership Strategy and Services, Botanic Gardens Conservation International, brian.lainoff@bgci.org

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PlantSearch:

BGCI's online database of plants in botanic gardens

PLANT SEARCH

BGCI's PlantSearch database is compiled from lists of living collections submitted to BGCI by the world's botanic gardens. The database presently includes over 1 million records.

What can you find in PlantSearch:

- An indication of how many gardens are growing a particular species and the ability to contact these gardens;
- Information on threat status of each taxa, provided by a direct link to IUCN Red Lists and CITES appendices;
- Species-specific nomenclatural and bibliographic information;
- Additional links for species listed as medicinal plants and crop wild relatives.

Benefits for your garden to participate in PlantSearch

- **Demonstrate the value of botanic gardens:** Help BGCI find out how many threatened plants are safeguarded in the collections of botanic gardens around the world.
- **Receive a FREE plant conservation audit:** PlantSearch easily identifies the globally threatened species in plant collections. You can access an online list of all taxa in your collection and any known conservation status within 24 hours of your data upload. PLUS, you will receive additional feedback on rarity in cultivation, and possible misspellings or questionable scientific names for your entire collection.
- **Share your collections with the world:** Uploading your collections data connects your garden with thousands of institutions and researchers via the online PlantSearch portal.

www.bgci.org/plant_search.php

for information on how your plant list can be added to PlantSearch in order to be included in the global plant conservation assessment.