

EUROGARD VII
PARIS

THEME A:
STRATEGIC FRAMEWORKS
AND BEST PRACTICE
FOR BOTANIC GARDENS

01.



THEME A



STRATEGIC FRAMEWORKS AND BEST PRACTICE FOR BOTANIC GARDENS

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LE PROJET SCIENTIFIQUE ET CULTUREL (PSC) DANS LES COLLECTIONS TROPICALES DES CONSERVATOIRE ET JARDINS BOTANIQUE DE NANCY (CJBN)



Photo credit : Pierre-François Valk / CJBM

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01. Résumé

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LES CONSERVATOIRE ET JARDINS BOTANQUES DE NANCY (CJBN) ONT ENTREPRIS EN 2009 L'ÉLABORATION D'UN PROJET SCIENTIFIQUE ET CULTUREL (PSC), DÉMARCHE INSPIRÉE DES MUSÉES (LOI RELATIVE AUX MUSÉES DE FRANCE). L'OBJECTIF ÉTAIT DE FAIRE UN BILAN DE LA SITUATION EXISTANTE SUR LE FONCTIONNEMENT DU JARDIN BOTANIQUE, À TOUS LES NIVEAUX : HISTORIQUE, GESTION, TERRAINS ET BÂTIMENTS, PERSONNEL, PUBLICS, MUSÉOGRAPHIE, ACTIVITÉS SCIENTIFIQUES ET CULTURELLES, PROGRAMMATION, PARTENARIATS, COMMUNICATION ET BIEN-SÛR AVANT TOUT COLLECTIONS.

L'étape suivante dans la démarche PSC a consisté en la rédaction d'un document définissant les orientations, les actions et moyens à mettre en œuvre pour réaliser les objectifs de l'établissement.

Concernant les collections, le travail s'est porté sur les collections de pleine terre, les collections tropicales, les collections du jardin d'altitude du Haut

Chitelet, ainsi que les collections patrimoniales (herbiers et bibliothèques). Au niveau des collections tropicales, au bout de plus de 30 ans de fonctionnement, les serres des CJBN ont rassemblé plus de 6 000 accessions de plantes en culture. Une réflexion a donc été engagée pour déterminer l'intérêt de ces collections, en lien avec d'autres grands jardins botaniques français, et cibler des groupes particuliers qui font la spécificité des CJBN.

01. Introduction

- Bour Aurélien
- Astafieff Katia



Photo credit : Pierre-François Valk / CJBN

UNE COLLECTION PEUT SE DÉFINIR COMME UN GROUPEMENT THÉMATIQUE DE PLANTES AYANT UNE VOCATION PARTICULIÈRE : SCIENTIFIQUE, PÉDAGOGIQUE, CULTURELLE, ESTHÉTIQUE, DE CONSERVATION OU SERVANT DE RÉSERVES POUR L'ENSEIGNEMENT OU LES EXPOSITIONS.

Chaque collection doit avoir une raison d'être précise, et doit être en accord avec les missions du jardin botanique. Il ne s'agit pas en effet d'avoir le plus grand nombre d'espèces possibles d'une même famille pour avoir une collection complète.

Nous nous sommes basés sur les critères proposés par le BGCI (Botanic Gardens Conservation International), qui doivent être remplis par une institution pour être considérée comme jardin botanique :

- un degré de permanence des collections raisonnable
- une base scientifique pour les collections
- une documentation précise sur les collections
- un suivi des plantes en collections
- un étiquetage adapté
- une ouverture au public
- la communication des informations aux autres jardins botaniques, institutions ou au public

- des échanges de graines et de matériels avec d'autres jardins botaniques ou institutions de recherche
- des recherches réalisées à partir des plantes en collection
- des programmes de recherche sur la taxonomie, grâce aux herbiers

Nous nous sommes également basés sur les niveaux de reconnaissance du CCVS (Conservatoire français des Collections Végétales Spécialisées) qui présente l'avantage de réaliser un recensement des collections importantes dans les différents jardins botaniques.

Etat des lieux

Trente-sept collections, d'importance variable, ont été initialement répertoriées, correspondant soit à des familles de plantes (Marantacées, Broméliacées, etc.), soit à des thématiques particulières (plantes des îles de l'océan indien, plantes insectivores, etc).

01. Etat des lieux

- Bour Aurélien
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Nous avons aussi identifié :

- **LES COLLECTIONS SPÉCIALISÉES**, de nature à être reconnues à l'échelle internationale. Elles sont centrales pour le jardin et susceptibles de servir pour des projets de recherches. Pour celles-ci, l'exhaustivité est un objectif, et la maintenance de la collection est une priorité.
- **LES COLLECTIONS NON SPÉCIALISÉES**, qui possèdent un nombre de taxons plus réduit. Elles contribuent à la diversité du matériel végétal disponible pour la pédagogie, la scénographie et les expositions.
- **LES COLLECTIONS THÉMATIQUES OU TRANSVERSALES**. Elles sont alimentées par les taxons issus des deux autres types de collection et constituent l'ossature des expositions permanentes et des parcours thématiques.

Points forts et points faibles des collections

Le bilan a permis de déterminer les points forts et les points faibles de collections. Les collections spécialisées sont les collections suivantes :

- Les Aracées
- Les Pélargoniums
- Les fougères tropicales et les plantes alliées (sélaginelles)
- Les plantes des îles Mascareignes et des Seychelles
- Les Fuchsias Lemoine (inclus dans la collection des Obtenteurs lorrains)

Ces collections sont en elles-mêmes des points forts pour le jardin botanique. Elles sont originales, riches et remarquables et ont un intérêt scientifique, pédagogique ou patrimonial important.

Ces collections ont cependant parfois été insuffisamment mises en valeur auprès du public. Si certaines actions ponctuelles ont été réalisées (exposition Pélargoniums ou présentation d'Aracées), les collections ne sont pas clairement identifiées auprès du public, faute de médiation spécifique à leur sujet. L'intérêt scientifique de certaines collections est encore à définir. Si un travail important a été réalisé au niveau des Aracées, les autres thématiques nécessitent encore une réflexion. La problématique de la conservation des espèces particulièrement rares est aussi à approfondir.

Les collections thématiques sont les suivantes :

- Les épiphytes
- Les plantes utiles à l'homme
- L'évolution des plantes terrestres
- Les relations plantes-insectes.

Ces collections constituent les piliers du jardin botanique. Leur potentiel pédagogique et scientifique nécessite d'être développé.

Si les plantes utilitaires sont régulièrement utilisées à des fins pédagogiques, les autres thématiques sont encore sous-exploitées.

Les collections non spécialisées sont les Bégonias, les Marantacées, ainsi que les plantes succulentes et les Cactacées. Elles contribuent à la diversité des plantes cultivées au jardin botanique. Elles ont notamment un intérêt pédagogique et attractif pour le public (plantes des milieux arides).

01. Actions

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Ce bilan a permis de réaliser un tri important dans les collections. Près de 1 500 accessions de collections non spécialisées ont été confiées à d'autres jardins botaniques dont le travail portait sur ces collections. Ce tri a permis aux CJBN de consacrer l'espace des serres et le temps de travail aux thèmes phares. Ainsi, depuis ce délai, plus de 1 000 nouveaux taxons ont enrichi les collections spécialisées et thèmes transversaux depuis 2009. Ce travail a été récompensé par la distinction du CCVS, qui a agrée 5 collections présentes dans les serres, dont deux en 2013 (les Aracées, les fougères tropicales, les plantes carnivores, les plantes myrmécophiles et le patrimoine horticole lorrain).

Par ailleurs, la reconnaissance de ces collections spécialisées à l'international a valu aux CJBN d'être sélectionnés pour accueillir le congrès de l'International Aroid Society (IAS) en 2009 et l'European carnivorous plants Exhibit and Exchanges (EEE) en 2013, deux événements majeurs dans les domaines concernés au niveau mondial.

Conclusions

Un effort important de communication doit être fait sur ces collections (site web, catalogues). Un ouvrage sur les plantes carnivores a été publié en 2014. D'autres efforts sont encore à réaliser pour mieux faire connaître les collections remarquables auprès du public.

Références

Cheney J., Navarrete Navarro, J. & Wyse Jackson, Peter (edited and compiled by), 2000. *Action Plan for Botanic Gardens in the European Union*, European Botanic Gardens Consortium.

Direction des musées de France, 2007. *Le projet scientifique et culturel*, Muséofiche 2.

Joly, M.-H., 2009. Le Projet Scientifique et Culturel a-t-il de l'avenir? *La lettre de l'OCIM*, 124 | juillet - août 2009.

<http://apps.kew.org/wcsp/home.do>

https://www.bgci.org/files/Worldwide/Botanic_Gardens/plant_collections_policy.pdf

https://www.bgci.org/resources/living_collections/

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

<https://www.mobot.org/MOBOT/Research/APweb/>

<https://worldplants.webarchiv.kit.edu/ferns/>

THE CULTIVATION METHOD OF *WELWITSCHIA MIRABILIS* HOOK.F. IN RHIZOBXES

Photo credit : The 11-years old plant XI of *Welwitschia mirabilis* with male inflorescences (2014),
Ewa Kazmierczak-Grygiel



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01. Abstract

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***WELWITSCHIA MIRABILIS* HOOK.F. (WELWITSCHIACEAE, GYMNOSPERMS) IS AN ENDANGERED AND STRICTLY PROTECTED SPECIES. IT IS A RARE PLANT IN BOTANICAL GARDENS.**

Among other things, it has low tolerance to transplanting. In the literature, it was recommended to sow seeds in a permanent place and to cultivate *Welwitschia* in a drain-pipe. This system makes repotting very difficult or impossible.

Seeds of *Welwitschia mirabilis* were collected *ex situ* in botanical gardens and sown from 2003 to 2004. For sowing seeds special containers made out of transparent plastic (rhizoboxes) and having inner pots out of metal net were used. This facilitates bedding the seedling out to the next container. For sowing we used porous soil of similar composition as for repotting seedling or young plants, with a defined amount of micro and macro elements.

Seedlings were kept in a laboratory condition in artificial light (photoperiod 12h/day), at temperature between 25-30°C, and 25-45% humidity. Older plants were grown in glasshouse conditions with lamplight. The plants were regularly watered. Depending on the season, one has to take care of high air humidity, sufficient ventilation and fertilization.

Seedlings, as well as older plants, of *Welwitschia*, were replanted at different stages. A few plants were cultivated in the same pot for a long period of time.

The growth and development of plants after repotting proceeded without disruption. This applied system of containers allowed us to transplant older plants. Our study shows that with this well-adapted method, *Welwitschia mirabilis* has a high tolerance to transplanting.

01. Introduction

• Kazimierczak-
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Photo credit : The 11-years old plant XI of *Welwitschia mirabilis* with male inflorescences (2014), Ewa Kazimierczak-Grygiel

***WELWITSCHIA MIRABILIS* HOOK.F. (WELWITSCHIACEAE, GYMNOSPERMS) IS AN ENDANGERED AND STRICTLY PROTECTED SPECIES. ITS DISTRIBUTION IS CONFINED TO A NARROW COASTAL STRIP IN THE NAMIB DESERT FROM KUISEB IN SOUTH WEST AFRICA TO CABO NEGRO IN ANGOLA (KERS 1967).**

Welwitschia is rare in botanical gardens, because it is a difficult plant to grow. Among other things, it exhibits low tolerance to transplanting. In the literature, it was recommended to sow seeds into their permanent location and to cultivate *Welwitschia* in a drain-pipe (Herre, 1954; Jaarsveld, 1992). This system makes repotting very difficult or even impossible.

Materials & methods

Seeds of *Welwitschia mirabilis* were collected ex situ in botanical gardens and sown from 2003 to 2004. For sowing seeds, special containers made out of transparent plastic sized 60 x 200 x 400 mm and equipped with inner pots out of metal net with dimensions of 50 x 70 x 100 mm were used. Seedlings were repotted in the same rhizoboxes, and small plants in rhizoboxes with dimensions of 115 x 260 x 400 mm (**Photo 1**). For sowing we used porous soil of similar composition as for repotting seeds, with a defined amount of micro and macro elements. The soil consisted of fine gravel and fine sand, seramis,

acid peat and leaf-litter earth and was sterilized via soil steaming and fungicide treated just before repotting.

Seedlings were kept in a laboratory condition in artificial light (photoperiod 12h/day), at temperature between 25-30°C, and 25-45% humidity. Older plants were grown in glasshouse conditions with lamplight. The plants were regularly watered. High air humidity, sufficient ventilation and fertilization need to be taken care of, depending on the season. Within the first days after repotting, the plants were put in diffused light.

Data regarding morphological development of seedlings have been gathered systematically by measuring length and width of cotyledons and leaves within 12 months and root growth within 2 months after sowing.

For repotting, seedlings at various development stages were chosen, i.e. between the 50th and 517th day after sprouting.

01. Materials & methods

• Kazimierczak-Grygiel Ewa

The four stages of plant development were set on the basis of the ratio of leaf length to cotyledon length (**Tab. 1**). A movable front wall and an internal container made it possible to transplant plants with little harm to the upper part of the root ball.



> PHOTO 1

Rhizoboxes made of transparent plastic. One or two transparent walls screw together

plant remaining plants in the same way. Observations of the seedlings' development allowed us to distinguish growth stages of juvenile plants based on the proportion of length of their cotyledons and leaves: $L < Li$, $L = Li$, $L = 2Li$, $L > 3Li$ (L – leaves, Li – cotyledons; **Tab. 1**). We removed the bigger part of the root prior to placing the plant in a new container and left only less than 18 cm long, regardless of the original length of the root and age of the plant. Shortening of roots did not cause dieback or even noticeable slower growth of plants.

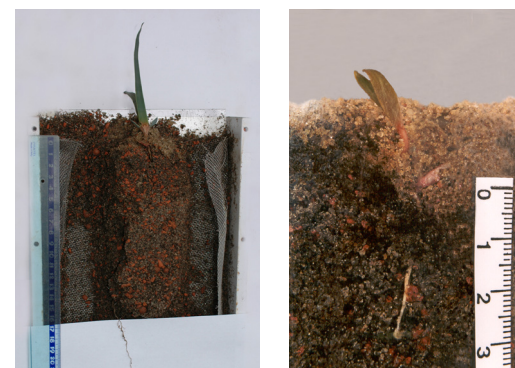
Four plants of *Welwitschia mirabilis*, were repotted as oldest plants (VII, VIII, X, XI; **Tab. 1**), i.e. from 8 to 10 years after sprouting. The growth and development of plants after transplanting proceeded without disruption.

Two plants were cultivated in the same pot for a long period of time i.e. over 7 years (plant IV and XII; **Tab. 1**). In this case, the growth of the root system and the leaf weight were limited (**Photo 3**). The applied system of containers allowed us to transplant older plants without problems.

Results

The seedlings exhibited important root growth in length, i.e. from 2,6 cm to 4,8 cm before cotyledons appeared on the soil surface (**Photo 2**). When leaf primordia appeared, the root length amounted from 3,3 cm to 6,7 cm. Within 60 days the seedlings' roots reached the bottom of the containers. At this time, some seedlings started to produce lateral roots. The average root growth in length for all observed plants amounted to 0,29 cm/day.

Replanting of the first three plants ended with success despite various age and development stage of these plants. Therefore, we have decided to trans-



> PHOTO 2

Left: Seedling „II” - 2 days after germination (2003). Right: The young seedling „V” - repotted in 2003. Leaves longer than cotyledons ($L = 2Li$), the root about 30 cm long

01. Results

• Kazimierczak-Grygiel Ewa

> PHOTO 3

Left: The main root of plant „XII” (2004) during first repotting (7 years old, 2012). **Right:** The dense root system with soil protected with the net



Marking of the plant	Date of sowing	Date of germination	Date of 1 st repotting	Ratio of leaf / cotyledon	Plant's age [days]	Date of 2 ^d repotting	Plant's age [years]
III	2003-04-04	2003-04-22	2003-06-11	L<L1	50	-	-
X	2004-05-14	2004-06-13	2004-08-11	L<L1	59	2013-08-20	9
IX	2004-05-14	2004-06-08	2004-09-15	L<L1	99	-	-
V	2003-04-04	2003-04-25	2003-09-01	L=2L1	129	-	-
VIII	2003-11-20	2004-01-01	2004-07-21	L=2L1	202	2012-07-12	8
XI	2004-05-14	2004-06-16	2004-09-15	L=L1	91	2013-10-17	9
VII	2003-04-04	2003-04-25	2003-07-17	L=L1	83	2013-11-06	10
VI	2003-04-04	2003-04-23	2003-09-20	L>3L1	150	-	-
II	2003-04-04	2003-04-25	2004-09-23	L>3L1	517	-	-
XII	2004-09-29	2004-10-18	2012-08-08		2851	-	> 7-
IV	2003-04-04	2003-04-22	2012-08-22		3410	-	> 9-

Discussion

In the literature, there are not detailed descriptions available of *Welwitschia mirabilis* seedlings or plant replanting. Any information on the use of rhizobxes in the cultivation of this plant cannot be found either. Experiments in various botanical gardens show that the first eight months are critical as far as the cultivation of *W. mirabilis* is concerned (Jaarsveld, 1992). Due to the tap root system, repotting is possible only within the first weeks or not until several years have passed, when plants are older.

The pace of root growth in length of *W. mirabilis* in in situ research amounted initially to 0,5-1 cm/day, reaching 1 m within 8 months. Such pace of root development facilitates reaching wet stratum in soil (Eller et al., 1983; von Willert, 1994; Henschel & Seely, 2000). In the described experiment, the average root growth for 5 plants amounted to 0,29 cm/day. The taproot early formed lateral roots, which intercrossed and formed natural grafts with one another (Rowley, 1972).

In the AMU Botanical Garden first seedlings sown in the years 1998-2002 were cultivated successfully in traditional ceramic or plastic pots. It was, however, technically difficult to transplant them. For sowing seeds and transplanting plants of *W. mirabilis* from 2003 to 2004 special rhizobxes were used, which allowed us to observe the development of the tap root system and eliminate the necessity for repotting seedlings within the first years (Kazimierczak-Grygiel, 2002) (Photo 4).

Statistical presentation of obtained results was limited due to small sample size. Experiments obtained at the Adam Mickiewicz Botanical Garden

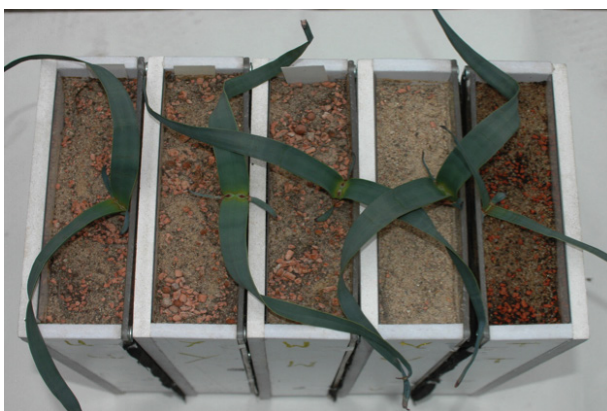
> TABLE 1

Date of plant's age and repotting stage

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• Kazimierczak-Grygiel Ewa

show that cultivation of *W. mirabilis* plants, including replanting of seedlings and juvenile plants, does not cause any problems.



> PHOTO 4

Bottom: The comparison of the growth of 5 seedlings (2003) growing in rhizoboxes: „II”, „VI”, „IV”, „III”, „VII”. Above: The comparison of the growth of 3 plants (2003) in 2013: „II”, „VI”, „III”

Conclusions

1. The described method enabled repotting of *Welwitschia* plants at various development stages,
2. The application of rhizoboxes with an inner pot facilitates repotting and limits the damage to the root system during repotting,
3. *Welwitschia* plants cultivated in containers require regular watering, fertilization and light exposure,
4. Rhizoboxes ensure successful growth of *Welwitschia* plants for even up to twenty years,
5. *Welwitschia mirabilis* exhibits high tolerance to transplanting.

01.

References

• Kazimierczak-
Grygiel Ewa

Eller, B.M. et al., 1983. Ecophysiological studies on *Welwitschia mirabilis* in the Namib Desert, *S. Afr. J. Bot.* 2: 209-223.

Henschel, J. R. & Seely, M., 2000. Long-term growth patterns of *Welwitschia mirabilis*, a long-lived plant of the Namib Desert (including a bibliography). *Plant Ecology* 150 (1-2): 7-26.

Herre, H., 1954. *Welwitschia mirabilis* Hook.f. from seed to seed in the Botanic Garden of the University of Stellenbosch. *C.P.J.S. Afr. Bot.* 20: 23-24.

Jaarsveld, E., 1992. *Welwitschia mirabilis* in cultivation at Kirstenbosch. *Veld and Flora* 78 (4): 118-120.

Kazimierczak-Grygiel, E., 2002. Rozmnażanie i uprawa *Welwitschia mirabilis* Hook. f. w Ogrodzie Botanicznym UAM w Poznaniu, *Prace Ogródu Botanicznego UAM* 1: 141-151.

Kers, L. E., 1967. The distribution of *Welwitschia mirabilis* Hook. f. *Svensk. Bot. Tidskr.* 61: 97-125.

Rowley, G., 1972. Voyage into the impossible – I meet *Welwitschia*. *Journal of The Royal Horticultural Society* 8: 346-350.

Willert, J.D. von, 1994. *Welwitschia mirabilis* Hook. f. – Das Überlebenswunder der Namibwüste, *Naturwissenschaften* 81: 430-442.

THE INTERNATIONAL PLANT EXCHANGE NETWORK (IPEN) AND THE NAGOYA PROTOCOL

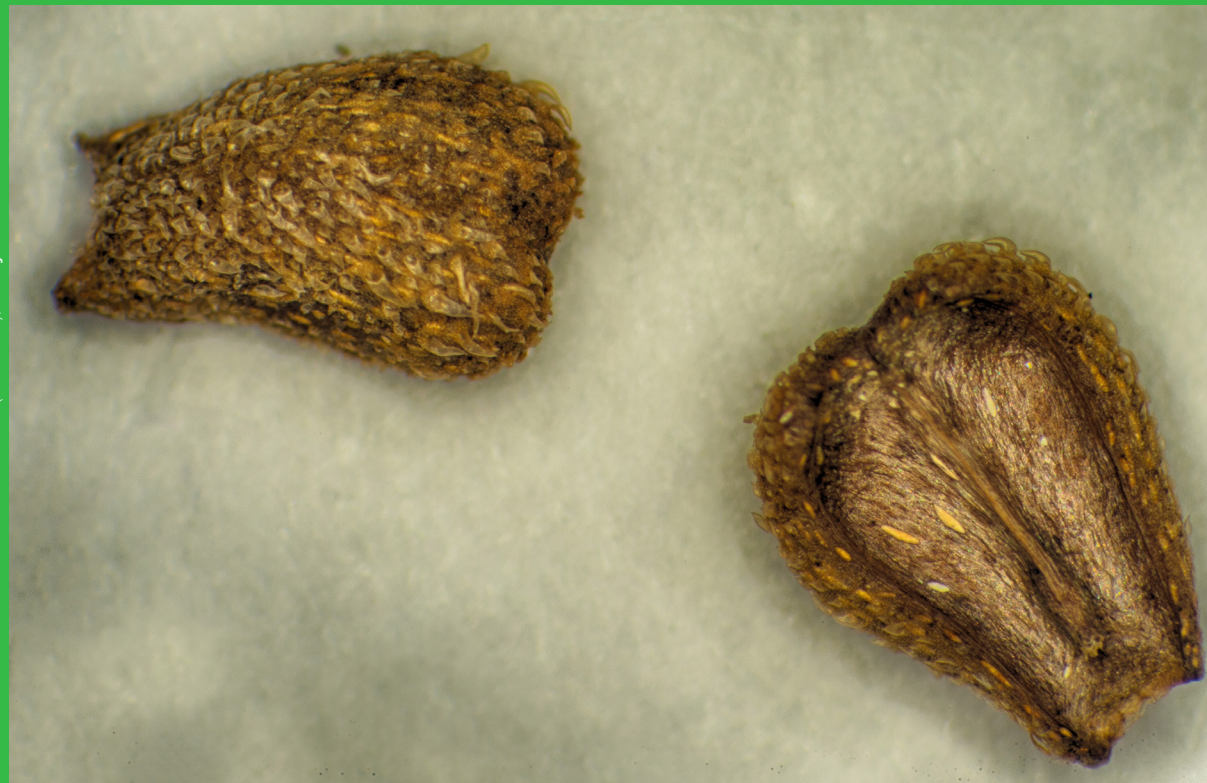


Photo credit : Seeds of *Richardia brasiliensis* Comes (Rubiaceae), **Rudolf Fromm**iak

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01. Introduction

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Photo credit : Seeds of *Richardia brasiliensis* Gomes (Rubiaceae), Rudolf Hromniak

THE INTERNATIONAL PLANT EXCHANGE NETWORK (IPEN) WAS ESTABLISHED IN 1998 AS A SYSTEM FOR BOTANIC GARDENS TO FACILITATE THE TRADITIONAL EXCHANGE OF LIVING PLANT MATERIAL FOR RESEARCH, CONSERVATION, EDUCATION AND FOR RAISING PUBLIC AWARENESS ON BIODIVERSITY (LOBIN ET AL., 2004, VON DEN DRIESCH ET AL., 2005).

IPEN endorses the principles of regulating access to genetic resources and a fair and equitable sharing of benefits arising from their utilization (in short: Access and Benefit-sharing, ABS) laid down in Article 15 of the *Convention on Biological Diversity* (CBD). Therefore, IPEN is designed to be transparent and trustworthy to providers of plant genetic resources. At the same time it intends to mitigate negative effects for Botanic Gardens potentially caused by additional bureaucracy related to material transfer or documentation. IPEN has received recognition as a best practice model and as an instrument for implementing the ABS principles of the CBD (e.g., IEEP et al., 2012, Greiber et al., 2012 and CBD, 2013). IPEN is open to botanic gardens worldwide and today has 191 members from 33 countries¹.

With its focus on the ABS, the IPEN system was well prepared for the new, legally binding aspects of the “*Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention of Biological Diversity*” (NP). With the coming into force of the NP on 12th October 2014, IPEN had to formally incorporate the elements of the NP into

its regulations. The present paper intends to inform about the general principles of IPEN and the recent steps taken to ensure the ongoing functionality of the IPEN in the age of the Nagoya Protocol. The adapted IPEN Code of Conduct has now been opened for signature by new members, but also by current members, as IPEN requires the renewal of memberships after 5 years.

IPEN coordination group (formerly called IPEN task force) and secretariat

The day-to-day work of IPEN, which includes answering questions of IPEN members and non-members about the CBD- and NP-consequences for Botanic Gardens or the scope and intentions of IPEN, is carried out by the IPEN Coordination Group. This group of botanic gardens network representatives (actual composition see **footnote 1**) are nominated by botanic gardens net-

¹
www.bgci.org/policy/ipen/

01. IPEN coordination group (formerly called IPEN task force) and secretariat

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works in consultation with the *European Botanic Gardens Consortium*² (for Europe) and with BGCI³ or IABG⁴ (for non-European gardens). To support the IPEN Coordination Group in handling the expected additional work in the context of the NP-obligations, an IPEN Secretariat was established in 2017. The Secretariat is hosted by the Botanical Garden of the University of Vienna, (contact address: Rennweg 14, 1030 Vienna, Austria, ipen@univie.ac.at).

Major tasks of the Secretariat and the Coordination Group are the development and update of the IPEN in accord with the developments of the international biodiversity conventions, especially the CBD and the NP, and the promotion of IPEN activities and member interests in the national and international context. In consultation with national botanic gardens networks, the IPEN Coordination Group also assesses if applicants meet the IPEN criteria, and deals with IPEN registrations at the IPEN website (<http://www.bgci.org/resources/ipen/>). All applications and questions to the IPEN Coordination Group shall be directed to the Secretariat. The Secretariat is also in charge of keeping an updated list of IPEN-members and of relevant contacts. In the future, it is intend to set up a regular information tool for IPEN members related to new developments in ABS and NP regulations and their relevance for Botanic Gardens.

IPEN membership

In order to become an IPEN member, an applicant must be a botanic garden in the definition outlined in the International Agenda for Botanic Gardens (BGCI, 2012, see also <http://www.bgci.org/ourwork/1528>). It must be registered by BGCI (in BGCI's Garden Search database: http://www.bgci.org/garden_search.php)

in order to have a Garden Institution Code necessary for issuing IPEN numbers (**see below**). Private individuals are not eligible for membership. The applicant has to be a legal entity or part of a larger legal entity, e.g., of a university.

An application for IPEN-membership has to be sent to the IPEN Secretariat, following the instructions outlined on the IPEN website (http://www.bgci.org/policy/Criteria_for_IPEN_membership_and_registration/). This includes a commitment to implement the "main principles of the IPEN" as described in the Code of Conduct. The IPEN Coordination Group handles the application and, if appropriate, seeks advice about the application from the respective national or regional networks, BGCI or IABG.

The IPEN code of conduct

The IPEN Code of Conduct⁵ is the core element for the functionality and understanding of the IPEN. This document has to be endorsed by every garden applying to join the network as a commitment to act in accord with the IPEN requirements. It contains rules and regulations related to the acquisition, documentation, maintenance and supply of living plant material within and beyond the IPEN system as well as on benefit-sharing. It also provides a standardized template for Material Transfer Agreements (MTA) to be used for exchanges with institutions that are not member of the IPEN. A key aspect of the IPEN Code of Conduct is that plant material transferred within the network may only be used for non-commercial purposes of scientific research, education, conservation, raising public awareness and display.

2

www.botanicgardens.eu

3

Botanic Gardens
Conservation
International
(www.bgci.org)

4

International Association
of Botanic Gardens
(http://iabg.scbg.cas.cn/)

5

Available on the BGCI
webpage (<http://www.bgci.org/files/ABS/IPEN/IPEN%20Code%20of%20Conduct.doc>).

01. The IPEN code of conduct

- Kiehn Michael
- Löhne Conny

In 2017, the wording of the Code of Conduct has been adjusted in order to make full reference to the Nagoya Protocol and to ensure compliance with its provisions. No substantial changes to the Code of Conduct were necessary, since the original version was designed for compliance with the ABS regulations of the CBD, which were specified but not altered by the NP. The new version of the Code of Conduct now includes explicit references to the NP at the appropriate positions and exemplifies its implications. It also provides clearer guidance how material can leave IPEN (including commercialisation).

The IPEN number: basis for documentation and material transfer

Every plant accession transferred within the IPEN must carry an IPEN number. This number serves as a unique identifier of the plant material. It therefore must be created by the first garden that introduces an accession to the IPEN, and it has to remain connected to the accession and all its descendants through all generations to come, including any further transfer within IPEN. The IPEN number is a code identifying the garden which created the number, the country of origin, and the presence or absence of restrictions regarding the use of the material (**details see below**). Thus it allows the tracing of the origin of the plant genetic resource at every stage of the plant exchange within the network. This creates transparency for the country of origin and ensures that its interests do not get lost along the chain of transfers within IPEN.

The full set of information relevant for this accession, e.g., complete taxonomic data, type of material, source, permits related to the acquisition or use, and any conditions or terms of the country of origin, including original PIC and MAT⁶ documents, stay at the garden which entered the material into the IPEN and created the IPEN number. This garden is immediately identifiable by the IPEN number. For all other gardens, only the IPEN number (and in case of any transfer or use restrictions details on such restrictions) is needed as documentation. This is easily manageable and secures the interests of provider countries.

The IPEN number is composed of four elements. They are presented and explained here with an example from the Botanical Garden of the University of Vienna, taken from its seed catalogue for 2010:

AT-0-WU-CAR100208 is the IPEN number connected to an accession of *Heliospermum pusillum* (Waldst. & Kit.) Rchb.

“AT” (for Austria) is the code for the country of origin (two positions in the IPEN number, abbreviation according to ISO 3166-1-alpha-2; if the origin is unknown: “XX”). “0” indicates: no restrictions on transfer or non-commercial use of the material exist (one position in the IPEN number, “1” would indicate that there are restrictions). “WU” (= University of Vienna) is the unique Garden code of the institution that first introduces the material to the IPEN. Those garden codes can be found on the BGCI website under “Garden Search”. “CAR100208” is the specific identification number (accession number) used by the Botanical Garden of the University of Vienna. Any other IPEN member receiving material with such an IPEN number material might use their own accession number for internal purposes, but are obliged to keep the origi-

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PIC = Prior Informed Consent issued by the providing country's authorities. MAT = Mutually Agreed Terms between provider and user of the respective genetic resources.

01. The IPEN number: basis for documentation and material transfer

- Kiehn Michael
- Löhne Conny

nal IPEN number and to forward it with any future transfer of this material to third parties. As already reported by Kiehn (2015) the traceability within the IPEN system has already been proven for this IPEN number: the *Index Seminum* 2012 of the Botanic Garden of the University of Münster (Germany) offers seeds of *Silene pusilla* Waldst. & Kit. The IPEN number connected with this position (AT-0-WU-CAR100208) clearly indicates that the seeds offered here represent offspring of material from the 2010 catalogue of the Botanical Garden of the University of Vienna; in spite of different scientific names.

Immediate minimum obligations regarding documentation

An IPEN member does not immediately have to put all its collections into the IPEN documentation system (i.e. adding IPEN numbers to all accessions). The minimum obligation is to include those accessions which are offered for exchange/transfer within the IPEN system. At least for those plant genetic resources an IPEN number must be issued by the member garden, and documentation must be stored to be made available upon request. Ideally (and depending on infrastructural, personal and financial resources), other accessions can also be included into the IPEN system (on a voluntary basis).

Material transfer to institutions outside of IPEN

The IPEN Code of Conduct clearly describes the procedures to be followed by member gardens if plant genetic resources are requested by an institu-

tion that is not a member of IPEN. In such a case, the potential recipient will have to sign, at minimum, an IPEN Material Transfer Agreement, which will bind him to the same terms and conditions as applicable within IPEN (i.e. non-commercial purposes of scientific research, education, conservation, raising public awareness and display). The recipient has to keep the full documentation for that material. Depending on the conditions defined by the providing country for the material in question, such a transfer might also require additional *a priori* steps by the potential recipient, i.e., obtaining of a PIC or MAT for the intended uses. This secures ABS and NP compliance for material leaving the IPEN.

Commercialization

The traceability of the source of plant genetic resources in the IPEN system also provides a sound basis for every step necessary for an intended commercial use of plant genetic resources in accord with the CBD and the NP. Anyone who intends to use material transferred under the IPEN system has to check first if the providing country of this material regulates access to and use of its genetic resources.

If so, the potential commercial user has to seek PIC and MAT for the intended use from this country's authorities. Only then and in accord with the obligations stated there, this material, now element of separate agreements, can become subject of commercial utilization. This holds true independent of the question whether an IPEN member or a third party intends to use the material for a commercial purpose.

01. IPEN and benefit-sharing

- Kiehn Michael
- Löhne Conny

IPEN members, through their endorsement of the IPEN Code of Conduct, express their commitment for a fair and equitable sharing of benefits arising from utilisation of genetic resources. The IPEN system has been established in order to facilitate material exchange for non-commercial purposes in botanic gardens, but it also provides options and clear guidelines for commercial use of such material. Nevertheless, misperceptions of IPEN in this regard were expressed, e.g., by Kamau *et al.* (2010: 257): “*Networks of ex situ collections exist that exchange biological material among themselves and with researchers fostering taxonomic research, but excluding commercialisation and, in consequence, the regulation of benefit sharing*”. Such misunderstanding needs to be actively counteracted, e.g. by better communicating IPEN activities in benefit-sharing like joint excursions or projects with institutions in countries of origin, sharing of research results, knowledge and know-how transfers, training, staff exchanges, donation of equipment and educational material, community development activities and monetary benefits from commercialisation projects (von den Driesch *et al.*, 2005: 39, IEEP 2012).

work and the needs of botanic gardens, allowing botanic gardens to continue their efforts related to conservation, research and public outreach. They also will continue to promote botanic gardens` ideas and the corresponding needs towards relevant (political) stakeholders on national, regional and international levels. Ideally, the implementation of the NP could even lead to a harmonized accession and documentation policy for non-commercial purposes with standardized procedures for PICs and MTAs. Strengthening IPEN (by increasing the number of members and the number of countries represented) also strengthens the position of the IPEN Coordination Group in such negotiations. There is still some doubt about the functionality of IPEN in securing the transparency of transfers of plant genetic resources for provider countries (Godt, 2013: 260f.). As such a functionality is a requirement for the acceptance and credibility of the system, IPEN structures and operations needs to be further promoted and proven by best practice examples.

Outlook

The IPEN framework has proven to reduce the administrative burden for its member gardens when exchanging plant material. IPEN has been recognized as best practice model for ABS-compliance, and it was stated that IPEN deserves support for these efforts (see, e.g., Godt, 2013: 261). The IPEN Code of Conduct has been adjusted to fully comply with the provisions of the Nagoya Protocol. The IPEN Coordination Group continues to inform botanic gardens about the developments connected with the NP. Its members will stay in contact with CBD authorities to further raise awareness on the

01. References

- Kiehn Michael
- Löhne Conny

BGCI, 2012. *International Agenda for Botanic Gardens in Conservation: 2nd Edition*. Botanic Gardens Conservation International, Richmond, UK. http://www.bgci.org/policy/international_agenda/.

CBD – Convention on Biological Diversity, 2013. *Survey of model contractual clauses, codes of conduct, guidelines, best practices and standards by the United Nations University – Institute of Advanced Studies*. Information document for the Third Meeting of the Open-Ended Ad Hoc Intergovernmental Committee for the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (UNEP/CBD/ICNP/3/INF/2). <https://www.cbd.int/kb/record/meetingDocument/96397?RecordType=meetingDocument>.

Godt, C., 2013. Networks of ex situ collections in genetic resources. In: Winter, G. & Kamau, E. C. (Eds.): *Common Pools of Genetic Resources*. Routledge, Abingdon/Oxon: 246-267.

Greiber, T., Peña Moreno, S., Áhrén, M., Nieto Carrasco, J. Kamau, E.C., Cabrera Medaglia, J., Oliva, M.J. & Perron-Welch, F., 2012. *An Explanatory Guide to the Nagoya Protocol on Access and Benefit-sharing*. IUCN, Gland, Switzerland.

IEEP, Ecologic and GHK, 2012. Botanic Gardens – sectoral sheet. In: *Study to analyse legal and economic aspects of implementing the Nagoya Protocol on ABS in the European Union. Final report – Annexes: 164-179*. <http://ec.europa.eu/environment/nature/biodiversity/international/abs/pdf/ABS%20FINAL%20REPORT%20-%20Annexes.pdf>.

Kamau, E.C., Fedder, B. & Winter, G., 2010. The Nagoya Protocol on Access to Genetic Resources and Benefit Sharing: What is New and what are the Implications for Provider and User Countries and the Scientific Community? *Law, Environment and Development Journal* 6/3: 246-262. <http://www.lead-journal.org/content/10246.pdf>.

Kiehn, M., 2015 (2014). The International Plant Exchange Network and the Nagoya Protocol of the Convention on Biodiversity. In: Krigas, N., Tsoktouridis, G., Cook, C.-M., Mylona, P. & Maloupa, E. (Eds.) *European botanic gardens in a changing world: insights into Eurogard VI: 377-384*; Balkan Botanic Garden of Kroussia (Hellenic Agriculture Organisation-Demeter), Thessaloniki, Greece.

Lobin, W., von den Driesch, M., Klingenstein, M., van den Wollenberg, B., Delmas, M., Helminger, T., Kiehn, M., Laine, K., Schumacher, F. & Waldren, S., 2004. International Plant Exchange Network (IPEN). An exchange system for botanic gardens for non-commercial purposes according to the CBD. In: Stolpe, G. & Fischer, W. (Eds.) *Promoting CITES-CBD Cooperation and Synergy. BfN Skripten* 116: 231-234. Bonn, German Federal Agency for Nature Conservation.

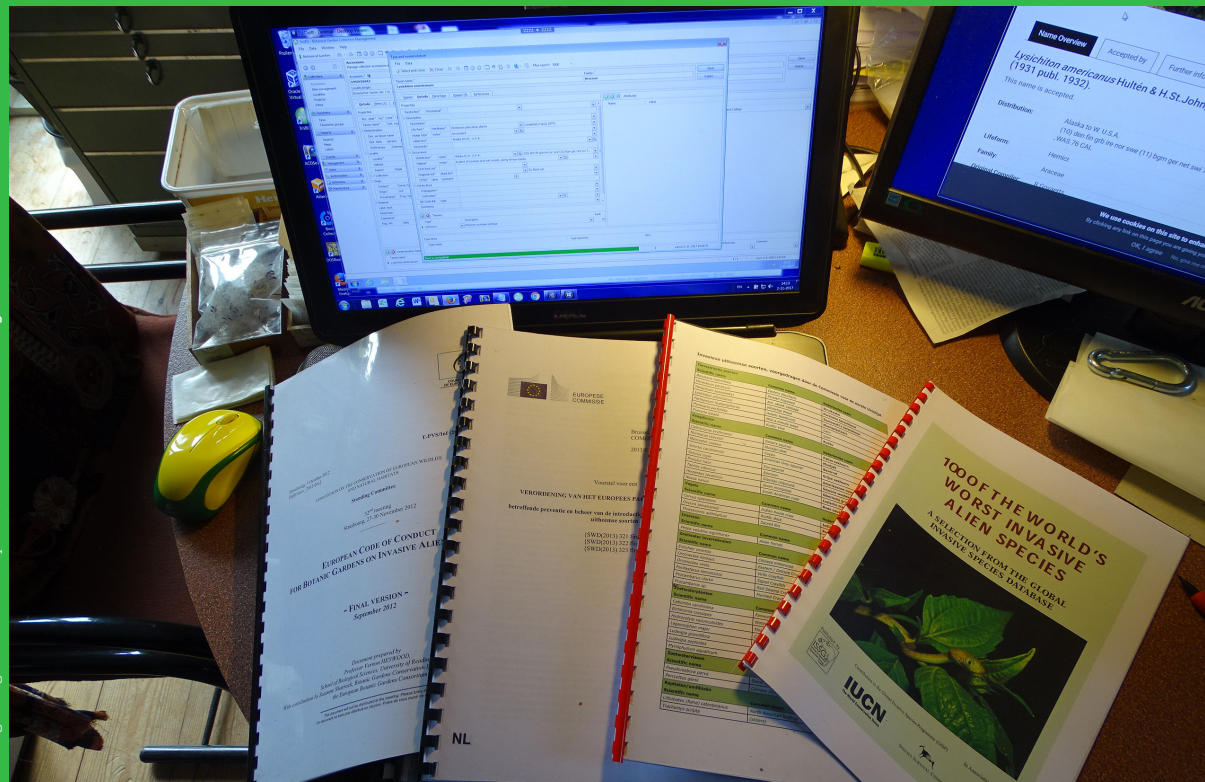
von den Driesch, M., Lobin, W., Helminger, T., Gröger, A. & van den Wollenberg, B., 2005. The International Plant Exchange Network (IPEN): An instrument of botanic gardens to fulfil the ABS provisions. In: Feit, U., von den Driesch, M. & Lobin, W. (Eds.): *Access and Benefit-Sharing of Genetic Resources. Ways and means for facilitating biodiversity research and conservation while safeguarding ABS provisions. BfN Skripten* 163: 31-44. Bonn: German Federal Agency for Nature Conservation.

**WHERE LIVING COLLECTIONS
AND CONVENTION REGULATIONS MEET.
A NEED FOR STRENGTHENING NETWORKING
WITHIN THE BOTANIC GARDEN COMMUNITY**

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Photo credit: The pile of documents of important regulations, on top of which the four most recent ones regarding invasive alien species, Bert van den Wollenberg



01. Abstract

• *van den
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WE SEE BOTANIC GARDENS AS PLACES OF QUIET CONTEMPLATION. BEHIND THE SCENES HOWEVER, BOTANIC GARDENS HAVE TO INCREASINGLY QUICKLY ADDRESS INTERNATIONAL LAW, AND KEEP UP WITH ANY CHANGES. WITH INCREASING URGENCY AND SPEED, BOTANIC GARDENS HAVE TO ADDRESS NEW LEGAL REQUIREMENTS.

In the past CITES was the most notable convention to reckon with, but now there's the Nagoya Protocol, invasive species, biosafety, and safety requirements regarding visitors and staff.

At the same time, individual botanic gardens are increasingly facing budget restrictions, leading to less garden staff, where more garden staff would be the necessary development. Apart from knowing how to propagate plants, we now also have to know the laws pertaining to them.

Unless the botanic garden community develops mechanisms to deal more efficiently with the challenges posed by these conventions and their resulting national laws, they increasingly run the risk of legal enforcement. A well-known example is CITES, where any plant of which the name needs to be changed, either for nomenclatural or taxonomic reasons, or following proper identification, may lead to a name that features on the CITES appendix 1/ EU

annex A list, for which a permit is required to have plants of that species in the collection. Legal staffs have a more fixed perception of names than we do. For the Nagoya Protocol, and the overarching CBD, proper names are also vitally important.

It is not by lack of interest or commitment, that botanic gardens run the risk of violating such regulations, but by lack of efficient mechanisms and protocols within botanic gardens, whereby they unknowingly may make mistakes. This is an even bigger challenge for the smaller gardens, where specialised staff is often lacking. Where individual gardens cannot keep up, networks can be the key to new solutions that renders international law manageable to individual botanic gardens.

01. Introduction

• van den
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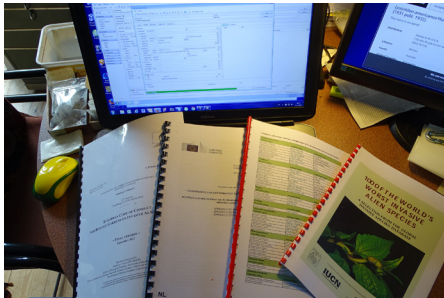


Photo credit : The pile of documents of important regulations, on top of which the four most recent ones regarding invasive alien species, Bert van den Wollenberg

IN THIS DAY AND AGE BOTANIC GARDENS ACROSS THE GLOBE ARE INCREASINGLY CHALLENGED TO MANAGE THEIR PLANT COLLECTIONS IN SYNC WITH A STEADILY GROWING NUMBER OF EUROPEAN AND INTERNATIONAL REGULATIONS, INCLUDING OCCASIONAL EMERGENCY MEASURES ISSUED BY THE EU WHICH REQUIRE A QUICK RESPONSE.

At the same time botanic gardens in general are facing stricter budgets rendering employment of more staff, in particular specialised staff, difficult if not impossible. Since implementation of legal requirements must be a priority, it follows that botanic gardens individually, but also the respective networks at various levels should explore possibilities of increasing efficiency in the current *modus operandus* to free up time.

Since many important regulations pertain to the plant collection, it is obvious that senior staff involved in the plant collection management, such as curators, collection administrators and scientific staff will be somehow involved in addressing the relevant legal requirements. An obvious efficiency effort should therefore be directed towards the collection management. This paper will focus on some major regulations, their respective collection management relevance, and their current problems to keep up. Finally, conclusions will be drawn and suggestions made on which level the respective issues could best be resolved, and how.

Relevant issues

For all conventions, regulations, and laws pertaining to plants individual botanic gardens need to know to which plants these pertain, and/or under what circumstances. Finding this out is not at all simple, and very time consuming. In addition to this, much if not all revolves around the proper names of the plants. Awareness of the currently accepted names, differences in the names used by various sources for plant names or regulations, different taxonomies used, and proper identification of the plants themselves all work towards confusion and as a result, potential non-compliance, despite the good intentions botanic gardens generally have. Some of the major conventions and regulations are discussed here. Each convention or regulation poses its own challenges for the collection managers to face, challenges which are discussed from the perspective of the collection management at an individual botanic garden.

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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES)

Nowadays botanic gardens in the EU may need permits for plant in their collection which are listed in CITES appendix I / EU annex A to possess them legally. In the EU, CITES is implemented via a series of EU regulations, known as the EU Wildlife Trade Regulations. The basic regulation is the *Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein*. In addition, there are regulations on implementation, permits, and suspension (to suspend import of a particular species into the EU). The EU Annexes A-D are not quite the same as the CITES appendices I-III, some species are “upgraded” in the EU annexes in comparison to their CITES pendant to accommodate stricter policies when deemed necessary. EU Annex D has no CITES pendant but exists of some CITES Appendix III-listed species and some non-CITES-listed species.

Since there is no “EU-law”, all EU regulations are implemented via national legislation in all EU Member States. Each Member State has the prerogative to apply stricter conditions than agreed within the Council of Europe. This means that botanic gardens within the EU must check the relevant laws of their own country, not the EU regulation or the CITES convention.

Whether or not a permit is needed also depends on whether such plants originate from the wild, and whether they were obtained after the coming into force of CITES in the country where the garden is situated. If such plants originated from cultivation, this would not be the case, and then such plants would be treated as if occurring on CITES appendix II / EU annex B. However, such a cultivated origin would still have to be substantiated with evidence,

requiring quite a detailed documentation. Equally, plants acquired prior to the coming into force of CITES in the country of the given botanic garden exempts these plants from needing a permit to underpin their legal possession. In addition to the above, the actual detection of the collection plants that are listed as CITES appendix I / EU annex A is less straightforward then it seems. The use of synonyms instead of the currently accepted name, and misspellings may lead to the non-detection of CITES appendix I / EU annex A specimens in the plant collection.

By uploading the plant collection data to BGCI's Plant Search Database, the plant collection data of a given botanic garden are amongst others cross-checked with the IUCN Red List and CITES databases. As a result, a botanic garden that uploads its plant collection data BGCI's Plant Search Database receives a “list of hits” of plant names which emerged on either database. This is very convenient, since by employing this procedure, a given botanic garden can quickly detect which plants in the collection are of the CITES appendix I / EU annex A category, since a separate column identifies the CITES-category (if any). CITES appendix I / EU annex A plants may require permits just to maintain them in the collection. The relevant accessions can then be checked as to whether a permit is indeed required, and if so, whether it is or is not present, in which latter case a follow-up is needed.

Data comparisons can be advantageous over cross-checking all records manually, which is a time-consuming affair. The potential advantage of data cross-checking is even greater when the data of taxa in the collection of CITES appendix I / EU annex A can be updated automatically. This does of course require more advanced software to be used for plant collection management, and a report of all living accessions of these CITES appendix

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I / EU annex A can make this work much easier. The disadvantage of data cross-checking, when this is done alphanumerically, so specific strings of characters, is that small misspellings will lead to non-matching, and in this particular case regarding CITES, potentially to non-detection of plants listed as CITES appendix I / EU annex A taxa. More fundamentally, this cross checking through the upload to BGCI's Plant Search Database, at least before 2015, would not lead to the desired detection when synonym names were used, since the names check was run past the International Plant Names Index (IPNI) Database, which does not distinguish between synonym and accepted names, since it is a database of published names only, which is quite useful in itself, but not for this particular purpose.

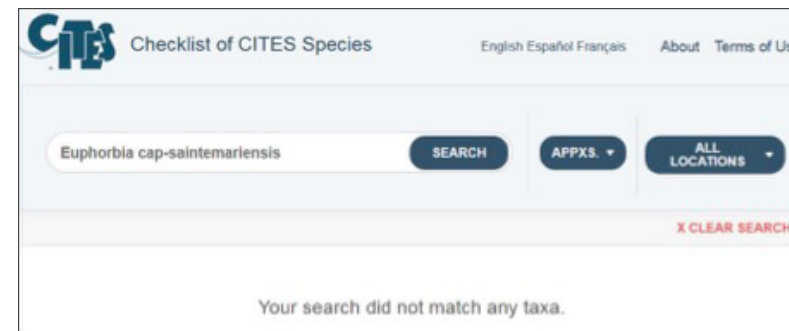
Recently BGCI has changed the names check, and BGCI can now check the uploaded plant names against The Plant List Database, which does recognize current and synonym names, allowing for a better check. The following example is based on the experiences before this change took place:



> PHOTO 1

Euphorbia capsaintemariensis Rauh
vs. *Euphorbia decaryi*
var. *cap-saintemariensis*
(Rauh) Cremers

In Delft we have this taxon recorded as *Euphorbia decaryi* var. *cap-saintemariensis* (Rauh) Cremers, in conformity with the Kew World Checklist of Selected Plant Families which we use as primary source to identify currently correct names. Under this name, it did not show up on BGCI's returned file of hits against the IUCN and CITES databases. Checking this name directly on the CITES checklist (<http://checklist.cites.org/#/en>) by performing the search using the name *Euphorbia decaryi* var. *cap-saintemariensis* came back as "Your search did not match any taxa". The search using the name *Euphorbia cap-saintemariensis* suffered the same fate.



Only when the dash ("-") character was removed, and the name *Euphorbia decaryi* var. *capsaintemariensis* or *Euphorbia capsaintemariensis* was used, was the taxon found and the CITES ranking (appendix 1) clarified.

In this case, the presence or absence of the "-" character resulted in failure or success in discovering the CITES ranking.

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Another example:

We have a plant recorded as *Euphorbia capsaintemariensis* var. *tulearensis*. Again, this plant does not show up on the CITES checklist as having a CITES listing. Searching for *Euphorbia tulearensis* however again reveals this to be a CITES appendix 1 taxon. In this case, the synonym name (or correct name as you would have it) of *Euphorbia capsaintemariensis* var. *tulearensis* is simply not recorded or recognized as a synonym of *Euphorbia tulearensis*. Such anomalies prevent efficient and effective searches, whether done by data comparison as when uploading data to BGCI's Plant Search Database, or searching for specific names directly at the CITES checklist page.

Searching for "*Euphorbia*" is not advisable since it leads to 36 pages to browse. In this case, downloading the search results may be more efficient, but this does imply manual searches, and will not be effective when synonym/correct names are searched for which are not connected to the names on the CITES checklist. The problematic recognition of CITES appendix I / EU annex A is challenge nr. 1.

Apart from synonyms which may complicate the identification of CITES appendix I / EU annex A taxa in the plant collection, the proper identification of the plants is yet another challenge with direct relevance. A further complication may be that a botanic garden may not have the proper keys and descriptions to its disposal to perform a proper identification. Smaller gardens usually also have a smaller library, and less access to scientific journals than the larger gardens.

When proper identification is possible since the necessary keys and descriptions are available, it may occur that a non-CITES listed species or CITES

appendix II / Annex B listed species turns out to be a CITES appendix I / EU Annex A species. Depending on other aspects this may then mean that all of a sudden a permit is required, but this is only evident when all CITES Appendix I / EU Annex A species are recorded in the database of that particular botanic garden, or is immediately checked on <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R1320>. On this website, there are links for every EU Member State and the official publication where the national legislation was published, after each individual EU Member State passed the national legislation to implement the EU regulation.

In short:

- Plant of CITES appendix I / EU annex A species identified to be CITES appendix II / EU annex B species: no problem.
- Plant of CITES appendix II / EU annex B species identified to be CITES appendix I / EU annex A species: **a permit may be required!**

The presence or absence of keys and descriptions to check the identity of CITES listed species, and this applies more generally to all plant identification, is our second challenge.

INVASIVE EXOTIC SPECIES (EU REGULATION NO 1143/2014)

In September 2012 the European Code of Conduct for Botanic Gardens on Invasive Alien Species was submitted to the Council of Europe (Heywood 2012). Subsequently, an illustrated version of this document was published in June 2013 (Heywood with Sharrock).

EU Regulation no 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of inva-

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sive alien species was published 22 October 2014. A EU blacklist of banned species, deemed of “Union Concern” is expected to be published at the end of 2015 or early 2016.

In the mean time, after this paper was presented in July 2015, the first EU list of 37 invasive alien species was adopted on July 13, 2016, and came into force on August 3 of the same year.

As is the case with CITES, for the EU Member States national legislation has been passed. E.g. in The Netherlands, this regulation has come into force on January 1, 2015.

At this point, no current list of banned species exists in The Netherlands, but a list of 7 aquatic plants no longer available from horticulture, based upon a voluntary Agreement on Aquatic Plants established in 2010 between the Ministry of Agriculture, the Association of Regional Water Authorities (Unie van Waterschappen), and the relevant horticultural organisations:

- *Crassula helmsii*
- *Hydrilla verticillata*
- *Hydrocotyle ranunculoides*
- *Ludwigia grandiflora*
- *Ludwigia peploides*
- *Myriophyllum aquaticum*
- Added in 2012: *Myriophyllum heterophyllum*

Other EU Member States may also have some national legislation regarding particular invasive species already, if these are of particular concern.

While CITES has had decades to become familiar to the botanic gardens community, the fast-developing national and international regulations are quite often unknown to individual botanic gardens. As a result of the EU regulation 1143/2014, and indeed in the onset to its development, the EU Consortium of Botanic Gardens has discussed this issue as early as June 2007, when Matthew Jebb (current director of the National Botanic Garden Glasnevin, Dublin, Ireland) presented the first results of a questionnaire sent to all the Consortium members, in order to obtain a more coherent picture of the presence of invasive plants in natural habitats, with the intention to monitor all the exotic plants in plant collections and when necessary add their potential for invasiveness in botanic gardens in separate columns. In the meantime botanic gardens are in general well aware of this issue, as with the voluntary Code of Conduct for botanic gardens. However, on an operational level, when it comes to identifying the individual invasive plant species, this is less straightforward. The EU regulation reports that some 12,000 species in the environment of the Union and in other European countries are alien, of which roughly 10 to 15 % are estimated to be invasive. The fact that these are still estimates means that more research is needed in quite a few cases. Of course, the European botanic gardens hold many more alien species than the 12,000 species referred to in the EU regulation. It is for this group of plant species that the Consortium project on invasive plants gathers information on the suspected or potential invasiveness in plant collection, as an “early warning system” for botanic gardens, to ensure that botanic gardens do not contribute to the problem that invasive plant species pose already.

Again, the big issue for botanic gardens is to locate the source of information on known invasive plants in natural habitats. Alien species may behave

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differently in different countries. E.g., *Alliaria petiolata*. This species has been introduced to New Zealand, Canada and the United States. It is native to Europe, ranging from England to Sweden to Turkestan, northwestern-Himalayas, India and Sri Lanka. In Finland however, it is an introduced species, although it has been recorded in Finland for several hundred years. In Finland, it is not considered to be invasive (*pers. comm.* Leif Schulman). It is important to have a precise understanding of the process and genetics of the invasive species to distinguish between alien plants which are not invasive, and alien plants which are. Some species which in the past were assumed to be native plants now turn out to be archaeophytes, aliens that colonized or were introduced many centuries ago. The process of colonisation in itself is a natural phenomenon, leading locally to a changing –though be it slowly–ecosystem. Stacey & Crawley (2015) argue that the current flora in the British Isles largely originates from refugia from southern and southeastern Europe, after the last glaciation ended some 128,000 years ago, leaving the British Isles largely devoid of plants at that time. Neophytes are distinguished from archaeophytes as plants to have arrived starting at a time where mankind significantly increased its influence on the composition of the native flora. For the British Isles, this pivotal date is 1500 AD.

It is not the alien plants that pose the problems, but those that invade our current ecosystems and change them to the detriment of the native flora. This is particularly noticeable when these invasive aliens also cause economic or health damage to man. Alien plants arrive in new territories either naturally, through natural vectors, or through introduction by man, deliberately or by accident. Understanding and differentiating between these requires new terminology and clear definitions, which are vital in order to effectively address the problems with invasive aliens effectively and proportionally. From

an evolutionary perspective, it is undesirable to put a ban on all neophytes, since adaptation to changes in the biotic or abiotic environment is a natural phenomenon, which does require the influx of neophytes that may be better adapted to the new situation than the extant flora. Neophytes may range from being surviving plants, not reproducing at all, to plants of casual occurrence, not reproducing every year, to naturalized plants, which are present for 5 or 10 years, to be called naturalised. When naturalised are to be considered invasive also requires clear circumscription in order to avoid confusion. Stace and Crawley (2015) define invasive plant species as naturalised species that form a substantial proportion of the biomass of the invaded community. However, when this occurs in man-made or highly disturbed habitats, they would not use the word invasive for such a species. A precise distinction between invasive species and the archaeophytes and the remainder of the neophytes is necessary for effective policies. However, it should be noted that in order to prevent outbreaks of invasions, we cannot afford to wait until the invasion is evident, since at that point, it may have become impossible to counter the invasion with effective measures. And such measures would also invariably mean a huge cost to contain or eradicate the particular invasive species. Therefore we would like to know in advance which alien plant species may become invasive in a particular area, in order for eradication or containment measures to be both effective and cost-effective.

Most of the botanic gardens in Europe maintain large numbers of exotic plants in their collections, and have done so for decades if not centuries. In addition to the voluntary code of conduct for botanic gardens on invasive plant species (Heywood 2012, Heywood with Sharrock 2013), the EU now also has adopted a regulation (No 1143/2014), and the first EU list of 37 invasive alien species was adopted on July 13, 2016. On June 19, 2017, another 12 spe-

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cies of plants and animals were added to the first list, and currently (November 2017), an addition of another 11 species is under consideration.

For all the species on the first list and subsequent additions, a number of measures will apply, such as a ban on import and export, transport, propagation, and presence within a collection without a permit.

For individual European botanic gardens the EU list will be straightforward, but it is less straightforward to identify the information source to check all the exotic plants in their collection for their invasive or potential invasiveness in their particular geographic situation. [Delivering Alien Invasive Species Inventories for Europe \(DAISIE\)](#)¹, [North European and Baltic Network on Invasive Species \(NOBANIS\)](#)² and [European Plant Protection Organisation \(EPPO\)](#)³, as well as National Initiatives, do provide detailed databases. However, these are not complete, nor is it easy for botanic gardens to obtain summary lists of problem taxa. It can be difficult for Garden managers and curators to obtain summary lists that provide at a glance indications of problem taxa, especially when it comes to such lists pertaining to their specific country. Again, checking the plant collection data against a good Invasive Species database would be very helpful to help focus attention on the specific exotic plants in that particular collection which are or potentially may become invasive. We are still far from that option, and for now, the challenge remains for botanic gardens to become aware of the known invasive and potential invasive plants in our plant collections. The first EU list of banned species only shows the most problematic of the invasive species, and subsequent additions to the list will address other species of concern for which the risk analysis was not ready at the time of publication of the first list.

1

www.europe-aliens.org/index.jsp

2

www.nobanis.org/

3

www.eppo.int/INVASIVE_PLANTS/ias_lists.htm

The absence of a summary list of all invasive plant species for botanic gardens to check their holdings against is the 3rd [challenge](#).

Botanic gardens can share information about exotic plant species which in their opinion may have a potential of invasiveness. It should be clear however, that in those cases, we need to ensure that more detailed information is gathered before such species are declared to be invasive, to ensure that such species actually behave invasive as defined, and are not confused with weediness in an artificial environment.

NAGOYA PROTOCOL

The Nagoya Protocol itself, and the EU regulation pertaining to it, have been discussed in another presentation, and therefore are not discussed here. However, there is a significant misunderstanding among many botanic gardens in Europe, as to the access to biodiversity within Europe. While the Nagoya protocol has paragraphs on access, the EU regulation lacks an access pillar. The reason for this is that several EU Member States do not intend to use the right to restrict access in order to ensure that benefits are shared equitably, as stipulated by the Nagoya Protocol. At this moment only Bulgaria and Spain have access restrictions, although other countries are considering it, or are in the process of implementation (e.g. France). The national absence of access regulation in relation to the Nagoya Protocol does not mean however, that access is free. This misunderstanding turned up at a discussion within the EU Consortium of Botanic Gardens at the first biannual meeting in Dublin, February 2015. Subsequently a questionnaire was sent to its members by the author. This preliminary assessment showed that in some countries species which are not protected by law, or growing in protected areas or private land, may be collected in some countries, while in others permits

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are required. Since the questionnaire was not completed by all, no further details are provided here. A more detailed study will be necessary if the level of detail desired is to be achieved.

However, it should be clear that plant collecting in the wild may be subjected to other national legislation than the legislation pertaining to the EU regulation of the Nagoya Protocol. This means that when collecting is contemplated, botanic gardens should first find out about the legitimacy of such collecting. This, however, is far from easy. The information websites are not always joined in one national “clearing house”, and often the language other than English is used, or initial information pages are in English, but when more details are referred to on other sites, the language changes from English to the national language. A further complication arises in federal states, where part or most of the legislation is issued by the individual states or cantons, as is the case respectively for Austria and Switzerland.

This constitutes the 4th challenge to botanic gardens: to find the proper information sites for each country where plant collecting is considered, in order to respect the national laws of that country.

PHYTOSANITARY REGULATIONS

The European directive from May 2000 (Council Directive 2000/29/EC) addresses the protective measures against the introduction of organisms which may be harmful to plants or plant products, and the measures intended to contain, restrict or prevent the spread of these organisms in the European Community. The extent to which this directive applies to botanic gardens varies with the various organisms to be contained. As a result, the famil-

ilarity with this directive is less well developed as compared to e.g. CITES or invasive species. The occurrence of *Anoplophora chinensis* (the Citrus Longhorned Beetle) triggered an emergency measure following outbreaks of this beetle in 2010 in Germany, the Netherlands, Italy and the United Kingdom (notified under document C (2012) 1310) lead to quite profound containment measures. This beetle occurs naturally in China, and is known to travel via imports of plants and wood. Although the beetles are most harmful to *Citrus*, a wide range of host plants can consolidate its presence within the EU: *Acer*, *Aesculus hippocastanum*, *Alnus*, *Betula*, *Carpinus*, *Cornus*, *Corylus*, *Cotoneaster*, *Crataegus*, *Fagus*, *Lagerstroemia*, *Malus*, *Platanus*, *Populus*, *Prunus laurocerasus*, *Pyrus*, *Rosa*, *Salix* and *Ulmus*. Since the listed genera and species of host plants also frequently occur in botanic gardens, a real concern rose among the botanic gardens of the countries in question. As woody plant imports from China do not occur regularly amongst European botanic gardens, and such imports would easily be noticed by the customs departments, botanic gardens were not perceived as a significant vector.

In May 2015 another EU emergency measure was issued concerning the bacterial disease caused by *Xylella fastidiosa*. This time, the bacterial outbreak had already infected large stands of olive trees in Lecce Province, Italy. This time, 7 pages of host plants were identified, amongst others also 25 entire genera: *Acer*, *Aesculus*, *Brassica*, *Carex*, *Citrus*, *Coffea*, *Erodium*, *Hemerocallis*, *Juglans*, *Malva*, *Melilotus*, *Morus*, *Platanus*, *Portulaca*, *Prunus*, *Quercus*, *Rubus*, *Salix*, *Sambucus*, *Sonchus*, *Sorghum*, *Vaccinium*, *Veronica*, *Vinca*, and *Vitis*.

Again, many of the potential host species and genera concern plants that are well-represented in collections of botanic gardens. However, since the origin of the infestation is within the European boundaries, where botanic gar-

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dens have a well-developed exchange of plants and seeds, the potential risks are higher. In the Netherlands, news about this emergency measure reached one botanic garden, and fortunately was shared almost immediately with the other gardens in the Dutch national network of botanic gardens (NVBT). At that point at least one botanic garden did intend to import *Citrus* plants from Italy, but upon hearing from this emergency measure, decided against it just to be on the safe side. This example shows that it is imperative to be informed about such measures, in order to ensure the proper follow-up by all relevant stakeholders. A faltering communication could potentially lead to undesirable imports which may again lead to new infestations. The 5th challenge for botanic gardens is not only to stay informed about conditions, restrictions, and changes therein of the standing phytosanitary regulation as implemented by national law, but even more challenging, to be aware of EU emergency measures, and their potential significance to each individual botanic garden.

Discussion

In the past decades, new regulations in the EU pertaining to plants, and therefore to botanic gardens with their living plant collections, have increased in number. In addition, in some cases the EU has issued emergency measures on short notice to contain potential acute damage to the economy, biodiversity or health. Since the legal measures issued are relevant to all individuals and organisations, in this case within the EU, this also affects botanic gardens. Increasingly therefore, botanic gardens are facing these issues with their legal aspects, while generally no additional staff is made available, nor does the staff in most cases possess sufficient legal knowledge. A com-

monly heard complaint is that when such policies are issued, these should also include increase of staff amongst the stakeholder organisations. Be that as it may, the current fact of life is that the burden of making ends meet between the currently available staff and existing workload on the one hand, and the duty to abide by the law on the other, is placed on all stakeholder organisations.

This inescapably means that botanic gardens have to reconsider their *modus operandus*. Yet botanic gardens do not all individually have to re-invent the wheel. The global botanic garden community is known to be a benevolent network with a strong sense of community feeling. The international seed exchange system which has existed for centuries and runs without mutual billing or assessment of gains and costs, is a good example of that. This community can and should try its best to address these challenges jointly as a community, where specific issues are addressed at the proper level where it can most efficiently be addressed, be it at the level of the individual gardens, their national networks, their international networks, or the international interdisciplinary cooperation with e.g. the international plant taxonomy community. The latter is usually addressed via the many larger botanic gardens that are part of more encompassing institutions with e.g. herbaria and or other plant research departments.

ACTIONS/RESPONSES FROM THE BOTANIC GARDENS COMMUNITY

The actions and responses of the botanic garden community should ensure that we are and remain fit for purpose. The alternative would be that individual botanic gardens might become side-tracked, as a result of which the many challenges, including support for the Global Strategy for Plant Conservation (GSPC), would come to rest on fewer botanic gardens.

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The possible actions to consider are split here into the various levels, starting with the level of the individual gardens, up to the interdisciplinary level. Some actions may turn out to be easier to resolve at another level. This can happen when botanic gardens or their institutes team up to address a particular issue. The division as proposed here is therefore to some extent arbitrary, yet it can be very useful in setting the stage in our thinking. Also, this listing may be incomplete, and time will tell what other initiatives or approaches can be added.

I. THE INDIVIDUAL LEVEL

- Ensure that the data on plant species in relation to regulations, i.e. CITES, invasive aliens, etc. can be consolidated within the botanic garden, preferably within the collection administration. This may in time affect the type of software used. Timely recognition of the needs but also new technological developments may help prepare for necessary changes. Prioritise also on the implementation of the more general aspects of conventions and regulations.
- Prioritise the efforts for plant identification. It is one of the most important activities in relation to the management of a plant collection, but due to various obstacles, such as the absence of the necessary tools (keys, descriptions, etc.) is often the least practiced. Setting targets may help, if only to direct more attention and effort in this direction.
- Check the plant names against the use of synonyms. A simple approach that will provide much insight is to use the facility of BGCI's Plant Search database. By uploading the names of the plants in the plant collection, these data are now checked against relevant databases such as The Plant List, the CITES -, and IUCN Red List databases. In return BGCI emails back

lists that show which of your plants have a CITES and/or IUCN listing, as well as any names not accepted as the currently correct name against The Plant List as the default authority for currently correct names. Names not verifiable by The Plant List are rejected and therefore possibly incorrect. This feature is extremely useful as a fast and elaborate names check. When your software cannot process the returned data file, this file will have to be processed manually, but much time is gained by the automated check. These are all direct benefits from uploading the data to BGCI's Plant Search database.

- The garden's plant collection data, when uploaded BGCI's Plant Search database, are added to the list of taxa known to be represented in at least one botanic garden in the world. This helps BGCI to demonstrate the role that botanic gardens jointly play in the ex situ conservation of plant species, and the threatened species represented therein. This is of particular relevance to article 8 of the GSPC, which is now part of the Convention on Biological Diversity (CBD). The list which is returned to the garden by BGCI also reveals the uniqueness of individual taxa, since in a separate column the total number of gardens known to maintain that particular taxon is listed in a separate column. A "1" means to only your garden is known to maintain that taxon. Of course, not all botanic gardens of the world have uploaded their data yet, but the more gardens do so, the more accurate and reliable this uniqueness indication becomes.
- Ensure that any plant collecting is done according to the relevant national legislation, and ensure that relevant documents are archived and linked to the plants collected, to underpin their legality as part of the botanic garden plant collection.
- Read and use, handbooks, manuals and protocols of best practice on the various issues in relation to plant collections, and regulations. BGCI has

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- produced handbooks on various issues in the past, to aid botanic gardens.
- Consider to join forces and adopt e.g the European Code of Conduct for Botanic Gardens on Invasive alien species, and consider joining the International Plant Exchange Network (IPEN), which is developed to help botanic gardens to address the requirements of the CBD.
 - Consider to become member of BGCI, and thus strengthen BGCI's capacity to represent botanic gardens internationally amongst the policy-makers.

II. THE NATIONAL LEVEL

The national networks of botanic gardens can play a significant role to assist their member gardens to address the many challenges.

- Ensure that the national network is known in circles of the relevant ministries of the national government. Try to achieve that relevant information regarding national legislation that implements international conventions and European regulations and directives is communicated to the network as the representative of the specific stakeholder group that botanic gardens are. This can be achieved e.g. by designating a contact person or contact group for each relevant ministry.
- Contact the ministry responsible for CITES, in order to ensure that it is clear to all member gardens for which plants permits are required, and assist in the process of acquiring these where necessary. In addition, make sure that protocols or procedures are developed and agreed with the relevant ministry to ensure timely renewal (permits expire after five years) and the procedure when new permits need to be issued. E.g., a CITES flow chart will be developed in line with the procedural views of the ministry for the Dutch network to clarify in each individual accession if a permit is required.
- Ensure close contact with the relevant ministry regarding their monitoring

of the implementation of the Nagoya Protocol / its EU regulation. Ensure that the member gardens know under which conditions the NP is applicable, and how to comply in such cases.

- Ensure that the conventions and their EU regulations are discussed on a regular basis, e.g. every 2-3 years. The members can be informed about changes in the legislation if and when these occur, but in addition, it is very useful to discuss the practicalities jointly to learn from each other, and keep the issues high on the agenda of the individual members.
- Develop an overview of tools for identification (keys, floras monographs etc.) within the network, to help each garden in accessing such tools when not in the possession of that garden. The Dutch network (NVBT) is developing such a repository for its members, who jointly have far more available than the members have individually. This repository will be available for members only, to ensure that issues such as copyright are not violated.

III. THE INTERNATIONAL LEVEL

Since the issues at the international level may be addressed at regional level as well (e.g. for the EU by the European Consortium of Botanic Gardens), as well as interdisciplinary, a sharp divide of the issues between them would be very arbitrary and artificial.

- A major issue on this level is the further development of data cross-checking of plant collections with taxonomic databases, as well as CITES- and IUCN databases. In particular, a "smart search" approach is needed such as internet search engines use nowadays, to ensure that small typing errors do not result in data mismatches, but instead are recognised when they should be.

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- The World Flora Online initiative is a hugely important and useful feature to the botanic garden community once it is up and running. The project also intends to provide keys and descriptions for the taxa listed. It would be hugely beneficial if such information would become available as soon as possible, even if the database is still in the development phase.
- Strive towards taxonomic publications to be published in open access journals rather than journals from publishers. Too often publications are not available unless paid for, or a subscription is taken, and this is a significant impediment for the smaller gardens or those with otherwise very limited budgets. It is a positive development that the EU recommends to its Member States that there should be open access to publications resulting from publicly funded research as soon as possible.
- Encouragement of the policy-makers to also include a more specific communication mechanism to contact the relevant stakeholder-groups more directly. Current policies tend to assume too much that stakeholders will be informed somehow, but in practice, this is not always the case, and in particular with important EU emergency measures, such communication seems to depend more on chance than on well-organised communication.
- Better access to relevant publications to a wider audience of stakeholders. Too often important publications are published in journals with copyright restrictions. In addition, quite often such journals are too expensive for the smaller botanic gardens with only small budgets. E.g. the ambition of the Dutch government is that in November 2018 60 percent of the scientific publications are published in open access journals, to increase to 100 percent in 2024. This is strongly supported by the Association of Dutch Universities.
- When topical manuals, handbooks or guidelines are developed, these would benefit from a stronger focus on the practical implementation, since

it is the practicalities that botanic gardens have to deal with. Especially in relation with the CBD and the Nagoya Protocol, the publications have been rather vague in this respect.

Botanic gardens are facing an ever-growing number of regulations, their documents and lists, the latter often being augmented irregularly. Individually, botanic gardens in general are facing an increasing administrative and legal challenge in order to secure the obligatory, often detailed, requirements. This would require dedicated staff that handles the legal obligations by turning these into the proper procedures and documentation within the existing garden administration. Some botanic gardens, mostly the large gardens with many staff members, actually do have such dedicated staff. For the smaller botanic gardens, and without opportunities to hire additional staff, the increasing legal obligations will only add to the weight of the existing overhead. As an overall conclusion to the growing demands, it seems clear that networking more strongly is the obvious solution for botanic gardens in order to cope with such increasing demands and expectations. Networking can provide the structural backbone for more and more detailed communication about all relevant issues that affect botanic gardens today. Such issues could be better handled by the existing networks of botanic gardens, ideally with staff formally allocated to dedicate sufficient time to keep up with the number of relevant regulations and the expanding scope of each regulation. Such dedicated staff could turn the many challenges from regulations into practical approaches for implementation that each member garden can incorporate into the daily routine. Some national networks of botanic gardens in Europe are already well-developed and up to the challenge, but other networks are still developing their *modus operandus*, while yet other networks are still in the process of establishment.

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Other approaches, e.g. emanating from the European Consortium of Botanic Gardens, might be necessary to deal with the current non-level playing field of national networks of botanic gardens in Europe.

References

Heywood, V.H., 2012. *European Code of Conduct for Botanic Gardens on Invasive Alien Species*. Council of Europe T-PVS/Inf (2012) 1. <https://wcd.coe.int/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=2590540&SecMode=1&DocId=1943644&Usage=2>

Heywood, V.H. & Sharrock, S., 2013. *European Code of Conduct for Botanic Gardens on Invasive Alien Species*. Council of Europe, Strasbourg, Botanic Gardens Conservation International, Richmond. <http://www.botanic-gardens.eu/downloads/Heywood&Sharrock-2013.pdf>

Stace, C.A. & Crawley, M.J., 2015. *Alien plants*. William Collins, London. ISBN 978-0-00-750214-1

Information sources

CITES checklist :

<http://checklist.cites.org/#/en>

Delivering Alien Invasive Species Inventories for Europe (DAISY):

<http://www.europe-aliens.org/index.jsp>

European Commission Regulation on CITES:

<http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R1320>

European Plant Protection Organisation (EPPO):

http://www.eppo.int/INVASIVE_PLANTS/ias_lists.htm

North European and Baltic Network on Invasive Species (NOBANIS):

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

The Plant List:

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

Global Strategy for Plant Conservation (GSPC):

<https://www.cbd.int/gspc/> & <https://www.bgci.org/policy/gspc/>

01. Abstract

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THE NAGOYA PROTOCOL ON ACCESS AND BENEFIT SHARING (ABS) IS A LEGALLY BINDING INTERNATIONAL INSTRUMENT THAT CAME INTO FORCE IN OCTOBER 2014.

While a significant motive for developing the new ABS regime is the fair and equitable sharing of monetary benefits arising from commercial exploitation of genetic resources, valuable non-monetary benefits that contribute significantly to conservation and sustainable use are also generated and shared in various ways. The Nagoya Protocol also establishes a compliance regime that means penalties will be imposed if genetic resources are utilised illegally. The European Union is a Party to the NP and has adopted Regulations on ABS that apply to all users of genetic resources in the Union.

Botanic gardens can be users and are suppliers of plant genetic material and it is therefore vital that they are aware of the new ABS framework being developed at both the EU and national level. This new framework is likely to have significant implications for botanic gardens and the way they work in the future.

BGCI and the Royal Botanic Gardens Kew have been working together to develop a set of training modules on ABS and the Nagoya Protocol for botanic gardens. These include guidelines for setting up an institutional ABS implementation toolkit, including the development of codes of conduct, best practice guidance and model agreements.

This paper will introduce the toolkit for botanic gardens implementing the Nagoya Protocol, followed by a case study from RBG, Kew. Both the NP and the EU Regulations encourage the adoption of sectoral codes of conduct, best practices and model agreements to assist implementation and several initiatives have begun in the botanic garden community. This paper will also provide an introduction to some of these initiatives.

01. Introduction

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Photo credit : Raising awareness of ABS issues with collection holders in Ethiopia, Suzanne Sharrock

THE NAGOYA PROTOCOL ON ACCESS AND BENEFIT SHARING UNDER THE CONVENTION ON BIOLOGICAL DIVERSITY (NAGOYA PROTOCOL) ENTERED INTO FORCE ON 12 OCTOBER 2014 ([WWW.CBD.INT/ABS/](http://www.cbd.int/abs/)).

At the time of writing, it had been ratified by 68 Parties, including the European Union. The Nagoya Protocol, when implemented at a national level, will govern the way genetic resources are accessed (in countries where the organisms carrying them are found) and used (by both researchers and commercial entities), and how any benefits arising out of their utilisation should be shared. The Protocol is a legally binding instrument and requires Parties to implement compliance mechanisms to ensure genetic resources are used legally, and to institute penalties if they are not.

The European Union ratified the Nagoya Protocol in June 2014 and passed the EU Regulation on Access and Benefit Sharing which came into force from October 2014 (http://ec.europa.eu/environment/nature/biodiversity/international/abs/index_en.htm), and is directly applicable in EU member states. Articles 4 (Obligations of Users), 7 (Monitoring User Compliance) and 9 (Checks on User Compliance) came into force one year later (October 2015). The EU Regulations focus on compliance measures for users of genetic resources in the EU. The Regulations apply to 'utilisation of genetic resources' in the EU that were

accessed *after* the Nagoya Protocol came into force, and *from a Party* to the Protocol that has clear access legislation. 'Utilisation of genetic resources' is defined, in Article 3(5) of the Regulations, as in the Nagoya Protocol Article 2(c): 'to conduct research and development on the genetic and/or biochemical composition of genetic resources'. It requires users to exercise 'due diligence' that genetic resources have been legally accessed.

The Regulations establish two checkpoints:

- On receipt of funding for utilisation projects
- At the final stage of development of a product in the EU

Competent authorities in each Member State will carry out checks on user compliance (Article 9) which will include spot checks and Member States will introduce penalties for non-compliance. The Regulations encourage the development of sectoral codes, best practices and model contractual clauses, and will be implemented through further guidance that is currently being developed.

01. Botanic gardens and ABS

- Williams China
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Botanic gardens acquire, use and exchange plants for a range of scientific, conservation, economic and cultural purposes. In these activities, it is important that botanic gardens comply with national laws and observe the terms under which the genetic resources in their collections have been provided. With the entry into force of the Nagoya Protocol, there is greater pressure on botanic gardens to monitor the use¹ of materials in their collection.

A global survey of botanic gardens was conducted in 2012 by Botanic Gardens Conservation International (BGCI) and the American Public Gardens Association (APGA) to assess awareness of access and benefit-sharing issues and potential preparedness for Nagoya Protocol requirements. Representatives of 222 gardens from 46 countries responded. Results indicated that many respondents were not yet familiar with access and benefit-sharing or the Nagoya Protocol. Exchange of plant material was common, but many gardens did not track transfers to third parties, use material transfer agreements, or link permits or restrictions to collection records. The survey demonstrated the need for capacity-building initiatives and practical tools to enable gardens and their networks to understand access and benefit-sharing, comply with new legislation, build trust and safeguard their role in conservation (Davis et al., 2015).

An ABS learning tool

In response to the survey, BGCI in partnership with the Royal Botanic Gardens, Kew, and with the financial support of the Japan Biodiversity Fund, has developed a set of ABS self-learning modules. These modules aim to address the lack of awareness about the Convention on Biological Diversity, and ABS

issues in particular, amongst the botanic garden community. The modules are available on the BGCI website (www.bgci.org/policy/abs_learning/).

The modules take a step-by-step approach, with a module covering each of the following elements:

- Introduction to the CBD
- History of the Nagoya Protocol
- Key articles of the Protocol
- Practical implementation by botanic gardens
- Developing a checklist / toolkit
- Developing contracts and agreements

Each module consists of a set of slides which can be read directly on-line, or can be downloaded for off-line consultation. At the end of each module, a set of quiz questions tests the users' understanding of the issues covered in that module. A comprehensive list of resources and references for additional information is also provided. At the time of the EuroGard conference, the modules were available in English only. However, they have subsequently been translated and are available in French, Spanish and Chinese.

Case study: developing an ABS toolkit at the Royal Botanic Gardens, Kew

The Royal Botanic Gardens, Kew was founded in 1759 by Princess Augusta, the mother of King George III. For over 250 years it has focused on plant and

¹ It should be noted that 'use' or 'utilization' in the context of the Nagoya Protocol has a specific meaning, which is: 'to conduct research and development on the genetic and/or biochemical composition of genetic resources, including through the application of biotechnology'.

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fungal discovery, identification and naming. As a botanic garden it is open to the public, with over 1.7 million visitors a year, and employs approximately 700 staff in science and horticulture. It was designated a UNESCO World Heritage Site in 2003. Kew is a non-departmental public body, part funded by the UK Department for the Environment and Rural Affairs (Defra) and is answerable to a Board of Trustees ([Kew's Science Strategy](#)).

Kew holds nineteen major collections including preserved plant and fungal collections (the Herbarium), living material (The Seed Bank and Living Plant collections) and extensive visual reference collections (library, art and archives, as well as on-line resources including databases). Kew has an active fieldwork collecting programme, with scientists going on more than 60 fieldwork trips each year, bringing back thousands of new specimens. Kew's work involves an extensive international network of overseas partners – over 400 collaborating institutes worldwide in over 110 countries.

Kew's Collections in Numbers
Herbarium (7.5 M) & Fungarium (1.25 M)
Living collections (+30,000 species)
Millennium Seed Bank (+30,000 species; c. 2 billion seeds)
DNA and tissue bank (+42,000 accessions)
DNA C-value (+7,000 species)
Slide collections (+100,000 slides)
Library (> 750,000 volumes), archives (250,000), artwork (> 175,000), paintings, prints and drawings
Over 300 international scientists visit each year
More than 60 overseas plant collecting trips annually
Exchange over 60,000 herbarium specimens and 10,000 live plants and seeds each year
Working with 400 collaborating institutes
In over 110 countries worldwide

Kew has been proactive in ensuring that it works closely with partners to ensure plants are collected legally, according to national law, and that research taking place at Kew is in line with national and international legislation and conservation priorities, both in the UK and in the countries where it works. In 1992, with negotiations of the Rio Convention taking place, Kew saw that action was required to maintain the trust of partners to continue to develop its collections and research. In consultation with staff and Trustees Kew's first 'benefit-sharing' policy was introduced, outlining Kew's commitment to sharing benefits with countries of origin.

Since then Kew has been active in following the development of the Convention on Biological Diversity (CBD) and working to develop a policy in ABS and streamline this with other botanical research institutes in the UK and worldwide. In 1994, a CBD Officer post was established, and a CBD Unit created. Between 1997 and 2000 Kew coordinated a UK Department for International Development (DFID) funded project involving 28 botanical institutions from 21 countries, to develop best practice ABS guidelines for botanical institutions. The resulting 'Principles on Access to Genetic Resources and Benefit-Sharing' (www.bgci.org/policy/abs_principles/) cover best practice in acquisition, curation, use and the supply of material, and associated benefit-sharing. The Principles have been endorsed by over 25 botanical institutions worldwide and were used to form the basis of Kew's current ABS policy. This approach is the basis of the way Kew works in this area today.

The Principles and Kew's own ABS Policy (including model agreements) have been influential. They have been widely cited by the CBD Secretariat, the EU and by the UK Department for Food and Rural Affairs (Defra) as examples of best practice and have influenced the development of the CBD's

01. Case study: developing an ABS toolkit at the Royal Botanic Gardens, Kew

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- Sharrock Suzanne

Bonn Guidelines as well as that of national legislation in countries as diverse as India and Australia.

As well as influencing international and national legislation and policy on genetic resources, Kew's ABS policy has also been a vital tool for working transparently with partners and stakeholders. Kew's current Policy on ABS ([Kew's Policy on ABS](#)) was approved by the Director and Board of Trustees and has been effective since December 2004. Kew's policy is designed to ensure that all material brought into Kew (either collected on fieldwork, or from other institutions and individuals) has been legally acquired on mutually agreed terms, that it is used and supplied by Kew on terms and conditions consistent with those under which it was acquired, and that benefits arising from the use of genetic resources by Kew are shared fairly and equitably as agreed with partners in the country of origin of the material.

In order to implement the ABS Policy Kew has, over the years, developed and put in place a suite of practical measures and tools so that staff are supported and given the tools to ensure that material in the collections is used according to terms and conditions under which it was acquired. This institutional ABS Toolkit (submitted to the CBD Secretariat by the EU as an information document: www.cbd.int/abs/submissions/icnp-3/EU-Kew-letter.pdf) governs the way Kew manages its plant collections, addresses issues related to Access and Benefit Sharing (ABS) under the Convention on Biological Diversity and national legislation, keeps track of Kew's bilateral contracts and obligations, and supports Kew's vital conservation partnerships.

THIS TOOLKIT INCLUDES:

- **KEW'S POLICY ON ABS** (www.kew.org/sites/default/files/ABSPolicy.pdf) that includes a commercialisation policy. The policy was written in 1993 and revised in 2004.
- **A DEDICATED CBD UNIT** (currently 1 full time member of staff) working with a wider cross-departmental group of approximately 20 scientist and horticulturalist to develop and update Kew's policies, processes and model agreements, in line with ABS regulations and institutional requirements.
- **AN INTERACTIVE INTERNET-BASED STAFF GUIDE ON ABS** setting out best practice for collecting, use and supply of genetic resources, links to documents and policies, and up to date guidelines for staff working with Traditional Knowledge (TK) and Indigenous and Local Communities (ILCs).
- **A CROSS-DEPARTMENTAL 'OVERSEAS FIELDWORK COMMITTEE'** (OFC) which is responsible for monitoring all overseas fieldwork collecting trips by Kew staff (approximately 60 overseas collecting trips per year). The team is comprised of staff representatives in all departments and corresponds through email. The procedure for planning overseas fieldwork ensures that national laws and legislation are followed, appropriate permissions from all relevant stakeholders are obtained and kept, and benefits are agreed and shared fairly. It also ensures that collections are curated appropriately afterwards, and any terms and conditions are linked to permits and terms of use. In addition the OFC ensures that staff work according to sectoral best practice standards and models that a record is kept of the countries in which Kew is working, and that they are working safely following government safety advice.
- **A SUITE OF TEMPLATE AGREEMENTS**. These include Access and Benefit Sharing Agreements (for governmental partners) and Memoranda of Un-

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derstanding (for institutional partners) to outline the terms of long term collaborative projects with partners institutions (in 2015 there are over 70 active agreements). In addition Kew has developed a standard set of Material Supply Agreements for different types of material, and a donation letter to ensure that material donated to Kew has been legally collected and transferred, and that any additional terms of use are recorded.

- **POLICIES FOR VISITING RESEARCHERS** in all departments ensure that the hundreds of scientists, students consulting the collections each year are aware of terms under which this material can be used. Kew has also developed policies for DNA data, images and information harvesting (<https://www.kew.org/science/data-and-resources/science-terms-and-conditions>).
- **STAFF TRAINING AND AWARENESS-RAISING SESSIONS**. The CBD Unit offers a daylong session to all Kew staff to outline Kew's policies and best practice guidance. The course runs at least once per year and is attended by over 30 staff per session.

Kew's existing records management systems have been adapted and amended to ensure that they keep track of key ABS information:

- PIC/MAT documents (agreements, permits, certificates of compliance)
- the date of legal extraction of the material from the country of origin
- the country of origin and the provider of the material
- terms of use, including any restrictions and benefit-sharing
- any unique identifiers supplied with the material

Records management systems at Kew include databases, logbooks and both paper and digital systems. Staff training is essential to ensure that key information is held and passed between departments and, crucially, to any third party user.

Collaboration and information sharing with colleagues in the non-commercial research community to build a harmonised sectoral approach to ABS (for instance work with the international botanic gardens community through BGCI, with the UK plant community through PlantNetwork, the Common Policy Guidelines and Principles on ABS (www.bgci.org/resources/abs/) and the Consortium of European Taxonomic Facilities (CETAF) ongoing work (www.cetaf.org/).

Having an existing ABS toolkit has meant that Kew was in a strong position to respond to the new framework of the Nagoya Protocol and the reporting requirements of the EU Regulations on ABS. Following the coming into force of the Nagoya Protocol, Kew is reviewing the existing ABS Toolkit to ensure it is able to comply both with the due diligence and reporting requirements of the EU Regulation, and also any changes in the national ABS legislation in countries where they have partnerships and access genetic resources. Kew continues to work with others in the non-commercial research sector, at the UK, EU and International level to develop best practice implementation tools and resources for our sector.

Kew worked with partners and others in the botanic garden sector to come up with a sector approved approach and to review and upgrade procedures in all departments in the following areas:

- Ensure that all new accessions are collected or transferred to Kew legally, according to the national law of the provider country.
- Record the date of accession into Kew, and also, where possible, the date of legal extraction of the genetic resource from the country of origin.

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- Review databases in all departments to ensure that they have fields for this information and that they are secure from tampering and have a clear audit trail for any changes made.
- Review staff procedure in all departments to ensure that material is always used and supplied in line with terms and conditions under which it was acquired.
- Develop and review our ABS policy and specifically Model Supply Agreements. Ensure agreements with third parties clarify that material is being supplied on non-commercial terms only and that if a change of use is intended they need to inform us so that new PIC and MAT can be negotiated with the Provider.

Conclusion

Since the entry into force of the Nagoya Protocol and in particular the introduction of the EU Regulations, the level of awareness of ABS issues amongst botanic gardens, especially in the EU, has increased significantly. However, there is still a need for further capacity building and training in this area. The ABS learning modules discussed here are being seen as a useful tool to help guide the development of botanic garden policies on ABS. Botanic gar-

dens are clearly keen to comply with the NP, but lack of capacity can be an issue especially for smaller gardens. Botanic gardens welcome simple step by step guidance that helps them navigate different policy areas, and for smaller more local gardens this guidance needs to be simple to follow and in a local language. BGCi is continually looking for opportunities to work with the botanic gardens community to build capacity in this area.

While the focus within Europe tends to be on access issues, there is a need to demonstrate and document best practice in benefit sharing as well. Further work is planned in this area and BGCi will be looking to develop practical case studies, models and examples to continue to support botanic garden implementation.

01. References

- **Williams China** **Botanic Garden Conservation International (BGCI)** webpages: www.bgci.org/resources/abs/
- **Sharrock Suzanne**

Convention on Biological Diversity and Nagoya Protocol Websites: www.cbd.int/abs

Davis, K., Smit, M., Kidd, M., Sharrock, S & Allenstein, P., 2015. An access and benefit-sharing awareness survey for botanic gardens: Are they prepared for the Nagoya Protocol? *South African Journal of Botany* 98: 148-156.

EU Regulations on Access and Benefit Sharing: http://ec.europa.eu/environment/nature/biodiversity/international/abs/index_en.htm

Kew's Policy on ABS. Royal Botanic Gardens, Kew Policy on ABS: www.kew.org/sites/default/files/ABSPolicy.pdf

Kew's Science Strategy. Royal Botanic Gardens, Kew. Science Strategy 2015-2020: <https://www.kew.org/science/who-we-are-and-what-we-do/kews-science-strategy>

The Principles on ABS: www.bgci.org/policy/abs_principles/

**WORLD FLORA ONLINE MID-TERM
UPDATE : FLORE MONDIALE EN LIGNE
POUR 2020**



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01. Résumé

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Peter

ON ESTIME QU'IL EXISTE SUR TERRE 400'000 ESPÈCES DE PLANTES VASCULAIRES, DONT 10% RESTENT ENCORE À DÉCOUVRIR. CES PLANTES, TANT CONNUES QU'INCONNUES, PEUVENT DÉTENIR LES RÉPONSES À DE NOMBREUX PROBLÈMES DE SANTÉ, SOCIAUX, ENVIRONNEMENTAUX ET ÉCONOMIQUES DANS LE MONDE.

Un inventaire complet du monde végétal est vital pour que de nombreuses espèces menacées soient protégées et que leur potentiel soit réalisé avant que ces espèces, et les possibilités qu'elles offrent, ne disparaissent.

En 2010, la Stratégie Mondiale pour la Conservation des Plantes, SMCP (*Global Strategy for Plant Conservation*, GSPC) de la Convention sur la Diversité Biologique des Nations Unies désignait comme son premier objectif (Objectif 1) le besoin d'avoir «Une flore en ligne de toutes les plantes connues». Avec cette idée derrière la tête, en janvier 2012 à St Louis, Missouri, USA, les représentants de quatre institutions : le *Missouri Botanical Garden*, le *New York Botanical Garden*, le *Royal Botanic Garden Edinburgh*, et le *Royal Botanic Gardens, Kew* – tous membres du *Global Partnership for Plant Conservation* (GPPC) – prirent l'initiative de se rencontrer et de discuter des moyens permettant d'atteindre cet objectif 1 de la SMCP à l'échéance de 2020. La réunion a abouti à la proposition d'une esquisse de l'étendue et du contenu d'une Flore du Monde en Ligne (World Flora Online, WFO), ainsi qu'à la décision de créer un consortium international d'institutions et d'organisations afin de collaborer

à sa réalisation. Le projet de WFO a par la suite été lancé en Inde, à l'occasion d'un événement qui s'est tenu pendant la 11^{ème} Conférence des Parties à la Convention (COP) sur la Diversité Biologique en octobre 2012, pendant laquelle la COP adopta par ailleurs cette initiative de la WFO. En janvier 2013, un Protocole d'Accord (*Memorandum of Understanding*) fut proposé à des signataires. A la fin juillet 2014, 34 institutions ont signé ce Protocole d'Accord. Une série d'autres institutions et organisations dans le monde entier est également invité à participer au Consortium de la WFO.

La WFO sera un compendium libre d'accès des espèces de plantes du monde entier, basé sur le Web. Elle sera un projet international, collaboratif, construit à partir des flores publiées et des connaissances existantes, des check-lists et des révisions, mais requerra aussi des collectes et l'acquisition de nouvelles informations sur des groupes de plantes peu connues et des plantes venant de régions inexplorées.

Le projet représente une étape décisive vers un service fournissant des informations globales consolidées sur la flore du monde.

01. Abstract

- **Loizeau Pierre-André**
- **Wyse Jackson Peter**

THERE ARE AN ESTIMATED 400,000 SPECIES OF VASCULAR PLANTS ON EARTH, WITH SOME 10 PERCENT MORE YET TO BE DISCOVERED. THESE PLANTS, BOTH KNOWN AND UNKNOWN MAY HOLD ANSWERS TO MANY OF THE WORLD'S HEALTH, SOCIAL, ENVIRONMENTAL AND ECONOMIC PROBLEMS.

A full inventory of plant life is vital if many threatened species are to be protected and if their full potential is to be realized before many of these species, and the possibilities they offer, become extinct.

In 2010, the updated *Global Strategy for Plant Conservation* (GSPC) of the U.N. Convention on Biological Diversity included as its first target (Target 1) the need for “An online flora of all known plants.” With this background in mind, in January 2012 in St Louis, Missouri, U.S.A., representatives from four institutions: the *Missouri Botanical Garden*, the *New York Botanical Garden*, the *Royal Botanic Garden Edinburgh*, and the *Royal Botanic Gardens, Kew* — all members of the *Global Partnership for Plant Conservation* (GPPC) took the initiative to meet and discuss how to achieve GSPC Target 1 by 2020. The meeting resulted in a proposed outline of the scope and content of a World Flora Online, as well as a decision to form an international consortium of institutions and organizations to collaborate on providing that content.

The World Flora Online project was subsequently launched in India, at an event held during the 11th Conference of the Parties to the Convention on

Biological Diversity in October, 2012 where the COP also adopted a decision welcoming the World Flora Online initiative. In January, 2013 a Memorandum of Understanding on the World Flora Online, was opened for signature. Up to the end of July 2016, 34 institutions and organizations had signed the MOU. A range of other institutions and organizations worldwide is also being invited to participate in the WFO Consortium.

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

The project represents a major step forward in developing a consolidated global information service on the world's flora.

01. Introduction

- Loizeau
Pierre-André
- Wyse Jackson
Peter



LA STRATÉGIE MONDIALE POUR LA CONSERVATION DES PLANTES (SMCP, GLOBAL STRATEGY FOR PLANT CONSERVATION, GSPC, EN ANGLAIS) A ÉTÉ ADOPTÉE PAR 193 GOUVERNEMENTS LORS DE LA CONFÉRENCE DES PARTIES (COP) DE LA CONVENTION SUR LA DIVERSITÉ BIOLOGIQUE (CDB) EN AVRIL 2002 (SECRÉTARIAT DE LA CONVENTION SUR LA DIVERSITÉ BIOLOGIQUE 2002).

Elle constitue une importante avancée mettant en évidence la prise de conscience de la menace qui pèse sur les plantes dans le monde entier, tout en proposant, pour la première fois, un cadre cohérent pour une politique et des actions nécessaires à la diminution de l'appauvrissement continu de la diversité végétale. Elle a été réévaluée pour une seconde phase le 29 octobre 2010 par décision X/17 de la COP en proposant 16 objectifs (Convention sur la diversité biologique. Conférence des parties 2010). Ceux-ci visent l'objectif ultime de diminuer la perte de biodiversité des plantes en 2020. Ils contribuent par ailleurs au Plan Stratégique pour la Biodiversité 2011-2020 (Convention on Biological Diversity 2012).

Le 1^{er} objectif de la Stratégie Mondiale pour la Conservation des Plantes définit que pour 2020, la diversité des plantes devrait être comprise, documentée et reconnue. Les objectifs de ce but (Convention sur la diversité biologique. Conférence des parties 2010) sont :

- l'établissement d'une flore en ligne de toutes les plantes connues

- l'évaluation de l'état de conservation de toutes les espèces végétales connues
- les informations, la recherche et les produits associés sont développés et partagés

En effet, il faut comprendre que d'une part la nature au sens large subit une pression anthropique insupportable et certainement non durable, et que d'autre part les informations permettant de la décrire et de la protéger sont éclatées dans toute la littérature scientifique. La SMCP dans son ensemble, et son premier objectif, la création d'une Flore du Monde en Ligne (World Flora Online, WFO, www.worldfloraonline.org), ont pour but de faire prendre conscience de la nécessité de conserver le monde végétal pour le bien de l'humanité et de réunir la documentation de référence afin d'en faciliter l'utilisation et d'améliorer le travail de conservation (Wyse Jackson & Miller 2015).

01. Un inventaire du monde végétal

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On estime à 400'000 le nombre d'espèces de plantes vasculaires sur Terre, dont environ 10 à 20% de celles-ci sont encore à découvrir (Joppa et al. 2011). Ces plantes, connues ou inconnues, peuvent répondre à certaines questions posées par les problèmes de santé, sociaux et économiques du monde. Un inventaire complet du vivant est vital si l'on veut pouvoir bénéficier de leur potentiel complet avant que de nombreuses espèces, et les possibilités qu'elles offrent, ne disparaissent. C'est en effet en connaissant et en nommant les plantes que des programmes de conservation qui leur sont destinés peuvent être élaborés.

La Stratégie Mondiale pour la Conservation des Plantes (SMCP) de 2002 avait comme objectif premier l'établissement d'une liste de toutes les espèces connues. Grâce à une collaboration entre les institutions mondiales ayant constitué les plus importantes bases de données de noms de taxons, et notamment grâce au travail du Jardin botanique de Kew et du Jardin botanique du Missouri, cette liste a vu le jour en 2010. Elle a été mise à jour en septembre 2013 dans une version 1.1.

The Plant List (www.theplantlist.org) est une liste de travail de toutes les espèces végétales connues. Elle vise à être globale pour les espèces de plantes vasculaires (plantes à fleurs, conifères, fougères et de leurs alliés) et des bryophytes (mousses et hépatiques). Pour chaque nom au niveau de l'espèce, les informations comprennent le ou les auteur(s) du nom, le lieu de publication de l'article, et un statut du nom en accepté, synonyme ou non-résolu dans son utilisation taxonomique actuelle. Pour chaque nom inclus, chaque fois que c'est possible, des liens sont également fournis sur l'enregistrement d'une base de données en ligne, sur l'entrée correspondante dans IPNI, et sur la source d'information sur ce taxon. Pour chaque enregistrement de nom,

The Plant List indique le niveau de confiance relatif à l'exactitude du statut du nom ; les évaluations de confiance sont basées principalement sur la nature et l'intégrité taxonomique de la source de données (Paton 2013).

World Flora Online

Le projet World Flora Online (WFO) a été créé en réponse à l'objectif 1 de la Stratégie Mondiale pour la Conservation des Plantes (SMCP) dans sa version actualisée de 2010 (Convention sur la diversité biologique. Conférence des parties 2010; Convention on Biological Diversity 2012). En janvier 2012 à St Louis, Missouri, USA, les représentants de quatre institutions : le *Missouri Botanical Garden*, le *New York Botanical Garden*, le *Royal Botanic Garden Edinburgh*, et le *Royal Botanic Gardens, Kew* – tous membres du *Global Partnership for Plant Conservation* (GPPC) – prirent l'initiative de se rencontrer et de discuter des moyens permettant d'atteindre cet objectif 1 de la SMCP à l'échéance de 2020. La réunion a abouti à la proposition d'une esquisse de l'étendue et du contenu d'une Flore du Monde en Ligne (World Flora Online, WFO), ainsi qu'à la décision de créer un consortium international d'institutions et d'organisations afin de collaborer à sa réalisation.

Le projet de WFO a par la suite été lancé en Inde, à l'occasion d'un événement qui s'est tenu pendant la 11^{ème} Conférence des Parties à la Convention (COP) sur la Diversité Biologique en octobre 2012, pendant laquelle la COP adopta par ailleurs cette initiative de la WFO.

Les termes et les justifications techniques pour le but 1 suggèrent que la flore devrait inclure les noms acceptés et une synonymie complète, en con-

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struisant cette taxonomie sur les résultats des objectifs précédents pour le but 1 (période allant de 2002 à 2010), visant à développer “ une liste de travail, largement accessible des espèces végétales connues constituant un pas vers une flore mondiale complète “ (Convention on Biological Diversity 2012). De nouvelles connaissances devraient également être incorporées dès qu’elles seront disponibles.

Le projet est basé sur l’observation que de nombreuses institutions mettent en œuvre des projets de flore numériques au niveau national, et qu’il serait intéressant de réunir ces informations en un seul point afin d’en faciliter la consultation et la synthèse. La WFO devrait devenir sur internet la ressource fondamentale et vérifiée, documentant toutes les plantes connues dans le monde. Elle offrira des capacités de recherche sur des informations vérifiées ainsi que de nouvelles données, et établira des liens avec les espèces d’autres bases de données et catalogues existants.

La WFO couvre l’ensemble du monde végétal en partant des bryophytes jusqu’au angiospermes. Elle sera libre d’accès sur internet.

En échange de l’attribution et de l’implication dans le projet, le Consortium de la WFO demande que les organisations contribuent en :

- déterminant les noms des espèces acceptées, et les synonymes de chaque nom accepté
- identifiant les sources et fournissant des traitements précis de chaque espèce provenant à la fois de flores et de monographies

Un référentiel taxonomique consensuel

Comme on l’a vu plus haut, le projet est basé sur une liste préliminaire de toutes les espèces végétales connues, qui est disponible sur le site internet *The Plant List* (www.theplantlist.org), constituant le référentiel taxonomique auquel les descriptions d’espèces et d’autres informations spécifiques doivent être rattachées. Cependant, *The Plant List* étant une liste statique, celle-ci ne suffit pas à représenter l’évolution des concepts taxonomiques au fur et à mesure que les groupes de recherche de par le monde les établissent. Aussi il est apparu assez rapidement que le référentiel taxonomique de la WFO devait devenir un outil dynamique de l’état de la connaissance de la systématique mondiale pour être utile. Ceci est rendu possible par la mise en base de données de ce référentiel et par le développement d’un outil de gestion collaboratif, ou d’ingestion de taxonomies partielles. Le Consortium de la WFO travaille actuellement à la mise en place d’un outil informatique performant de gestion de la taxonomie.

Sans rejeter la possibilité de taxonomies alternatives, la World Flora Online présentera un consensus au niveau de la classification, ce qui devrait faciliter la compréhension du monde végétal par des non-botanistes. Pour atteindre cet objectif, le projet a besoin de l’expertise de réseaux collaboratifs et de taxonomistes individuels afin de développer une classification consensuelle.

01. Un outil pour la conservation, mais pas que...

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L'objectif est de fournir des informations qui contribuent à une bonne compréhension de la situation du monde végétal dans un environnement en évolution constante, soumis à la pression humaine.

En premier lieu, ce sont les personnes qui s'occupent de conservation qui devraient bénéficier des informations du site internet, mais aussi les taxonomistes et tous les scientifiques utilisant des informations venant du monde végétal (par exemple les écologistes, les anthropologues, les archéologues ou les pharmacologues).

Les personnes appelées à contribuer au projet sont les fournisseurs de données primaires, les conservateurs dans les herbiers, les systématiciens, les informaticiens ou autres gestionnaires de données.

Un important travail de réflexion a été mené par les participants au projet, afin de définir les informations qui doivent apparaître dans le site internet. Ainsi les bénéficiaires doivent avoir un accès libre aux données depuis de multiples plateformes internet, pouvoir imprimer ou télécharger des données, indépendamment de leur dimension, rechercher des taxons par nom scientifique et/ou par pays ou région, être informé du nom scientifique retenu pour chaque taxon, être informé de la synonymie relative, ainsi que de la classification adoptée tant par le fournisseur de données que par la classification consensuelle adoptée par WFO, et surtout voir affiché la description des taxons pour chacune des flores les ayant décrits.

Par ailleurs le site devrait pouvoir afficher des photos ou des dessins des taxons, ou au minimum des liens internet externes sur ces informations, proposer des outils d'identification (clés) des plantes d'un pays ou d'une ré-

gion ou des liens internet sur de tels outils, informer sur la distribution des taxons enregistrés dans la WFO, informer de la source des données et de leur fiabilité, etc.

Un soutien très large de la communauté

Le projet de WFO est soutenu par le *Global Partnership for Plant Conservation* depuis 2011 dont l'objectif principal est de favoriser la mise en œuvre de la Stratégie Mondiale pour la Conservation des Plantes en facilitant la communication entre initiatives poursuivant le même but (Wyse Jackson 2013). Le projet a aussi été considéré comme prioritaire lors du Congrès International de Botanique à Melbourne en 2011.

A l'issue de la conférence internationale organisée conjointement par l'UNESCO et le Muséum National d'Histoire Naturelle de Paris en septembre 2014, avec pour thème « Quels botanistes pour le 21^e siècle? Métiers, enjeux et opportunités » (Rakotoarisoa et al. 2016), la déclaration finale appelle toute la communauté des botanistes et des scientifiques travaillant avec le monde végétal, ainsi que leurs institutions, à augmenter leurs efforts afin d'atteindre les objectifs et les buts de la SMCP, notamment ceux dont la charge incombe aux botanistes, y compris l'achèvement de la WFO pour 2020 permettant de fournir un référentiel essentiel à la connaissance des plantes du monde entier.

01. Un soutien très large de la communauté

- Loizeau Pierre-André
- Wyse Jackson Peter

La WFO est organisée dans le cadre d'un Consortium d'institutions, qui ont toutes signés un accord de partenariat (*Memorandum of Understanding*). Ouvert aux signatures en janvier 2013, le Consortium de la WFO comptait, en juillet 2015, 29 institutions partenaires. Une année après, il compte 34 institutions (**Tableau 1**).

Etabli principalement autour d'institutions européennes et nord-américaines, ce Consortium recherche toutefois des partenariats dans le monde entier.

Un consortium actif et dynamique

Après une réunion de lancement à St-Louis, USA, en janvier 2012, suivie d'une réunion d'organisation en juillet de la même année toujours à St-Louis, le Consortium de la WFO s'était réuni à trois reprises au moment de la tenue de la conférence Eurogard VII, en novembre 2013 à Edimbourg, en juin 2014 à St-Petersbourg, et en janvier 2015 à Genève. Deux réunions ont eu lieu ensuite, à Rio de Janeiro en octobre 2015 et à New York en avril 2016.

Le Consortium est organisé en quatre entités : le Conseil réunit tous les membres du Consortium et décide des options stratégiques. Il est appuyé par un secrétariat. Deux sous-groupes travaillent pendant l'année au développement du projet : le « Groupe de travail Taxonomique » fait des propositions concernant la classification, la taxonomie et l'appel aux experts, et le « Groupe de travail Technique » travaille sur l'architecture de la base de données, sur le contenu du site internet, et sur les outils à développer.

> **TABLE 1**

Membres du Consortium de la WFO, état en juillet 2016



Academy of Sciences	St. Petersburg, Russia
Allen Herbarium, Landcare Research	Lincoln, New Zealand
Australian Biological Resources Study	Canberra, Australia
Botanic Garden and Botanical Museum Berlin-Dahlem, Dahlem Centre of Plant Science (DCPS)	Berlin, Germany
Botanic Garden Meise	Meise, Belgium
Botany Department of Trinity College Dublin	Dublin, Ireland
Conservatoire et Jardin botaniques de la Ville de Genève	Geneva, Switzerland
Core Facility Botanical Garden of the University of Vienna	Vienna, Austria
Euro+Med Plantbase	Berlin, Germany
Flora Iberica Project	Madrid, Spain
Flora Malesiana Foundation	Leiden, Netherlands
Flora of North America Association	US & Canada
Forest Research Institute Malaysia	Kuala Lumpur, Malaysia
Global Biodiversity Information Facility	Copenhagen, Denmark
Institute of Botany, Academy of Sciences of the Czech Republic	Prague, Czech Republic
Institute of Botany, Azerbaijan National Academy of Sciences	Baku, Azerbaijan
Institute of Botany, Chinese Academy of Sciences	Beijing, China
Institute of Botany, Slovak Academy of Sciences	Bratislava, Slovakia
Instituto de Botánica Darwinion	Buenos Aires, Argentina
Instituto de Ecología A.C.	Veracruz, Mexico
Instituto de Pesquisas Jardim Botânico do Rio de Janeiro	Rio de Janeiro, Brazil
Komarov Institute of Botany	St. Petersburg, Russia
Kunming Institute of Botany, Chinese Academy of Sciences	Kunming, China
Missouri Botanical Garden	St. Louis, Missouri, USA
Muséum National d'Histoire Naturelle	Paris, France
National Biodiversity Institute (INBio) of Costa Rica	Santo Domingo de Heredia, Costa Rica
Natural History Museum	London, UK
Naturalis Biodiversity Center	Leiden, Netherlands
Royal Botanic Garden	Edinburgh, Edinburgh, UK
Royal Botanic Gardens	Kew, London, UK
Smithsonian National Museum of Natural History	Washington, DC, USA
South African National Biodiversity Institute	Pretoria, South Africa
The New York Botanical Garden	New York, NY, USA
Tsitsin Main Botanical Garden	Moscow, Russia
UNESCO Chair in Plant Conservation and Biodiversity in Macaronesia and in Western Africa	Gran Canaria, Spain

01. Un projet collaboratif

- Loizeau
Pierre-André
- Wyse Jackson
Peter

Deux prototypes de portail fonctionnels ont été développés au Missouri Botanical Garden et au Royal Botanic Gardens de Kew. Le premier développé par le Missouri Botanical Garden avait surtout travaillé le design, s'attachant à mettre en évidence les résultats utiles au public cible. Le second portail était basé sur le travail fait par Kew pour afficher les données du groupe *eMonocot* (www.emonocot.org).

Finalement le Consortium a décidé d'adapter le logiciel proposé par Kew, et a remercié le Missouri Botanical Garden pour sa proposition d'en assurer le développement. On retrouve dans ce portail des éléments tels que le nom scientifique, le protologue, quelques images, des descriptions provenant de plusieurs sources, le positionnement dans la classification adoptée, une phylogénie, un statut UICN. La description de l'habitat est aussi affichée en fonction des sources, comme la distribution, la conservation et les usages. Le matériel Type est aussi mentionné, ainsi qu'une carte de distribution. Enfin on pourra afficher la synonymie, la bibliographie et les copyrights en fonction des sources. A propos de la synonymie, la WFO devrait proposer des classifications alternatives en fonction de différents projets, l'une d'elles étant la classification consensuelle proposée par la communauté des taxonomistes participants au projet WFO.

La réunion de Genève au début 2015 a apporté par ailleurs de nouvelles réjouissances. Ainsi par exemple le New York Botanical Garden a obtenu de Google un financement permettant de placer le projet dans le cloud sur des serveurs mis à disposition par cette entreprise. Le Jardin botanique de Rio a mis à disposition du temps d'informaticien permettant de travailler le design en général. Les Conservatoire et Jardin botaniques de la Ville de Genève ont proposé leur logiciel de gestion de la nomenclature comme un

des outils pouvant gérer le référentiel taxonomique. On notera que ce logiciel permet une gestion « par projet », permettant ainsi de visualiser sur une base de noms valides plusieurs taxonomies en parallèle, l'une d'elle étant la taxonomie consensuelle proposée pour la WFO. Ce ne sont que quelques exemples de l'investissement consenti par les partenaires de ce projet, chaque membre du Consortium apportant son expertise et des moyens en fonction de ses possibilités, mais dans tous les cas avec un désir profond d'aboutir à un résultat utile et enthousiasmant.

L'éternel problème des moyens financiers

La WFO fonctionne sur les moyens mis à dispositions par les partenaires, ou les moyens financiers que ceux-ci ont pu trouver pour assurer leur participation. On aurait pu s'attendre à un soutien plus fort de la part des gouvernements, dans la mesure où la SMCP est soutenue par les signataires de la Convention sur la Diversité Biologique. Malgré cela, ce soutien est appréciable dans la mesure où il permet d'orienter et de justifier la participation des institutions partenaires actuelles et futures à cet important projet. Par ailleurs il permet de solliciter des sponsors.

01. Conclusion

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Pierre-André
- Wyse Jackson
Peter

L'effort consenti de manière volontaire par les institutions est un point très encourageant, qui démontre l'importance de ce projet pour le développement futur non seulement de la conservation, mais aussi de la taxonomie et de la publication de flores. En effet, ce projet collaboratif met en commun les moyens des institutions partenaires afin de partager les données de référence utiles à tous. Ceci est rendu possible par l'évolution impressionnante de la communication à travers internet. Bien qu'il existe encore des points du globe qui restent peu ou difficilement accessibles à l'information électronique, la communication est intense dans la majorité des lieux actifs en botanique et en conservation. Les informations que la WFO mettra à disposition de tous vont certainement accélérer tous les processus liés à la nomenclature et à la taxonomie, et apporter des informations et des aides à la décision concernant les problèmes globaux de conservation. On notera par ailleurs que la plupart des objectifs de la Stratégie Mondiale pour la Conservation des Plantes ne pourront se réaliser que si ce premier objectif d'une Flore du Monde en Ligne est réalisé.

Contacts

Toutes les institutions intéressées sont cordialement invitées à participer à ce projet collaboratif. Les personnes de contact sont Peter Wyse Jackson (peter.wysejackson@mobot.org) et Pierre-André Loizeau (pierre-andre.loizeau@ville-ge.ch), co-présidents de la WFO.

Références

Convention on Biological Diversity, 2012. *The Global Strategy for Plant Conservation: 2011-2020*. Botanic Gardens Conservation International, Botanic Gardens Conservation International, Richmond, U.K.

Conférence des parties à la Convention sur la diversité biologique, 2010. *Stratégie Mondiale pour la Conservation des Plantes: X/17*.

eMonocot, disponible sur : www.emonocot.org (accessed 18 July 2016).

Joppa, L. N., Roberts, D. L & Stuart, L. Pimm, 2011. How many species of flowering plants are there? *Proceedings. Biological sciences / The Royal Society* 278 No. 1705: 554–559.

Rakotoarisoa, N.R., Blackmore, S. & Riera, B. (Eds.), 2016. *Botanists of the twenty-first century: roles, challenges and opportunities: Based on the proceedings of the UNESCO International conference "Botanists of the twenty-first century: roles, challenges and opportunities" held in September 2014 in Paris, France*, UNESCO, Paris.

Secrétariat de la Convention sur la diversité biologique, 2002. *Stratégie Mondiale pour la Conservation des Plantes*. Botanic Gardens Conservation International, Richmond [England].

The Plant List, disponible sur : www.theplantlist.org (accessed 15 July 2016).

World Flora Online, disponible sur : www.worldfloraonline.org (accessed 15 July 2016).

Wyse Jackson, P., 2013. A Global Partnership for Plant Conservation—Supporting the Worldwide Implementation of the Global Strategy for Plant Conservation. *Ann. Missouri Bot. Gard.* 99 (2): 129–243.

Wyse Jackson, P. & Miller, James S., 2015. Developing a World Flora Online - a 2020 challenge to the world's botanists from the international community. *Rodriguésia* 66 No. 4: 939–946.

THE INPN (NATIONAL INVENTORY OF NATURAL HERITAGE), A MANAGEMENT TOOL FOR FRENCH BIODIVERSITY KNOWLEDGE DISSEMINATION AND CONSERVATION: THE EXAMPLE OF FLORA AND HABITAT

Photo credit : Composition extraite de l'Inventaire National du Patrimoine Naturel, <https://inpn.mnhn.fr>, Muséum national d'Histoire naturelle [EJ], 2003-2018., Solène Robert et Emeline Oulès, 2018



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01. Abstract

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A ROBUST KNOWLEDGE BASE IS THE FIRST STEP IN SUCCESSFUL NATURE CONSERVATION.

The “Inventaire National du Patrimoine Naturel” (INPN), a National Inventory of Natural Heritage, was created in 2003 using data managed by the Natural Heritage Department (UMS 2006 Patrimoine Naturel) of the French Natural History Museum (MNHN). The development and management of the INPN by the Museum is enshrined in national legislation (the Environmental Code L411-5) and funded by the French Ministry of Environment. More than a simple inventory, the INPN is a national programme of management, consolidation and dissemination of biodiversity knowledge, underpinning the broader “Information System on Nature and Landscapes” (SINP) within France. As a national information platform, the INPN provides data about marine and continental fauna, flora and fungi across the mainland France, Corsica and its overseas territories, as well as information on protected areas (their features, boundaries and distribution). This remit has been recently extended to natural habitats and geological heritage (INPG). The INPN provides information on species distribution (national reference layers) and status (taxonomy, associated regulations, and IUCN Red List status) for more than 160,000 species, including 34,766 floristic species [1]. In Europe, Flora databases are very often managed by universities and enhanced thanks to expert botanists. With regard to data on flora, the main partners are: Federation of National Botanic Conservancies (FCBN), French Society of Orchidophily (SFO), French Forests Office (ONF), MNHN, National Geographical and Forest Information Institute (IGN), Botanical Society from Alsace (SBA), Institute of research for

development, Global Biodiversity Information Facility (GBIF) and private organisations.

Collected data are often heterogeneous, and therefore pass through a formal process of standardisation, control and scientific validation. Common standards are key to the interoperability of information systems. The MNHN holds the scientific responsibility to implement the national taxonomic repository called TAXREF. This register is the backbone of the species information system which allows to manage and share data.

In 2015, the national “Flora” data in the INPN have nearly reached 30 million (species occurrence data), thanks to partnerships, and in particular with the FCBN and the Ministry of Environment. Data processing is currently underway, this is why this number might actually evolve. Over the next years, the completion of national survey data layers, will help define (and fill) knowledge gaps. In combination, these INPN programmes help to set public conservation policy for natural heritage, and reinforce the importance of consistency in knowledge acquisition for biodiversity management and conservation.

01. Introduction

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Photo credit : Composition extraite de l'Inventaire National du Patrimoine Naturel, <https://inpn.mnhn.fr>. Muséum national d'Histoire naturelle [Ed]. 2003-2018. . Solène Robert et Emeline Oulès, 2018

BEING A BOTANIST IS A PASSION, WE COLLECT LIST OF PLANTS ON PAPER SHEETS OR COMPUTERS, WE PRESERVE PLANT SPECIMENS IN HERBARIA, AND TAKE NUMBERS OF PICTURES. WE EVEN MAKE MAPS TO LOCATE THEM, AND THEIR HABITATS.

This is a worldwide phenomenon and it has been so for centuries. So many data, but still, how do we use those precious information? How do we share this knowledge in order to improve nature conservation?

This is why, every data collector, professional or skilled observer, have been developing solutions to store all their information in one place. It all began in the 1980ies, together with computer development, and in the 1990ies with the World Wide Web. Since the beginning of the new century, public organisations and associations, created big databases, collecting all the information on biodiversity. In an attempt for all to speak the same language, and to use the same informatics codes, data are now more homogeneous and, as a consequence more useful. The Museum (MNHN), is one of those public organisations, which works on data compilation and dissemination at the national level. Thus, the MNHN was mandated by the French Ministry of Environment for this task.

Background

EUROPEAN LEGISLATION FOR A NATIONAL REFERENCE BANK OF FRENCH BIODIVERSITY

Officially launched in 2005, the INPN is a national information platform, which provides data about marine and terrestrial fauna, fungi, flora and habitat across metropolitan France and its overseas territories (species distribution and status), as well as information on protected areas. The platform is constantly evolving, and will soon include geological, mineralogical, and palaeontological resources. The INPN is kept up to data via naturalist networks, scientific expertise, collections, biodiversity conservation/research programmes, as well as conventions with the private sector.

The State ensures and organises data exchange between biodiversity actors thanks to the Information System on Nature and Landscape (SINP). As specified in the European INSPIRE Directive and in the Aarhus International

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Convention, environmental knowledge must be made available to the greatest number of people.

Indeed the State, through the SINP, ensures the design, animation and assessment, at the regional and national levels, while the Museum (UMS2006/MNHN) ensures the scientific responsibility of the inventories led within this framework.

NATIONAL REPOSITORIES (TAXREF, HABREF)

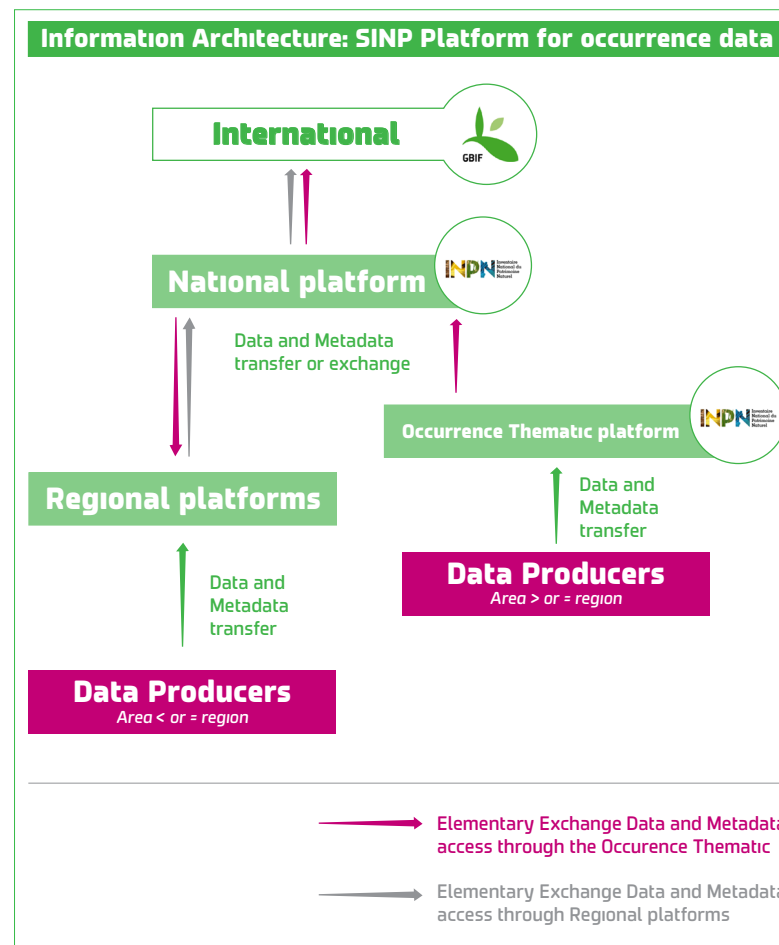
The prerequisite to manage and disseminate biodiversity knowledge is the use of standards to speak a common language. Those standards are then used to produce robust data through a formalised process.

Here is an overview of those national standards:

- taxonomic repository TAXREF,
- laws and regulation, in conjunction with TAXREF,
- Habitats repository HABREF.

TAXREF is the keystone of the species information system. It lists valid scientific names and their synonyms, reflecting the taxonomic knowledge at a given time to ensure the use of the same valid name for a species in all French territories. The current version was released in December 2015, it is already the 9th version.

The number of floristic taxa in France (metropolitan and overseas territories) is 32,705 (Gargominy *et al.*, 2015), which includes 26,489 taxa only for the



> **FIGURE 1**
Information architecture, Information System on Nature and Landscape (SINP), platforms for occurrence data. Robert S., 2015

Tracheophyte branch (vascular plants). Regarding metropolitan France, the taxonomic register of vascular plants is implemented within the framework

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of a four-party convention between the French Ministry of Environment, the FCBN, the Tela Botanica association and the MNHN.

HABREF is a national repository comprising the official reference versions of the typologies of habitats or vegetation covering marine and/or continental environments in France (metropolitan and overseas territories) (Clair et al., 2015). It includes 19 typologies representing 18,600 units (habitat types) and comprised correspondences (~16,000) and connections between habitats and species (20,000).

The legal protection and the regulation of wildlife species and natural areas, is one of the cornerstones of the policy of biodiversity conservation. 'Laws and regulation', concerns both species (associated regulations) and natural or protected areas (National parks or reserves, Natura 2000 areas, Natural Areas of Ecological Fauna and Flora Interest...). Concerning natural or regulated areas, the platform provides mainly descriptive data such as site name, date of creation, renewal or modification, region(s), official text, fauna-flora-habitat data, and geographical information (GIS layers). Concerning species status, for instance, the number of texts and the taxonomic shift between these texts and scientific expertise make them difficult to use. The Museum (UMS2006/MNHN) produced tables of species in conjunction with the national taxonomic repository TAXREF that can be used by policy makers.

DATA COLLECTION AND DISSEMINATION

In 2015, the national "Flora" data in the INPN have reached nearly 30 million (species occurrence data). Data processing is currently underway, this

is why this number might actually evolve. Those occurrence data mainly concerns Vascular plants.

Distribution across the French mainland and Corsica, is available for more than 7,000 floristic species, and is updated as often as possible. This digital atlas of species per department is called the Atlas of the Departmental Biodiversity and Marine Sectors (ABDSM) (Haffner et al., 2012). The department was chosen, as a relevant administrative entity which has the advantage of being a rather thin inventory unit to provide an acceptable level of biogeographical information on species distribution but requires an effort on data acquisition sufficiently reduced to consider frequent updates. The summary information presented on these cards are based on expert opinion (likely presence or absence of the species), recent observations from botanists, and scientific papers. An innovative aspect lies in the estimation of absence of the species clearly differentiated from a simple lack of information. It is a starting point to initiate national inventories.

The French plant biodiversity is assessed throughout the country, thanks to the work of scientists, and skilled observers from public or private organisations and associations. Data are collected and monitored thanks to field work, scientific literature and collections. It is of a great interest to know precisely when and where the data was collected, this is why data sources appears on each species search (Metadata).

The main sources for plant occurrence data are: National Botanic Conservancies (CBN) and their Federation (FCBN), French Society of Orchidophily (SFO), French Forests Office (ONF), MNHN, associations, Natural Reserves (RNN), National and regional nature parks, natural areas conservancies, In-

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stitute of research for development (IRD), Global Biodiversity Information Facility (GBIF) and private organisations.

Collections are a significant source of data, collected throughout centuries, they sometimes become a tool, which helps us to understand the evolution in plant distribution, or to establish links between human activities and species decline.

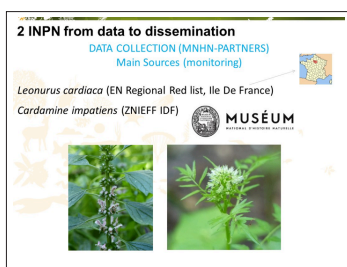
The Museum of Natural History preserves the national Herbarium, with around 8 million specimens from all over the world. Some of the specimens hosted in Paris are or will be part of the information available on the INPN.

Participatory sciences are now spreading and are of a great help to monitor ordinary biodiversity, through national inventories. There are three ongoing projects at the Museum, concerning this subject, which will soon be part of the INPN:

- “Vigie Flore” and “Sauvages de ma rue”, held together with the French association Tela Botanica. Citizens can be involved in those projects, and increase information on common and urban vascular plants.
- “Les Herbonautes”, which is a digital herbarium. Skilled observers can fill the gaps from the Paris herbarium missing information.

> FIGURE 2

Wild plants of high natural heritage value, found inside the Botanical Garden in Paris (O. Delzons, 2014)



Focus on monitoring programmes from the UMS2006/MNHN & Botanical Garden

Biodiversity is also assessed at the Botanical Garden from Paris.

The Natural Heritage Department from the Museum (UMS2006/MNHN) defined an Ecological Quality Index (IQE, Indicateur de Qualité Ecologique) for site management (Delzons et al., 2013). This Environmental Quality Index is a standardised assessment tool based on a six day inventory of biodiversity. It aims to provide information on three key aspects of biodiversity, i) diversity, ii) wildlife and natural heritage value and iii) ecological functionality, and to propose management measures to preserve biodiversity. In order to create this indicator, inventories were conducted on 29 sites over a four-year period, and compared with published literature and expert knowledge. This approach uses composite indicators and is continually evolving thanks to experience feedbacks and a community of practice created for the purpose.

The IQE was similarly conducted inside the Botanical Garden in 2014. We are currently working together with the managers of the garden in order to help this nature to grow, and to inform our visitors, without disturbing their habits or this historic place.

Outcomes and perspectives

Besides clustering data in one place, the INPN, is a tool for biodiversity actors. In order to illustrate this fact, here are some important outcomes and partnerships connected with the INPN and flora/habitat conservation.

ATLASES

The production of atlases, is one of the first outcomes. Digital atlases, such as the Atlas of the Departmental Biodiversity and Marine Sectors, are now spreading. However available and exhaustive paper plant atlases covering

01. Outcomes and perspectives

- Oulès Emeline
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French mainland and Corsica have not been updated for all plants. In 2008 the French Society of Orchidophily (SFO) transferred more than 420,000 data on orchid's observations to the INPN. As a consequence, in 2010, the Atlas for wild orchids, from mainland France and Corsica, which was coordinated by the SFO, was released as a scientific publication from the Museum. This work is also related to the assessment of the French orchid Red List from mainland France and Corsica, in partnership with the federation of botanic conservancies (FCBN), the International Union for Conservation of Nature (IUCN) and the SFO. The next step would be a national vascular plant Atlas for mainland France and Corsica.

WORK ON RED LISTS AND NATURA 2000

IUCN's Red Lists of threatened species is a global assessment of the risk of extinction of species or subspecies of plants and animals. The list of floristic species to be assessed is established consistently with the national taxonomic repository. Once confirmed, the results are published and disseminated on the sites of IUCN France and the INPN.

Reporting on Natura 2000, concerns all countries of the European Union, as enshrined in the Fauna, Flora, and Habitats European Directive (1992). France led a systematic assessment for the European Commission on the conservation status of wild fauna, flora and habitats of community interests on its territory. The last report, from the Natural Heritage Department (UMS2006/MNHN), covers the years 2007-2012 and concerns 100 plant, 7 lichen and 205 animal species in France, as well as 132 types of habitats in both terrestrial and maritime ecosystems (Bensettiti & Puissauve, 2015).

DEFINE INVENTORY NEEDS AND HELP ENVIRONMENTAL POLICY DECISION MAKING PROCESS

Finally, with 30 Million occurrence data on flora, the completion of national survey data layers will help define inventory needs and fill knowledge gaps.

Moreover, numbers of analyses can be done thanks to those available information, and can improve or guide environmental policy:

- studies on the evolution in plant diversity or distribution. This evolution can be compared to data on climate change, land use evolution, anthropic pressures....,
- studies on the evolution of flora hotspots,
- improvement of conservation planning, using flora atlases,
- update knowledge gaps on natural areas, related to the national Strategy of Creation of Protected Areas (SCAP).

01. References

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Bensettiti, F. & Puissauve, R., 2015. – *Résultats de l'évaluation de l'état de conservation des habitats et des espèces dans le cadre de la directive Habitats-Faune-Flore en France*. Rapportage « article 17 ». Période 2007-2012. MNHN-SPN, MEDDE, Paris, 204 p.

Clair M., Gaudillat V., Louvel-Glaser J., Michez N. & Poncet L., 2015. HABREF v2.0, *référentiel des typologies d'habitats et de végétation pour la France. Guide méthodologique*. Rapport SPN 2015-60. Muséum national d'Histoire naturelle, Paris, 53 p.

Delzons, O., Gourdain, P., Siblet, J.-P., Touroult, J., Herard, K. & Poncet, L. 2013. LIQE: un indicateur de biodiversité multi-usage pour les sites aménagés ou à aménager. *Rev. Ecol. (Terre et vie)*, vol.68, 2013.

Gargominy, O., Tercerie, S., Régnier, C., Ramage, T., Schoelinck, C., Dupont, P., Vandel, E., Daszkiewicz, P. & Poncet, L. 2015. TAXREF v9.0, *référentiel taxonomique pour la France : méthodologie, mise en œuvre et diffusion*. Muséum national d'Histoire naturelle, Paris. Rapport SPN 2015 – 64. 126 pp.

Haffner P., Poncet L., Da Costa H. & Touroult J., 2012. *Atlas de la biodiversité départementale et des secteurs marins*. Rapport méthodologique – version 1. Rapport SPN 2012-36, 9 p.

<https://inpn.mnhn.fr>

<https://spn.mnhn.fr>

<https://inpn.mnhn.fr/programme/referentiel-taxonomique-taxref?lg=en>

https://inpn.mnhn.fr/espece/cd_nom/105548?lg=en

https://inpn.mnhn.fr/espece/cd_nom/87933?lg=en <https://inpn.mnhn.fr/programme/referentiel-habitats>