Global Survey of

Ex situ Rhododendron Collections

Botanic Gardens Conservation International

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BGCI

Plants for the Planet

Contents

Acknowledgements

Many botanic gardens around the world have freely contributed data to the survey (Annex 4), and their contributions are gratefully acknowledged. BGCI would also like to acknowledge the assistance of the following organisations in the promotion of the survey and the collection of data: Chinese Academy of Science (CAS) Botanic Gardens Committee, European Botanic Garden Consortium, Rhododendron Society.

Cover image: *R. caespitosum* from Near Lake Habbema, Papua, Indonesia (Debbie White)

Summary

Following a collaborative international effort, *The Red List of Rhododendrons* was jointly published in 2011 by BGCI and FFI under the partnership of the Global Trees Campaign. The report highlighted the urgent conservation need with 75 taxa on the verge of extinction in the wild (Critically Endangered and Endangered).

The first stage of action is to establish the extent to which rhododendrons are currently being held within *ex situ* collections around the world by carrying out a global survey.

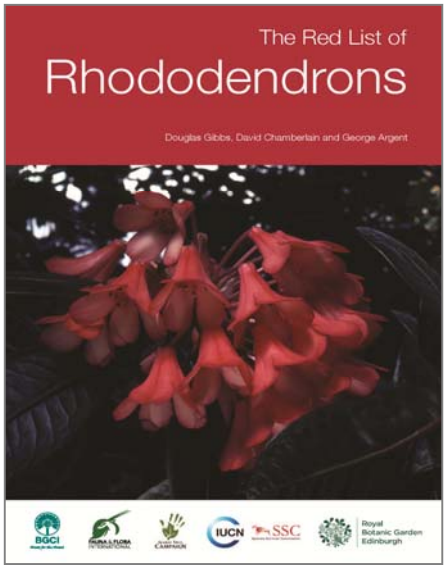
The survey identified 12,068 rhododendron records[1] from 304 institutions in 42 countries. However, only 276 *ex situ* records representing just 48 of the most threatened rhododendrons were located. This means that many of the Critically Endangered or Endangered taxa are currently not known to cultivation and therefore at great risk of extinction if threats that they are facing in the wild are not addressed.

A better understanding of the conservation status of group (*The Red List of Rhododendrons*) and a better understanding of the *ex situ* collections status contained in this survey forms a strong basis with which to set conservation priorities and action.

The report concludes by making a call for further information to fill gaps in our knowledge of collections and by making a series of recommendations based on the results of the survey including: the strengthening of existing *ex situ* collections, establishing new collections, implementing restoration and reintroduction activities, involving local communities and organisation in conservation activities, developing public awareness programmes and enhancing BGCI's *PlantSearch* database.

[1] For the purposes of this survey, a record is the presence of a single living *Rhododendron* taxon within an institution and may include multiple accessions and/or individuals.

Introduction

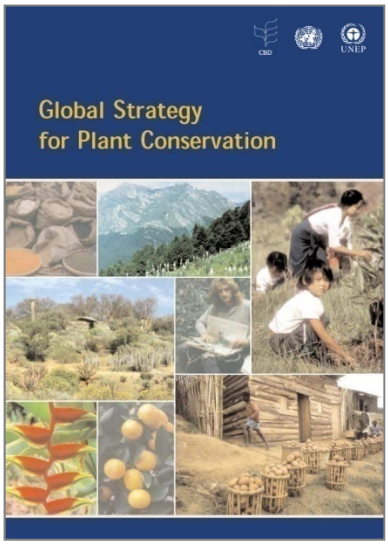


The Red List of Rhododendrons was published jointly by Botanic Gardens Conservation International (BGCI) and Fauna & Flora International (FFI) in 2011, under the partnership of the Global Trees Campaign. Electronic copies of the report are available from the BGCI website (www.bgci.org).

Rhododendrons are stunning horticultural plants widely cultivated in temperate regions. In the wild they are mainly associated with centres of diversity in the Himalayas and in South East Asia where they form important components of montane ecosystems.

Rhododendron is a large genus, with *The Red List of Rhododendrons* assessing 1157 taxa. Of these taxa, one has already been lost to and one saved from extinction by being brought in to cultivation highlighting the value of botanic gardens. Based on the information presented in the Red List report, urgent attention is required for the 75 taxa considered to be at most risk of extinction (Endangered or Critically Endangered) according to the IUCN Red List Categories and Criteria.

Some of these threatened rhododendrons are reduced to a handful of individuals in the wild and it would be a tragedy if such species are needlessly lost. It is clearly important that all Critically Endangered (CR) and Endangered (EN) taxa are represented in well-managed *ex situ* collections as an insurance policy for the future and in support of Target 8 of the *Global Strategy for Plant Conservation* (GSPC) and wider conservation efforts.



Global Strategy for Plant Conservation (2011-2020), Target 8:

At least 75 per cent of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes

At the same time habitat protection and restoration should be reviewed and mechanisms put in place for local people to be involved in and benefit from the *in situ* conservation and management of these important plants.

Methods

An international survey of *ex situ* collections of globally threatened rhododendrons, building on information held within BGCI's *PlantSearch* Database, was undertaken by BGCI. The results of the survey have enabled us to identify which Critically Endangered (CR) and Endangered (EN) species are currently known to be held in *ex situ* collections. From this information, the gaps and the opportunities have been identified in order to develop a prioritised plan for the long term integrated conservation of the most threatened rhododendrons.

All BGCI's institutional members were invited to participate in the survey; however participation in the survey was not limited to BGCI members. Awareness of and invitations to participate in the survey was promoted through BGCI's website (www.bgci.org) and a range of networks, organisations and events including rhododendron societies.

The survey primarily focussed on collecting data on the Critically Endangered (CR) and Endangered (EN) taxa since these are of the highest conservation priority. Information on other taxa was also collected when possible.

The survey of *ex situ* collections was carried out via through a range of methods, including:

- Analysis of data held in BGCI's *PlantSearch* database (www.bgci.org/plant_search.php)
- Through direct contact with botanic gardens and networks
- Data collected from online databases of living collections:
  - The multisite BG-BASE search facility maintained by Royal Botanic Garden Edinburgh (rbg-web2.rbge.org.uk/multisite/multisite3.php)
  - Database of Asian Plants in Cultivation maintained by Quarryhill Botanical Garden and California Academy of Sciences (research.calacademy.org/research/botany/quarryhill/index.asp)

In addition to the presence or absence of a rhododendron from a collection, the following closed questions were also asked:

- Is this rhododendron from a known wild source or from horticultural/unknown origin?
- What is the approximate size of the collection?
- Is this rhododendron collection part of a restoration or reintroduction programme?

The resulting submissions were cross-checked with the published *Red List of Rhododendrons* and accepted synonyms.

Although efforts were made to limit their impact on the final results, the survey has inherent limitations which mean that it can never be considered to be truly exhaustive and final. Surveys, such as this one, can be limited by issues of non-stable taxonomy, unclear synonymy, correct identification of specimens, the degree of participation by collection holders in the survey and the dynamic nature of *ex situ* collections which evolve and change over time. A number of taxa were assessed at the infra-specific level, however institutions did not always record infra-specific taxonomy therefore these taxa are likely to be under-represented in the survey.

Also, important additional specimens will be held in private collections which are poorly represented in surveys such as this.

A final caveat is that this survey does not attempt to assess the accessibility nor the associated data of the collections; two key factors in determining the true conservation value of any *ex situ* collection.

Results

General findings

The survey identified 12,068 rhododendron records[1], from 304 institutions in 42 countries. This indicates that 67% of Rhododendron taxa are found in living collections

Although this forms the largest number of records, by far, included in any of the recent *ex situ* surveys carried out by BGCI (i.e. Magnolias, Maples, Quercus), just 2% of the collections are of the most threatened Rhododendrons (EW, CR and EN).

The 2% or 276 records represent 48 of the 77 most threatened rhododendrons:

Extinct in the Wild:

Rhododendron kanehirae

Critically Endangered:

Rhododendron acrophilum, R. amesiae, R. auritum, R. carstensense, R. changii, R. chapmanii, R. coxianum, R. eriocarpum var. tawadae, R. fleuryi, R. formosum var. formosum, R. griersonianum, R. hemsleyanum, R. linearilobum, R. longiflorum var. longipetalum, R. mendumiae, R. rhombifolium, R. subansiriense, R. taxifolium, R. tuhanensis

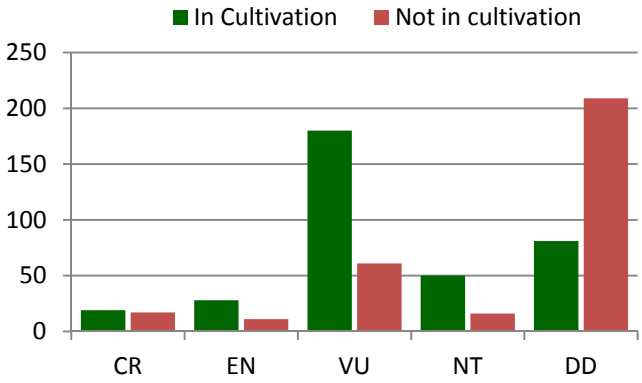
Endangered:

Rhododendron acuminatum, R. adenosum, R. alborugosum, R. amagianum, R. arboreum var. nilagiricum, R. baconii, R. balangense, R. eurysiphon, R. eymae, R. farinosum, R. fletcherianum, R. huidongense, R. jingangshanicum, R. lamrialianum ssp. gunsalamianum, R. macabeanum, R. madulidii, R. mallotum, R. meijeri, R. nakaharae, R. nitidulum var. omeiense, R. platypodum, R. pubicostatum, R. sanctum, R. santapaui, R. triumphans, R. uwaense, R. vellereum, R. viscidifolium

[1] For the purposes of this survey, a record is the presence of a single living *Rhododendron* taxon within an institution and may include multiple accessions and/or individuals.

Table 1. Summary results – the number of rhododendrons in or not in cultivation

	In Cultivation	Not in Cultivation	Total
EX	0	1	1
EW	1	0	1
CR	19	17	36
EN	28	11	39
VU	180	61	241
NT	50	16	66
DD	81	209	290
LC	411	72	483
Total	770	387	1157

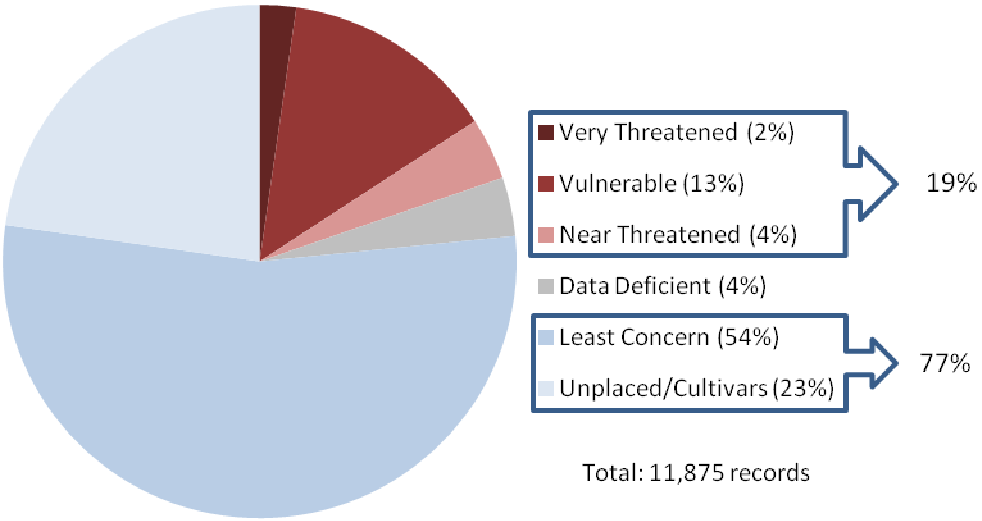


With 48 of the most threatened taxa (EW, CR and EN) known to be present in *ex situ* collections to some extent, means 17 CR taxa and 11 EN taxa are currently unknown to horticulture. Therefore if the wild populations disappear, then there are no secure *ex situ* collections available to return the species to the wild or prevent the taxa from becoming extinct.

The Global Strategy for Plants Conservation calls for at least 75% of threatened plants to be in *ex situ* collections by 2020. This survey would indicate that currently, *ex situ* collections contain 53% of threatened Rhododendron taxa (EW, CR, EN, VU, NT and DD).

Collection balance

Whilst Rhododendrons are very popular with botanic gardens internationally, only 2% of the 12,068 records represent the most threatened taxa (EW, CR or EN). The bulk of the collections, 77%, are made up of the taxa of Least Concern or cultivars or taxa which have not been matched to taxa assessed within *The Red List of Rhododendrons*.



Ex situ collections representativeness

The survey attempted to gauge how representative the *ex situ* collections are by requesting information on the size of the collection and whether the collection is derived from known wild sources or not.

It is likely that many of the collections of the very threatened rhododendrons are based on wild collected material simply because of their rarity they are not available via the traditional horticultural sources. However, relatively little information about the source of the material and the size of the collections was submitted (See Table 2) and it is difficult to draw conclusions about how representative the known *ex situ* collections are and their value to restoration and recovery action. Even if the collections are based on wild collected material, it does not guarantee that the associated documentation linking the collections to their sources exists or is at a level which supports their value to future restoration and reintroduction activities.

Table 2. Number of records by RDL category and source of material

	Unknown or horticultural source	Known wild source	
	No. of collections	No. of collections	No. of species
EW	4	0	1
CR	101	12	11
EN	138	21	18
VU	1515	116	89
NT	433	48	33
DD	421	31	23
LC	5969	513	304

Collections that are known to be based on wild collected material of the very threatened rhododendrons include:

Critically Endangered:

R. acrophilum, *R. amesiae*, *R. auritum*, *R. carstensense*, *R. formosum var. formosum*, *R. griersonianum*, *R. hemsleyanum*, *R. mendumiae*, *R. subansiriense*, *R. taxifolium*, *R. tuhanensis*

Endangered:

R. acuminatum, *R. adenosum*, *R. alborugosum*, *R. amagianum*, *R. arboreum var. nilagiricum*, *R. baconii*, *R. balangense*, *R. fletcherianum*, *R. lamrialianum ssp. gunsalamianum*, *R. macabeanum*, *R. madulidii*, *R. meijeri*, *R. nakaharae*, *R. nitidulum var. omeiense*, *R. platypodum*, *R. sanctum*, *R. uwaense*, *R. viscidifolium*

Recommendations and the way forward

Rhododendrons are an incredibly popular group of plants as demonstrated by the fact that more than 12,000 records are included in this survey. This is no doubt in part due to the size of the plants, diversity of forms and their flowers which reflect the diversity of habitats from which they are found. However the size and diversity of the group, combined with the high number of very threatened taxa currently absent from *ex situ* collections demand that efforts should focus on these taxa over the Vulnerable (VU), Near Threatened (NT) and the Data Deficient (DD) taxa. However, given the great interest in the group there should also be great potential to address these priorities.

With these very threatened taxa in mind the report recommends the following actions:

- ***Strengthen and develop existing* ex situ *collections to ensure that they are representative, accessible and safe.*** It is vital that *ex situ* collections are maintained at the highest standards in order to be of real conservation value. It is important that all of the very threatened rhododendrons are held in at least 2 secure and well documented *ex situ* collections that are representative of the natural diversity of the taxa and located whenever possible in the country of origin (see Annex 2 for the priority list) as called for by the GSPC.
- ***Establish or identify* ex situ *collections of taxa which are currently not known to be in cultivation.*** Efforts should be made to bring taxa in to cultivation to ensure that if the threats facing wild populations continue, the taxa will be safe in *ex situ* collections. Where possible these new *ex situ* collections should be developed within the country of origin.
- ***Develop and implement restoration and reintroduction activities for the most threatened taxa.*** There are a number of taxa which are well known to science and are under extremely high risk of extinction, these taxa should be the focus of concerted conservation efforts to address the drivers of threat, strengthen and conserve the remaining wild populations by appropriate methods. The GSPC calls for at 20% of *ex situ* collections to be made available to support restoration and recovery efforts.
- ***Involve local communities and organisations in conservation activities.*** As with all successful conservation activities, the involvement of the local communities and organisations is critical to the long term conservation of threatened species, and should be encouraged and supported from the earliest stages of planning conservation activities.
- ***Develop public awareness and understanding programmes in regions where rhododendrons are at most threat.*** To support current conservation efforts and develop new opportunities, public awareness and understanding programmes need to be developed and implemented as an integral component of conservation activities. This includes both areas where rhododendrons naturally occur and are utilised, as well as regions where they are of horticultural importance and interest.
- ***Enhancing BGCI's* PlantSearch *database to include more botanic gardens and explore the possibility of including additional information.*** Currently the number of botanic gardens contributing information to the *PlantSearch* database is limited, as is the quality of the information included. Through technical improvements of the database as well as wider promotion of its value to conservation efforts, surveys such as this one could become more comprehensive and efficient.

Annex 1 Very threatened rhododendron collection count

The number of collections which include the very threatened taxa (CR and EN):

Species	Number of collections	Country of origin
Critically Endangered taxa		
Rhododendron acrophilum	3	Philippines
Rhododendron amesiae	8	China
Rhododendron auritum	8	China
Rhododendron carstensense	1	Indonesia
Rhododendron changii	3	China
Rhododendron chapmanii	13	United States
Rhododendron coxianum	3	India
Rhododendron eriocarpum var. tawadae	9	Japan
Rhododendron fleuryi	1	Viet Nam
Rhododendron formosum var. formosum	6	India
Rhododendron griersonianum	18	China, Myanmar
Rhododendron hemsleyanum	24	China
Rhododendron linearilobum	1	China
Rhododendron longiflorum var. longipetalum	3	Malaysia
Rhododendron mendumiae	1	Philippines
Rhododendron rhombifolium	1	China
Rhododendron subansiriense	5	India
Rhododendron taxifolium	4	Philippines
Rhododendron tuhanensis	1	Malaysia
Endangered taxa		
Rhododendron acuminatum	2	Malaysia
Rhododendron adenosum	8	China
Rhododendron alborugosum	1	Indonesia
Rhododendron amagianum	13	Japan
Rhododendron arboreum var. nilagiricum	4	India
Rhododendron baconii	1	Malaysia
Rhododendron balangense	6	China
Rhododendron eurysiphon	1	China, Myanmar
Rhododendron eymae	1	Indonesia
Rhododendron farinosum	2	China
Rhododendron fletcherianum	10	China
Rhododendron huidongense	1	China
Rhododendron jingangshanicum	2	China
Rhododendron lamrialianum ssp. gunsalamianum	1	Malaysia
Rhododendron macabeanum	33	India
Rhododendron madulidii	1	Philippines
Rhododendron mallotum	14	China, Myanmar
Rhododendron meijeri	1	Malaysia
Rhododendron nakaharae	19	Taiwan
Rhododendron nitidulum var. omeiense	7	China
Rhododendron platypodum	1	China
Rhododendron pubicostatum	2	China
Rhododendron sanctum	16	Japan
Rhododendron santapaui	5	India
Rhododendron triumphans	1	Viet Nam
Rhododendron uwaense	1	Japan
Rhododendron vellereum	1	China
Rhododendron viscidifolium	4	China

Annex 2 Priority List for new *ex situ* collections

According to the results of the survey, the following *Rhododendron* taxa are a high priority for inclusion in new *ex situ* collections or need to be located in existing collections:

Critically Endangered (CR) taxa currently absent from* ex situ *collections:

R. boninense (Japan)
R. brachypodum (China)
R. dilatatum var. *boreale* (Japan)
R. dilatatum var. *satsumense* (Japan)
R. dutartrei (Indonesia)
R. evelyneae (Papua)
R. guangnanense (China)
R. keiskei var. *hypoglaucum* (Japan)
R. liboense (China)
R. longiflorum var. *bancanum* (Indonesia)
R. magniflorum (China)
R. mianningense (China)
R. monkoboense (Malaysia)
R. nymphaeoides (China)
R. reynosoi (Philippines)
R. wilhelminae (Indonesia)
R. zaleucum var. *pubifolium* (China Myanmar)

CR taxa currently in very few ex situ collections and therefore still a priority for new collections:

R. acrophilum (Philippines)
R. carstensense (Indonesia)
R. changii (China)
R. coxianum (India)
R. fleuryi (Vietnam)
R. linearilobum (China)
R. longiflorum var. *longipetalum* (Malaysia)
R. mendumiae (Philippines)
R. rhombifolium (China)
R. tuhanensis (Malaysia)

Endangered (EN) taxa currently absent from ex situ collections:

R. arunachalense (India)
R. cernuum (Indonesia)
R. degronianum ssp. metternichii kyomaruense (Japan)
R. kiyosumense ssp. mayebaraeohsumiense (Japan)
R. langbianense (Viet Nam)
R. nanophyton var. nanophyton (Indonesia)
R. pomense (China)
R. roxieoides (China)
R. subenerve (China)
R. taxoides (Indonesia)
R. tenuifolium (China)

EN taxa currently in very few ex situ collections and therefore still a priority for new collections:

R. acuminatum (Malaysia)
R. alborugosum (Indonesia)
R. baconii (Malaysia)
R. eurysiphon (China, Myanmar)
R. eymae (Indonesia)
R. farinosum (China)
R. huidongense (China)
R. jingangshanicum (China)
R. lamrialianum ssp. gunsalamianum (Malaysia)
R. madulidii (Philippines)
R. meijeri (Malaysia)
R. platypodum (China)
R. pubicostatum (China)
R. triumphans (Vietnam)
R. uwaense (Japan)
R. vellereum (China)

Annex 3 Ranked botanic garden collections

The most significant botanic garden collections of rhododendrons as determined by assigning a score for each taxa within the garden's collection, according to the Red List Category (EW-15, CR-10, EN-7, VU-5, NT-3, DD-2, LC-1, NE-0 points). For example, a collection of CR rhododendrons will score 10 points. The number of the most threatened taxa (CR and EN) and the number of unique or rare collections (taxa occurring in fewer than 3 gardens) is also given for each garden in the table.

	Botanic garden	Number of taxa	Number of unique or rare collections	Number of CR & EN taxa	Collection Score
1	Royal Botanic Garden Edinburgh, United Kingdom	734	184	32	1470
2	Royal Botanic Gardens, Kew, United Kingdom	404	14	12	729
3	Arboretum Wespelaar, Belgium	313	20	12	685
4	VanDusen Botanical Garden, Canada	302	6	13	596
7	University of California Botanical Garden at Berkeley, USA	281	25	10	555
5	University of British Columbia Botanical Garden, Canada	276	9	7	552
6	The Sir Harold Hillier Gardens, United Kingdom	280	5	6	520
8	Wentworth Castle Gardens, United Kingdom	213	6	7	516
10	Botanic Gardens of Adelaide, Australia	218	4	11	484
9	Royal Horticultural Society's Garden, Wisley, United Kingdom	246	3	7	483
11	San Francisco Botanical Garden (formerly Strybing Arboretum), USA	265	17	10	457
12	National Botanic Gardens, Glasnevin, Ireland	245	30	9	415
13	Green Bay Botanical Garden, USA	232	3	7	376
14	Royal Botanic Gardens, Melbourne, Australia	202	18	7	341
15	Københavns Universitets Botaniske Have, Denmark	160	5	4	327
17	Mendocino Coast Botanical Gardens, USA	145	7	8	326
16	Royal Veterinary and Agricultural University Arboretum, Denmark	218	0	2	319
18	Elisabeth C. Miller Botanical Garden, USA	171	4	4	308
21	University of Washington Botanic Gardens, USA	174	2	4	299
19	Kunming Botanical Garden, China	174	35	4	295
20	St. Andrews Botanic Garden, United Kingdom	165	6	5	291
22	Dunedin Botanic Garden, New Zealand	178	2	4	279
23	Bokrijk Arboretum, Belgium	165	2	3	277
24	Royal Horticultural Society's Garden, Rosemoor, United Kingdom	122	2	5	251
25	Botanical Gardens Wageningen UR, Netherlands	142	2	5	248
26	Howick Arboretum, United Kingdom	175	6	4	238
27	National Botanic Garden of Belgium, Belgium	126	0	3	219
28	The National Arboretum - Westonbirt, United Kingdom	104	1	5	206
29	Utrecht University Botanic Gardens, Netherlands	137	1	2	205
30	Royal Horticultural Society's Garden, Harlow Carr, United Kingdom	93	2	1	186

Annex 4 Participating institutions

The following 304 institutions from 42 countries are gratefully thanked for their contribution of data to this report:

Adkins Arboretum, United States; Alaska Botanical Garden, United States; Alpengarten Villacher Alpe, Austria; Alpinum 'Juliana', Slovenia; Annapolis Royal Historic Gardens, Canada; Arboretum and Botanic Garden, University of Bergen, Norway; Arboretum at Penn State, The, United States; Arboretum at the University of California, Santa Cruz, United States; Arboretum at the University of Guelph, The, Canada; Arboretum Freiburg-Guenterstal im Staedtischen Forstamt Freiburg, Germany; Arboretum Kirchberg, Luxembourg; Arboretum Mlyňany SAS, Slovakia; Arboretum of The Barnes Foundation, United States; Arboretum Oudenbosch, Netherlands; Arboretum Střední lesnické školy, Czech Republic; Arboretum Trompenburg, Netherlands; Arboretum Waasland, Belgium; Arboretum Wespelaar, Belgium; Arnold Arboretum of Harvard University, The, United States; Atlanta Botanical Garden, United States; Australian National Botanic Gardens, Australia; Bamboo Brook Outdoor Education Center, United States; Bartlett Tree Research Laboratories Arboretum, United States; Batsford Arboretum, United Kingdom; Batumi Botanical Garden, Georgia; Bayard Cutting Arboretum, United States; Beijing Botanical Garden, China; Bergius Botanic Garden, Sweden; Berkshire Botanical Garden, United States; Berry Botanic Garden - Seed Bank, United States; Betty Ford Alpine Gardens, United States; Bibliotheque Centrale, France; Bickelhaupt Arboretum, United States; Bishop Museum - Checklist of Cultivated Plants of Hawai'i, United States; Bokrijk Arboretum, Belgium; Botanic Garden of Rostock University, Germany; Botanic Garden of Smith College, The, United States; Botanic Garden of Tver State University, Russian Federation; Botanic Garden, Delft University of Technology, Netherlands; Botanic Gardens of Adelaide, Australia; Botanical Experimental Garden, United Kingdom; Botanical Garden Gorky State University, Russian Federation; Botanical Garden Kirghiz Academy of Sciences, Kyrgyzstan; Botanical Garden of Chelyabinsk State University, Russian Federation; Botanical Garden of Mari State University, Russian Federation; Botanical Garden of Tartu University, Estonia; Botanical Garden of the V.L. Komarov Botanical Institute, Russian Federation; Botanical Garden of Vilnius University, Lithuania; Botanical Garden-Institute, Ufa Research Center, Russian Federation; Botanical Gardens, Finland; Botanical Gardens at Heritage Park, United States; Botanical Gardens Wageningen UR, Netherlands; Botanische Gärten der Universität Bonn, Germany; Botanischer Garten, Germany; Botanischer Garten der Carl von Ossietzky-Universitat Oldenburg, Germany; Botanischer Garten der Friedrich-Schiller-Universitaet, Germany; Botanischer Garten der J.W. Goethe-Universitat, Germany; Botanischer Garten der Justus-Liebig Universität Giessen, Germany; Botanischer Garten der Martin-Luther-Universitat, Germany; Botanischer Garten der Philipps-Universität Marburg, Germany; Botanischer Garten der Ruhr-Universität Bochum, Germany; Botanischer Garten der Technischen Universitaet, Germany; Botanischer Garten der Technischen Universitaet, Germany; Botanischer Garten der Universitaet des Saarlandes, Germany; Botanischer Garten der Universitat Bern, Switzerland; Botanischer Garten der Universität Freiburg, Germany; Botanischer Garten der Universitat Kiel, Germany; Botanischer Garten der Universitat Osnabruck, Germany; Botanischer Garten der Universitat Zurich, Switzerland; Botanischer Garten und Botanisches Museum Berlin-Dahlem, Germany; Botanischer Garten und Naturkundliche Station der Stadt Linz, Austria; Bowman‘s Hill Wildflower Preserve, United States; Brisbane Botanic Gardens, Australia; Bristol Zoological Gardens, United Kingdom; Brooklyn Botanic Garden, United States; Brookside Gardens, United States; Cambridge University Botanic Garden, United Kingdom; Cape Fear Botanical Garden, United States; Catalogue of Medicinal Plants of Ukrainian Botanic Gardens and Parks, Ukraine; Catalogue of Rare Plants of Ukrainian Botanic Gardens and Parks, Ukraine; Center for Plant Conservation - Bogor Botanic Gardens, Indonesia; Center for Plant Conservation (USA), United States; Central Botanical Garden, Belarus; Central Siberian Botanical Garden, Russian Federation; Changchun Forest Botanic Garden, Jilin, China; Chanticleer Foundation, United States; Charles R. Keith Arboretum, The, United States; Charles University Botanic Garden (Botanicka zahrada University Karlovy), Czech Republic; Chicago Botanic Garden, United States; Chicago Botanic Garden - Dixon National Tallgrass Prairie Seed Bank, United States; City of Leeds Botanic Gardens, United Kingdom; City of Liverpool Botanic Gardens, United Kingdom; Cleveland Botanical Garden, United States; Coastal Maine Botanical Gardens, United States; Columbus Botanical Garden, United States; Connecticut College Arboretum, United States; Conservatoire et Jardins Botaniques de Nancy, France; Cornell Plantations, United States; Crosby Arboretum, The, United States; Dawes Arboretum, The, United States; Dendrological Park, Russian Federation; Denver Botanic Gardens, United States; Dixon Gallery and Gardens, The, United States; Dominion Arboretum, Canada; Donald E. Davis Arboretum, United States; Dr. P. Font i Quer Arboretum of Lleida Botanic Garden, Spain; Dr. Sun Yat-Sen Classical Chinese Garden, Canada; Duke Biology Plant Teaching and Research Facility, United States; Duke Farms, United States; Dunedin Botanic Garden, New Zealand; Edison and Ford Winter Estates, United States; Elisabeth C. Miller Botanical Garden, United States; Eloise Butler Wildflower Garden & Bird Sanctuary, United States; Ente Giardini Botanici

Villa Taranto, Italy; Eötvös Loránd University Botanic Garden, Hungary; Fellows Riverside Gardens, United States; Fernwood Botanical Garden and Nature Preserve, United States; Florida Botanical Gardens, United States; Foellinger-Freimann Botanical Conservatory, United States; Forstbotanischer Garten, Germany; Forstbotanischer Garten der Technischen Universitaet Dresden, Germany; Forstbotanischer Garten und Arboretum, Germany; Fort Worth Botanic Garden, United States; Frederik Meijer Gardens & Sculpture Park, United States; Frelinghuysen Arboretum, United States; Ganna Walska Lotusland, United States; Gardens of Fanshawe College and A.M. Cuddy Gardens, Canada; Garvan Woodland Gardens, United States; Glasgow Botanic Gardens, United Kingdom; Göteborg Botanical Garden, Sweden; Green Bay Botanical Garden, United States; Green Spring Gardens, United States; Greenwood Gardens, United States; Grugapark und Botanischer Garten der Stadt Essen, Germany; Harriet Irving Botanical Gardens, Canada; Helsinki University Botanic Garden, Finland; Henry Schmieder Arboretum, United States; Hergest Croft Gardens, United Kingdom; Hershey Gardens, United States; Hidden Lake Gardens, United States; Hof ter Saksen Arboretum, Belgium; Holden Arboretum, The, United States; Honolulu Botanical Gardens System, United States; Hortus Botanicus Amsterdam, Netherlands; Hortus Botanicus Reykjavikensis, Iceland; Howick Arboretum, United Kingdom; Hoyt Arboretum, United States; Hunan Forest Botanical Garden, China; Huntington Botanical Gardens, United States; Huntsville Botanical Garden, United States; Immanuil Kant State University Botanical Garden / Ботанический сад БФУ имени И. Канта, Russian Federation; Jackson's Garden of Union College, United States; Jardín Botánico "Lucien Hauman", Argentina; Jardin Botanico de la Facultad de Estudios Superiores, Mexico; Jardín Botánico Francisco Javier Clavijero, Mexico; Jardin Botanico Nacional, Chile; Jardin Botanique Alpin de la Jaysinia, France; Jardin Botanique de la Ville de Lyon, France; Jardin botanique de la Ville de Paris, France; Jardin Botanique de Marnay sur Seine, France; Jardin des Plantes de Paris et Arboretum de Chevreloup, France; Jardin des Serres d' Auteuil, France; JC Raulston Arboretum, United States; Jensen-Olson Arboretum, United States; Kadoorie Farm and Botanic Garden, China; Kalmthout Arboretum, Belgium; Københavns Universitets Botaniske Have, Denmark; Kunming Botanical Garden, China; Landis Arboretum, United States; Lauritzen Gardens, United States; Leuven Botanic Garden, Belgium; Lipizauga Botanical Sanctuary, Papua New Guinea; Ljubljana University Botanic Garden, Slovenia; Longwood Gardens, United States; Los Angeles County Arboretum and Botanic Garden, United States; Lushan Botanical Garden, China; M.M. Gryshko National Botanical Garden, Ukraine; Main Botanical Garden, Russian Academy of Science / Главный ботанический сад им. Н.В. Цицина РАН, Russian Federation; Maribor University Botanic Garden, Slovenia; Marie Selby Botanical Gardens, United States; Maymont Foundation, United States; Mead Garden, United States; Meadowlark Botanical Gardens, United States; Mendocino Coast Botanical Gardens, United States; Mercer Arboretum & Botanic Gardens, United States; Millennium Seed Bank, United Kingdom; Milner Gardens and Woodland, Canada; Minnesota Landscape Arboretum, United States; Missouri Botanical Garden, United States; Missouri State Arboretum, United States; Montreal Botanical Garden / Jardin botanique de Montréal, Canada; Morden Arboretum Research Station, Canada; Morris Arboretum, The, United States; Morton Arboretum, The, United States; Moscow State University Botanical Garden, Russian Federation; Mount Auburn Cemetery, United States; Mount Lofty Botanic Garden, Australia; Mount Usher Gardens, Ireland; Mountain Botanical Garden of the Dagestan Scientific Centre, Russian Federation; Mountain Top Arboretum, United States; Mt. Cuba Center, United States; Musee et Jardins Botaniques Cantonaux, Switzerland; Nanshan Botanical Garden, China; National Botanic Garden of Belgium, Belgium; National Botanic Garden of Latvia, Latvia; National Botanic Garden of Wales, United Kingdom; National Botanic Gardens, Glasnevin, Ireland; National Plant Germplasm System - USDA-ARS-NGRL, United States; Nebraska Statewide Arboretum, United States; Neuer Botanischer Garten der Universität Göttingen, Germany; New Brunswick Botanical Garden, Canada; New England Wild Flower Society - Garden in the Woods, United States; New England Wild Flower Society - seed bank, United States; New York Botanical Garden, The, United States; Niagara Parks Botanical Gardens and School of Horticulture, The, Canada; Norfolk Botanical Garden, United States; North Carolina Arboretum, The, United States; North Carolina Botanical Garden, United States; Northwest Trek Wildlife Park, United States; Novosibirsk Dendropark, Russian Federation; Oekologisch-Botanischer Garten Universitaet Bayreuth, Germany; Ogród Botaniczny Uniwersytetu Wroclawskiego, Poland; Oklahoma City Zoo and Botanical Gardens, United States; Orto Botanico di Bergamo "Lorenzo Rota", Italy; Orto Botanico Università degli Studi di Padova, Italy; Paignton Zoo Environmental Park, United Kingdom; Palmengarten der Stadt Frankfurt am Main, Germany; Patterson Gardens, Canada; Polly Hill Arboretum, The, United States; Pruhonic Park, Czech Republic; Pukeiti Rhododendron Trust Inc., New Zealand; Pukekura Park, New Zealand; Quarryhill Botanical Garden, United States; Queens Botanical Garden, United States; Rancho Santa Ana Botanic Garden, United States; Rancho Santa Ana Botanic Garden - Seed Bank, United States; Red Butte Garden and Arboretum, United States; Rogów Arboretum of Warsaw University of Life Sciences, Poland; Royal Botanic Garden (Bhutan), Bhutan; Royal Botanic Garden Edinburgh, United Kingdom; Royal Botanic Gardens Sydney, Australia; Royal Botanic Gardens, Kew, United Kingdom; Royal Botanic Gardens, Melbourne, Australia; Royal Botanical Gardens, Ontario, Canada; Royal Horticultural Society‘s Garden, Wisley, United Kingdom; Royal Horticultural Society's Garden, Harlow Carr, United Kingdom; Royal Horticultural Society's Garden, Hyde Hall, United Kingdom; Royal Horticultural Society's Garden,

Rosemoor, United Kingdom; Royal Roads University Botanical Gardens, Canada; Royal Tasmanian Botanical Gardens, Australia; Royal Veterinary and Agricultural University Arboretum, Denmark; San Diego Botanic Garden, United States; San Diego Zoo Botanical Gardens, United States; San Francisco Botanical Garden (formerly Strybing Arboretum), United States; Santa Barbara Botanic Garden, United States; Sarah P. Duke Gardens, United States; Scientific Plant Production Centre "Botanica" of Uzbek Academy of Sciences, Uzbekistan; Scott Arboretum of Swarthmore College, The, United States; Seeds of Success (SOS), United States; Sheffield Botanical Gardens, United Kingdom; Siberian Botanical Garden of Tomsk State University, Russian Federation; Singapore Botanic Gardens, Singapore; Smith-Gilbert Gardens, United States; St. Andrews Botanic Garden, United Kingdom; St.Kilda Botanic Garden, Australia; Station Alpine du Lautaret, France; Stichting Botanische Tuin Kerkrade, Netherlands; Sukhumi Botanical Garden, Georgia; Swansea Botanical Complex, United Kingdom; Tallinn Botanic Garden, Estonia; Tatton Garden Society/Quinta Arboretum, United Kingdom; The B.M. Kozo-Polyansky Botanical Garden of Voronezh State University, Russian Federation; The Harris Garden, United Kingdom; The National Arboretum - Westonbirt, United Kingdom; The Sir Harold Hillier Gardens, United Kingdom; Toledo Botanical Garden, United States; Toronto Botanical Garden, Canada; Tregothnan Estate, United Kingdom; Tresco Abbey Garden, United Kingdom; Tyler Arboretum, United States; UC Davis Arboretum, United States; United States Botanic Garden, United States; United States National Arboretum, United States; University of British Columbia Botanical Garden, Canada; University of California Botanical Garden at Berkeley, United States; University of Delaware Botanic Gardens, United States; University of Dundee Botanic Garden, United Kingdom; University of Idaho Arboretum & Botanical Garden, United States; University of Kentucky-Lexington Arboretum, United States; University of North Carolina at Charlotte Botanical Gardens, United States; University of Oslo Botanical Garden, Norway; University of Turku - Botanical Garden, Finland; University of Uppsala Botanic Garden, Sweden; University of Washington Botanic Gardens, United States; Utrecht University Botanic Gardens, Netherlands; VanDusen Botanical Garden, Canada; W. J. Beal Botanical Garden, United States; Warsaw University Botanic Garden, Poland; Wentworth Castle Gardens, United Kingdom; Willowwood Arboretum, United States; Wind River Canopy Crane Research Facility, United States; Wuhan Botanic Garden, China; Xishuangbanna Tropical Botanical Garden, CAS, China; Yew Dell Botanical Gardens, United States.