Conservatoire et Jardin botaniques Genève

Management Policy for the Living Collections 2018

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Summary

Preface

Dr Pierre-André Loizeau
Director

The *Conservatoire et Jardin Botaniques de la Ville de Genève* (CJBG) just celebrated 200 years of existence in 2017. Augustin-Pyramus de Candolle, the founder, conceived the original Botanical Garden essentially as a school of botany. Although we have no documents from the time indicating which species he chose to plant, he most likely chose them with care such that they would be representative of the diversity of the plant world, appropriate to support his university teaching. At the beginning of the nineteenth century, the Botanical Garden had more than 3000 species at its Bastions site.

Over the years this figure has remained relatively stable, the size of the collections corresponding to the area available for cultivation. In moving to its current site, the Botanical Garden increased in size considerably, and continued to grow with donations. More staff was hired. The gardens also benefited from the construction of several greenhouses, which significantly improved the ability to display plants from regions with climates far different from our own. Depending on the interest of a given curator or botanist-gardener, collections were assembled based on their knowledge and experience, networks, and travels.

Switzerland's ratification in 2014 of the Nagoya Protocol, which governs access to genetic resources and the fair and equitable sharing of benefits arising from their use, compelled the Botanical Garden to make a precise inventory of its collections so as to identify with certainty the plants acquired before the Protocol came into effect. This immense task led to the publication in 2014 of the first list of species cultivated at the CJBG, the "Catalogue of the Living Collections", registering approximately 8500 wild species.

Thus, after 200 years of existence, the CJBG held a remarkable collection for which we could imagine its significance and size, but which lacked any document formalizing its origin and evolution. Now, to manage is to plan. Following on the enormous effort of the 2014 inventory, it seemed essential to elaborate a management policy for our living collections, so as to identify their strengths and weaknesses and to orient their future development in a reasoned manner.

I would like to thank all those involved in this reflection for their contributions, and especially Nicolas Freyre, Head Gardener, who led this project with strength and conviction. The reflection about our collections makes it possible not only to direct their development in a coherent and measured way, but also to place gardener-botanists and scientists again at the center of their care.

Introduction

The Botanical Garden's living collections are the result of decades of work and experience; they constitute the very essence of the Garden as a museum and protector of biodiversity. As guardians of this heritage, we can only note that the collections do not always show a true logic, since these were foremost the work of men and women who had developed their passion over time and most often independently, at times to the detriment of overall coherence. That being the case, it was therefore proper to assess the quality of these collections and to set priorities for their development, so as to guarantee their scientific and educational relevance while assuring efficient and strategic management.

Collecting everything is impossible, and in any case would make no sense for a botanical garden of our size, thus the importance of establishing a clear vision and well-defined objectives. In other words, it is a matter of knowing precisely in which directions the Botanical Garden wishes to develop its living collections: at first, to inventory them; then to determine which are the major genera, families or themes that need to be emphasized; which are our strengths, but also to identify our weaknesses. This qualitative and quantitative analysis of our plant heritage is a necessary tool for giving meaning to the collections, but also rationalizing and enhancing our daily work.

1.1 The Garden as a medium for the collections

The naturalist spirit that reigned in Geneva during the 18th century allowed Augustin-Pyramus de Candolle to establish the first public Botanical Garden in Geneva at the beginning of the following century, in 1817. At first located in Bastions Park, the garden was moved in 1904 to its present location. During these 200 years, the Conservatory and Botanical Gardens of the City of Geneva (CJBG) have never ceased to play a role in the life of the people of Geneva. Faithful to the spirit of its founders, the institution has fulfilled, throughout the years, its mission of exploration, conservation, research, teaching and protection. With a fully organic garden since 2015, five buildings, a heritage including six million herbarium specimens, a library holding 120,000 volumes, and more than 70 ongoing research projects in Switzerland and abroad, the CJBG are among the most important botanical institutions in the world.

The Botanical Garden, the visible part of the CJBG, is spread over 28 hectares and three distinct sites. The Garden Unit is one of six units that make up the CJBG. It currently has 42 permanent employees with diverse skills, including 35 gardeners (28 full-time equivalents). They maintain close to 9000 different taxa in living collections. Today, the collection boasts more than 40,000 cultivated plants from five continents, represented by 15,000 entries in the database. A technical team (carpentry, mechanics, buildings, security, cleaning, logistics, database management) complements and supports this work daily.

The whole living collection provides for a multitude of scientific activities and outreach to the general public. In addition to the presentation of the collections offered to independent visitors, numerous guided tours are led throughout the year, directed to a broad public. Several educational spaces, such as the Ethnobotanical Gardens and the Scent and Tactile Garden, expose visitors to the diversity of plants and their potential uses. Every year, a temporary exhibition is mounted outdoors at the Botanical Garden, illustrating the know-how of the Institution or calling the public's attention to environmental and scientific themes. The dissemination of knowledge is today truly at the heart of our mission.

Training is also a priority, with around forty young people each year taking part in internships as prerequisites for professional schools, as fulfillment of civil service, or as alternative sentences (community service), or simply as an opportunity to explore a potential career. The staff of the Garden Unit also train horticultural apprentices in growing perennial plants.

Another mission, which has become central, is the conservation of locally threatened plants. Every year, the gardeners of the Rock Gardens grow plants *ex-situ*, with the goal of generating seeds for the seed bank or for reintroduction in the wild.

The future of the Garden is inscribed in a fundamentally ecological approach, which recently won the BIO label (certified organic) for the entire collection. Conserving the diversity of life, while respecting the surrounding ecosystem, is thus our daily challenge.

The Geneva Botanical Garden to date is broadly inserted in professional networks. It is a reference for many schools and offers its scientific and practical expertise to a wide public. Over 600 botanical gardens around the world receive our seed catalogue, part of a tradition of exchange enriching living collections. The Garden is represented and very active in national (HBH), European (JBF , EBGC), and international (BGCI , IABG) networks.

[1] **The "Organic Bud" label of Bio Suisse, since January 1, 2017** www.bio-suisse.ch
[2] ***Hortus Botanicus Helveticus*** botanica-suisse.org/fr/2015/hortus-botanicus-helveticus-2/
[3] ***Jardins Botaniques de France et des pays francophones*** www.jbf-pf.org
[4] **The European Botanic Gardens Consortium** www.botanicgardens.eu
[5] **Botanic Gardens Conservation International** www.bgci.org
[6] **International Association of Botanic Gardens** iabg.iubs.net/

Methodology

2.1 Definition of the collections

The first phase of this study consisted of quantitatively and qualitatively characterizing the collections at the CJBG, based on the Catalog of the Living Collections (Freyre et al., 2014). BGCI defines a living collection as a group of plants grown within a specific objective, which can be geographical, taxonomic, thematic or ecological (Gratzfeld, 2016). Following this principle, and viewing the entire heritage of plants at the Garden, we identified a number of collections (see chapter 3.1), all of which have been inventoried and documented in the CJBG database. Each collection is defined by a complete list of the cultivated plants comprising it and a descriptive profile.

This profile delimits the collection, indicates its location(s) in the Garden, summarizes its history, and lists the main modes of acquisition of the specimens in cultivation (Table 1). Several figures are also provided in this descriptive part: the number of taxa in the collection, and number of specimens under cultivation (thus giving the proportion of duplicates found in the Garden per taxon); the proportion of wild taxa to cultivars; and the representativeness of the collection, indicated by the number of taxa cultivated in the Garden as a percentage of the total number of known taxa in the group worldwide. This last figure is given only for collections with a clearly delimited number of taxa (family/genus/flora of a region).

Each collection is assigned to a gardener-botanist, who is responsible for its cultivation, and to a scientific advisor – internal or external to the CJBG – who provides expertise and guidance.

2.2 Evaluation methodology

For the second phase of the work, we conducted a quantitative and qualitative evaluation of these living collections. According to Peter Wyse-Jackson (1999), “A botanic garden is an institution holding documented collections of living plants for the purposes of scientific research, conservation, display and education.”

Collection Profile

Description of the collection	A brief and clear description of the collection, specifying the set of specimens/ plants/taxa which constitute it.
Location in the Garden	The physical placement of the collection in the Garden.
History of the collection	History of the creation of the collection and the gardeners/botanists involved, followed by a list of modifications/relocations/additions to the collection.
Principal mode of acquisition	A brief list of the source of the seeds/specimens that gave rise to the collection (field expeditions, *Index seminum*, donations, bequests, etc.).
The collection in a few figures	
Number of taxa	XX
Number of specimens cultivated	XX
Proportion wild taxa/cultivars	XX % wild
Representativeness	The number of taxa cultivated in the Garden as a percentage of the total number of taxa in the group worldwide
Manager of the collection	Name
Scientific advisor	Name

Table 1
Model for the descriptive profile of the collections.

Axes \ References	1	2	3	4	5
Geneva (Marret, 2010)	Conservation of historical and cultural heritage	Conservation	Research	Education	
Paris (Bray, com. pers., 2013)	Regional and historical dimension	Significance for *ex-situ* conservation and biodiversity	Partnership or scientific value	Pedagogical value	
Edinburg (Rae et al., 2006)	Historic collection or significance	Conservation projects or of conservation interest	Specific research projects	Education and interpretation in the widest sense	Teaching
Montreal (Labrecque, 2003)	Cultural needs	Conservation needs	Research needs	Educational needs	
GENEVA 2017	**Heritage**	**Conservation**	**Science**	**Education**	

Table 2
Evaluation criteria for the living collections of various Botanical Gardens, leading to the choice of the four categories retained for evaluating the living collections of the CJBG.

2.2.1 Evaluation criteria

With this this definition as a foundation, the evaluation process began with a literature search on how other Botanical Gardens have delineated and evaluated their own living collections. The examples of the Jardin Botanique de la Ville de Paris (Bray, pers. comm., 2013), the Royal Botanical Garden of Edinburg (Rae et al., 2006) and the Jardin Botanique de Montréal (Labrecque, 2003), as well as a preliminary analysis of the living collections of the CJBG (Marret, 2010), allowed us to bring out four categories for evaluating the significance of the collections: heritage, biodiversity conservation, significance for scientific research, and role in education (Table 2). The choice of these four major institutional values was reinforced by the fact that they are strongly linked to the five missions of the CJBG: to explore, conserve, research, transmit and protect.

In addition to evaluating these four categories for each collection, the time requirements for maintaining each collection was also taken into account in the analysis.

Heritage

The history of a collection may relate to a particular place or to a person who had the initiative to develop and emphasize it. It isn't easy to arrive at an objective heritage value through precise criteria. Nevertheless, heritage value is recognized as such when it is long-standing and/or when it embodies values specific to a certain place, local knowledge, or a known personage. These criteria probably vary greatly from one institution to another. The heritage value of each collection was evaluated according to the following criteria :

- significance to the Genevan botanical tradition,
- demonstration of regional know-how,
- historical collection,
- renowned collector.

Conservation

One of the most important missions of a Botanical Garden is its role in conserving biodiversity. The Global Strategy for Plant Conservation (BGCI, 2012), adopted by the Convention on Biological Diversity, defines 16 objectives, a number of which can be attributed to Botanical Gardens. This is especially true for objectives 4 to 10. We therefore have a very clear responsibility to study and conserve plant biodiversity, in all possible forms (seed banks, herbaria, etc.) and especially at the level of living collections. The value of each collection for biodiversity conservation was assessed according to the following criteria :

- threat status of one or more taxa,
- link to a reintroduction program,
- representativeness of the CJBG collection with relation to the total number of taxa for the group worldwide,
- origin of taxa (wild origin vs. cultivated).

Science

Some collections are directly connected to scientific research projects at the CJBG. These collections are of particular interest to the Institution, since they are objects for research and gain significance particularly through scientific publications. The value of each collection for scientific research was assessed according to the following evaluation criteria :

- scientific interest (intrinsic value),
- links to scientific publications,
- alignment with institutional research programs,
- partnerships with one or more external institutions.

Education

The Botanical Garden is visited daily by a broad public. Our role is to inform our visitors and transmit our knowledge to the widest possible audience. This is the aim of our annual exhibitions, which generally draw upon our living collections. The educational value of each collection was rated according to the following criteria:

- educational potential,
- visibility,
- links with educational programs,
- mention in educational publications,

- presence of dedicated signing,
- existence of special scenography
- documentation linked to the collection.

Cost A further criterion for consideration is the cost of maintaining a collection. We only considered hours of labor, not costs linked to specific inputs or particular infrastructure (for example, heating of greenhouses).

- 1 = ≤ 40 h/yr. (1 week),
- 2 = 40-400 h/yr. (1-10 weeks),
- 3 = 400-1000 h/yr. (10-25 weeks),
- 4 = 1000-1600 h/yr. (25-40 weeks),
- 5 = ≥ 1600 h/yr. (≥ 40 weeks).

2.2.2 Quantitative evaluation

The evaluation process unfolded based on a tripartite discussion between the gardener responsible for a given collection, the scientific advisor for the collection, and the Head Gardener. The advantage of this approach was to link gardeners, who bring their hands-on knowledge from the field, with botanists, who bring their scientific expertise. The role of the Head Gardener was to bring a global vision of the collections and to ensure a certain consistency of the overall process. In other words, he made sure that each collection was evaluated fairly and objectively relative to the others.

To prepare for the discussion, each participant received the collection profile form with factual descriptions, the list of plants in cultivation, as well as the evaluation criteria described above. The analysis took the form of an open discussion, in order to arrive, by consensus, at a score for each criterion. Based on the descriptive data for the collection (see Chapter 2.1. and Table 1) and the elements brought up during the tripartite discussion, each criterion was rated from 1 to 5, with 1 representing a low significance or cost, 5 representing a high significance or cost. To better visualize and compare the values from a global perspective, the results are presented in a diagram formed in the shape of a pentagon (Figure 1).

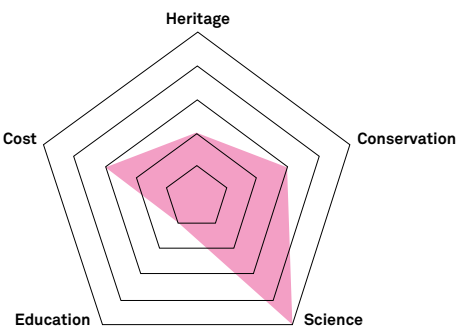

Figure 1
Example of the pentagonal diagram for the quantitative evaluation of a collection. This imaginary collection would have had a high scientific value (5/5), an average value for conservation (3/5), an average cost (3/5), a rather low heritage value (2/5), and little significance for education (1/5).

2.2.3 Qualitative evaluation

Each collection was also the object of a qualitative analysis, formalized through a series of comments and proposals for improvements.

The “comments” section illustrates and summarizes the most important points of the tripartite discussion which underlay the rating of each category (Heritage, Conservation, Science, and Education).

The section “proposed improvements” presents suggestions for enhancing a collection in one or several of the four areas. These proposals should be considered as potential improvements to be undertaken when opportune.

The comments and proposed improvements are included in the collection profiles in the appendix.

Results

The identification of the collections grew out of discussions among CJBG garden managers. A collection should be clearly definable and its boundaries easily delimited. The decision to attribute the status of a "collection" to a group of plants depended on several kinds of factors, which are not necessarily cumulative.

- Taxonomic collections were determined by their pertaining to a particular botanical genus or family, (e.g. *Quercus, Arecaceae*), or a higher taxonomic rank (e.g., ferns and allied plants),
- Geographical collections are composed of plant species from a given region, listed in a flora of reference (e.g., *Flora Helvetica*, 4th ed.),
- Ecological collections bring together species linked by a common habitat (e.g., Plants of the Rock Gardens),
- Thematic collections group together species around a shared functional aspect (e.g., ethnobotanical utility).

The notion of a collection does not necessarily imply a physical grouping within the CJBG. While some collections are easily identifiable and effectively grouped together at one location (e.g., Scent and Tactile Garden), others are scattered throughout the garden (e.g., the Flora of Switzerland).

3.1 The 40 collections of the CJBG

The table below presents the 39 collections of the CJBG, divided into four groups according to their taxonomic, geographical, ecological or thematic character. This effort allowed us to assign 85% of the plants cultivated at the CJBG to 39 identified collections. The remaining 15% are of interest in themselves, without being attributable to any particular collection. These largely comprise perennial ornamentals valued for landscaping; spectacular tree, shrub or vine species; and succulent or bulbous plants with remarkable morphologies or blooms. The 40th collection, which has not been evaluated, brings together symbolically all the plants grown at the CJBG. We have called it the General Collection. Finally, it should be noted that a given plant may pertain to several collections, as long as it conforms to the collections' characteristics (e.g. a plant of the Swiss Flora may also belong to a taxonomic collection and an ecological collection).

Taxonomic Collections

Acer	Cupressaceae	Pinaceae
Agave	Euphorbia	Quercus
Araceae	Ferns and Allied Plants	Rhipsalis
Arecaceae	Galanthus	Rhododendron
Artemisia	Gesneriaceae	Rosa
Begonia	Iris	Sansevieria
Betula	Orchidaceae	Saxifraga
Bromeliaceae	Paeonia	Sedum
Cactaceae	Pelargonium	
Citrus	Peperomia	

Geographic Collections

Flora of the Alps	Flora of Corsica	Flora of Switzerland

Ecological Collections

La Linnaea Alpine Garden	The Tufa wall	Plants of the Rock Gardens

Thematic Collections

Scent and Tactile Garden	Heritage Fruits	Threatened Plants of Switzerland
Ethnobotanical Gardens	Carnivorous Plants	

Table 3
List of the 39 living collections of the CJBG, grouped according to the categories proposed by BGCI (Gratzfeld, 2016).

It is interesting to note that 50% of the collections represent a genus, and 20% a family. The remaining collections concern the flora of a region, an ecological context, or a particular theme.

The collections vary greatly in terms of the number of specimens cultivated (see Table 4). They average 477 individuals, the extremes being 22 specimens (the collection of *Galanthus*) and 3454 specimens (Plants of the Rock Gardens). The ratio between the number of taxa represented and the number of individuals in the collection varies widely, from 1:3 to almost 1:1, with the average being about 1:2. The collection with the smallest ratio (1:3) is that of the Rhododendrons, and this large number of duplicates can be explained by their role in landscaping. The collections with the smallest number of duplicates of the same taxon (almost 1:1) are non-taxonomic collections: the La Linnaea Alpine Garden (94% of taxa represented by a single individual), the Ethnobotanical Gardens (92%), and the Scent and Tactile Garden (91%).

3.2 Quantitative results

The evaluation of the collections took place between May 2016 and April 2017. The open discussion led for each evaluation lasted about 2 hours. The approach of joining a gardener and a scientific advisor for each collection in itself has already been a positive result. The exchanges were for the most part fruitful, and the bringing together of different areas of expertise (applied – scientific) gave much added value to the evaluation process.

Table 4 presents the results of the evaluation of the 39 collections. A brief profile for each collection is found in the appendix.

Table 4
List of the 39 collections sorted alphabetically with the quantitative evaluation values for the four chosen categories. The sum of the values for Heritage, Conservation, Science, and Education is shown in the pink column.

Collection	Number of individuals	Number of taxa	Heritage	Conservation	Science	Education	Sum for the 4 categories	Cost
Acer	98	50	3	2	1	2	8	1
Agave	38	26	1	3	1	2	7	1
Araceae	187	130	2	3	1	2	8	2
Arecaceae	184	114	4	3	5	5	17	2
Artemisia	39	25	1	2	1	4	8	2
Begonia	129	75	2	1	1	2	6	2
Betula	61	28	3	2	1	1	7	1
Bromeliaceae	344	236	4	3	1	2	10	2
Cactaceae	520	292	3	3	1	4	11	3
Carnivorous Plants	128	67	1	2	1	3	7	2
Citrus	24	17	4	1	1	2	8	2
Cupressaceae	132	64	3	3	1	2	9	1
Ethnobotanical Gardens	412	377	4	3	4	5	16	5
Euphorbia	87	62	2	3	1	4	10	3
Ferns and Allied Plants	265	133	3	2	2	2	9	2
Flora of Corsica	1425	675	5	4	5	4	18	2
Flora of Switzerland	3130	1335	5	4	4	3	16	5
Flora of the Alps	3327	1517	5	4	5	4	18	4
Galanthus	22	14	3	3	1	2	9	1
Gesneriaceae	680	295	4	4	5	5	18	3
Heritage Fruits	77	51	4	4	2	2	12	3
Iris	278	212	3	3	1	3	10	2
La Linnaea Alpine Garden	338	316	5	4	4	2	15	3

Collection	Number of individuals	Number of taxa	Heritage	Conservation	Science	Education	Sum for the 4 categories	Cost
Orchidaceae	551	371	4	3	1	2	10	3
Paeonia	67	47	4	3	1	4	12	2
Pelargonium	48	45	1	1	1	1	4	1
Peperomia	90	53	2	1	1	1	5	2
Pinaceae	266	96	4	2	2	2	10	2
Plants of the Rock Gardens	3454	2834	5	4	4	5	18	5
Quercus	103	41	5	2	1	3	11	3
Rhipsalis	70	40	3	4	1	2	10	2
Rhododendron	390	107	3	3	1	3	10	2
Rosa	190	87	4	2	1	4	11	3
Sansevieria	41	26	2	1	1	1	5	1
Saxifraga	196	90	3	3	2	4	12	2
Scent and Tactile Garden	150	137	3	1	1	4	9	4
Sedum	185	73	1	2	1	3	7	1
Threatened Plants of Switzerland	685	357	3	5	5	4	17	3
The Tufa Wall	186	172	3	2	3	4	12	2
Minimum value	22	14	1	1	1	1	4	1
Maximum value	3454	2834	5	5	5	5	18	5
Average value	476.8	274.0	3.2	2.7	2.0	2.9	10.8	2.4

According to the evaluation results, the collections were classified into three categories (Table 5). **Priority** collections have a significance value equal to or greater than 15 for the 4 categories under consideration (not including costs), **significant** collections have a value equal to or greater than 9, while **secondary** collections have a value less than 9.

Priority collections	≥15	Significant collections	≥9	Secondary collections	<9
Flora of Corsica	18	The Tufa Wall	12	Acer	8
Flora of the Alps	18	Paeonia	12	Araceae	8
Gesneriaceae	18	Heritage Fruits	12	Artemisia	8
Plants of the Rock Garden	18	Saxifraga	12	Citrus	8
Arecaceae	17	Cactaceae	11	Agave	7
Threatened Plants of Switzerland	17	Quercus	11	Betula	7
Flora of Switzerland	16	Rosa	11	Carnivorous Plants	7
Ethnobotanical Gardens	16	Bromeliaceae	10	Sedum	7
La Linnaea Alpine Garden	15	Euphorbia	10	Begonia	6
		Iris	10	Peperomia	5
		Orchidaceae	10	Sansevieria	5
		Pinaceae	10	Pelargonium	4
		Rhipsalis	10		
		Rhododendron	10		
		Cupressaceae	9		
		Ferns and Allied Plants	9		
		Galanthus	9		
		Scent and Tactile Garden	9		

Tableau 5
Classification into priority collections (≥15), significant collections (≥9) and secondary collections (<9), based on the sum of the values for the four evaluation categories of each collection.

Priority collections are those for which the Geneva Botanical Garden has great responsibility, at both the national and international level. These collections must not only be maintained, but their quality and value should also be increased in the future.

Significant collections will be maintained to a high standard, but will not necessarily be enlarged.

Secondary collections will be maintained as they are, without plans for development, unless exceptional opportunities arise.

3.3 Qualitative results

The full results of the qualitative evaluation are presented at the end of each collection profile in the appendix. For the **comments** section, the information is systematically grouped into four categories, corresponding to the four categories of evaluation (Heritage, Conservation, Science, Education). In general, similar aspects arose repeatedly during the tripartite discussions. These included the following comments:

Heritage Details on the creation or location of the collection and its protagonists; information on the accumulated documentation for cultivating the taxa of the collection; age and/or great size of certain trees; reorganization of the collection and other works realized in the area harboring the collection.

Conservation Number of threatened or endemic taxa for a region found in the collection; lack of threat-level assessments for many taxa, especially from the tropics; proportion of wild taxa, and representativeness of the collection (see Table 1); local reintroduction projects involving certain taxa of the collection; challenges to cultivating taxa of the collection.

Science Listing of scientists from our institution and/or external scientists who conduct research with the collection; suggestion of topics for potential research; relevance for university instruction.

Education Existing teaching materials and pedagogical activities realized by way of the collection; period of attraction for the public (flowering, fruiting, foliage, etc.); highlighting of the outstanding features of the collection (pollination; human uses; scents; environmental adaptations; spectacular structures; diversity of the vegetative forms, inflorescences, habitats, geographies, etc.).

The **proposed improvements** reflect theoretical objectives for each collection. For most of the collections, an effort toward popularization and enhancement for the public is desired. Some proposed improvements also reccur regularly, such as checking the geographical origin of taxa, finishing labeling, checking IUCN threat status, locating remarkable or missing taxa to complete the collection, organizing guided tours presenting the collection, etc. Some proposals are specific to the nature of the collections, for example the problem of aging for collections of woody plants. Permanent objectives such as verification of nomenclature (synonymy), identification of undetermined plants, and general maintenance are not listed in the collection profiles.

Discussion

It is interesting to observe that the priority collections are almost invariably those for which a scientist has strong ties with the gardeners. In other words, a living collection gains significance and value when it is studied by a researcher at the Institution and interests the corresponding gardener in charge. The link between the Garden and the *Conservatoire* (the research division of the CJBG) is therefore very important for the development of our plant heritage, and should be promoted. On the ground, this link takes form through the joined effort of the researcher and the gardener, as is the case for example with the gesneriad *(Gesneriaceae)* and palm *(Arecaceae)* collections. The more this link is developed, the greater the opportunity for receiving quality plant material to increase the collection (field-collections of seed, plant exchanges, networking, etc.). The expertise and validity of the collection are also much better, while scientific development (publications) and/or educational enhancements (exhibitions, signage) are other dimensions that benefit greatly from the scientific knowledge of our researchers. The highest-ranking collections in this evaluation are all marked by strong dynamics of this kind.

Paradoxically, it is the scientific dimension that received the lowest rating (2.0 on average for all collections, see Table 4), while heritage received the highest rating (3.5 on average). This result shows that while our collections overall hold much historical importance, they are not sufficiently connected with institutional scientific research. This can also be explained by the fact that the necessary diversity of the collections, covering a vast number of species, cannot be matched with a corresponding number of active research projects and investigators.

Conclusion and outlook

The evaluation of our living collections has allowed us to bring out our strengths and weaknesses as a Botanical Garden. The priority collections of the Garden are now clearly identified, together with development objectives for each of them. This evaluation also pointed to the importance and relevance of the link between the Garden and the *Conservatoire*, and of bringing scientists and gardeners together on the ground.

The results of the qualitative analysis open many perspectives. Generally, this study reveals certain gaps in communication concerning our collections. One important perspective arising from the evaluation is to give our visitors more information, both on the ground (interpretive panels) and through electronic media. Following the evaluations, several concrete steps have already been taken. Certain collections thus have been featured on Facebook during flowering (*Arecaceae, Cactaceae, Orchidaceae,* the Ethnobotanical Gardens, Scent and Tactile Gardens, Plants of the Rock Gardens, and *Rhododendron*). Activities linking schools and collections have been put into motion (La Linnaea Alpine Garden). Specimen identification has begun, often in collaboration with taxonomists external to the CJBG, specialized in specific regions or taxonomic groups (*Orchidaceae*, Plants of the Rock Gardens, *Rhododendron*). On the ground, we have created a system of removable and modifiable panels, allowing us to quickly and concisely transmit information to visitors, for example about a particular plant at the moment it blooms.

Another important issue that emerges from the study is the visibility of our collections. It seems essential to us that they be available to the public, especially the most impressive ones, which isn't always obvious on the ground. A display case for rare or fragile tropical orchids, for example, was constructed in the entrance to the Winter Garden, so as to be able to present the blooms to the public without exposing them to damage. The temporary placement of orchids in this showcase during spectacular blooms was quickly extended to tropical representatives from other collections *(Araceae, Cactaceae, Citrus).*

It would seem interesting to us to put the results of this effort in perspective with similar efforts at other Botanical Gardens, regionally and internationally. If diversity is clearly at the heart of our mission, it is also important that we not spread ourselves too thin, but rather attempt to optimize our efforts to conserve living things. In Switzerland today, there is no dynamic of national reference collections. The French example (CCVS collections) shows that it is possible to clearly identify the strengths of each botanical garden and perhaps,

one day, to contemplate a strategy for living collections at a regional, and/or national level (to avoid, for example, having two nearby institutions specialized in the same plant family).

This collections-management policy is not fixed, since certain new collections could be added to the list (e.g. *Aloe, Salix*), or others be removed. Indeed, it is important to remain a dynamic institution, ever open to change.

We plan to re-evaluate the living collections in five years, in order to see whether the set objectives have been met and to decide on future actions for each collection. It is essential to always challenge ourselves, and continuously question the pertinence of our work.

[7] www.ccvs-france.org

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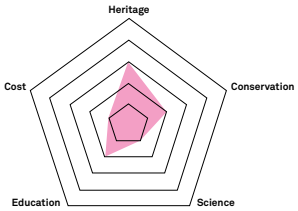
Appendix

All the evaluation profiles for the living collections are presented in the appendix. They are sorted alphabetically by collection name, and the contents of each profile follow the same order. The international and national legislative context is presented after the profiles.

Acer



Description of the collection	Includes all specimens of the genus *Acer* cultivated at the Garden.
Location in the Garden	Located principally in the Arboretum of the Terre de Pregny.
History of the collection	The collection was created and gathered at the Terre de Pregny by Maurice Thomet, garden manager until 2005, following the acquisition of the Pictet parcel in 1978.
Principal mode of acquisition	*Index seminum*, nursery.
The collection in a few figures	
Number of taxa	50
Number of specimens in cultivation	98
Proportion wild taxa/cultivars	72 % wild
Representativeness	22 %
Manager of the collection	Vincent Herpailler
Scientific advisor	Roger Beer

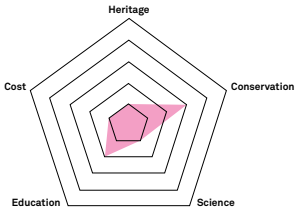
COMMENTS

• **Heritage** an old collection (>40 years). Problem of concurrent aging, since most individuals were planted at the same time in the early 1980s. Seeds sown in 2015 to diversify the collection.
• **Conservation** 6 species with protected status (*Acer buergerianum* CR, *Acer buergerianum* subsp. *formosanum* CR, *Acer cappadocicum* NT, *Acer griseum* EN, *Acer miyabei* EN, *Acer sinopurpurascens* VU).
• **Science** –
• **Education** –

PROPOSED IMPROVEMENTS

• Replant with young individuals to avoid simultaneous aging of the entire collection. Most of the subjects were planted at the same time, at the beginning of the 1980s.
• Create a descriptive panel for the collection.
• Check the IUCN threat status of cultivated taxa at the CJBG.

Agave



Description of the collection	Includes all specimens of the genus *Agave* cultivated at the Garden.
Location in the Garden	Located mainly in the temperate greenhouse and in the cold operational greenhouse.
History of the collection	Collection created by Jean Lambert in the 1960s, aiming to show the adaptations of succulent plant families to various dry climates. Beginning in 1988, landscaped plantings in the temperate greenhouse by Pierre Mattille.
Principal mode of acquisition	*Index seminum*, bequests.
The collection in a few figures	
Number of taxa	26
Number of specimens in cultivation	38
Proportion wild taxa/cultivars	99 % wild
Representativeness	14 %
Manager of the collection	Bertrand Guigon
Scientific advisor	Pierre-Louis Grange

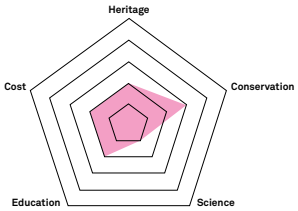
COMMENTS

• **Heritage** –
• **Conservation** special visit in 2017 of Jean-Marie Solichon, director of the Jardin Exotique de Monaco, for assistance with determinations and advice on cultivation (expertise in the field).
• **Science** –
• **Education** good visibility of the collection (temperate greenhouse, acclimatization trial beds, volcanic greenhouse). High potential appeal regarding the uses of Agave.

PROPOSED IMPROVEMENTS

• Check the IUCN threat status of the cultivated taxa at the CJBG.
• Seek wild seeds with field data.
• Create an interpretive panel for the collection.
• Develop guided visits and/or activities around this collection that would be of compelling interest to the public and schools.

Araceae



Description of the collection	Includes all specimens of the family *Araceae* cultivated at the Garden.
Location in the Garden	Tropical greenhouse, Winter Garden, and operational greenhouses; also present in the rock gardens and bulbous-plant beds.
History of the collection	Collection created by Jean Lambert in the 1960s and expanded since by his successors, with the goal of demonstrating the morphological diversity of this family.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	130
Number of specimens in cultivation	187
Proportion wild taxa/cultivars	92 % wild
Representativeness	4 %
Manager of the collection	Emilie Sanchez
Scientific advisor	Louis Nusbaumer

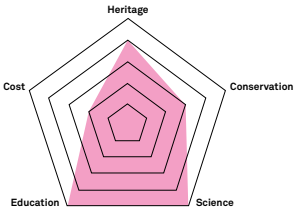
COMMENTS

• **Heritage** difficult cultivation due to the large size of several species.
• **Conservation** tropical species from humid environments, among the most threatened in the world; 1 species cultivated at the CJBG is near threatened in nature - NT *(Philodendron rugosum)*, and 1 species is in critical danger of extinction - CR *(Alocasia sanderiana)*.
• **Science** –
• **Education** great morphological diversity. Coevolution between plants and pollinators, foliar adaptations of understory plants, local flora, spectacular species. Use against malaria including antibiotic-resistant strains, toxicity, and culinary uses.

PROPOSED IMPROVEMENTS

• Highlight the most spectacular species.
• Register field data in the database for species collected in the wild (geographic origin).
• Attempt outdoor acclimatization of *Arisema* spp.

Arecaceae



Description of the collection	Includes all specimens from the family *Arecaceae* cultivated at the Garden.
Location in the Garden	Dispersed in the Garden between the temperate, tropical, Pregny, and Winter Garden greenhouses.
History of the collection	Collection created by Pierre Mattille in the 1980s. The initial goal was to create atmospheric landscapes in the various public greenhouses. At present, it is the largest collection of greenhouse palms in Switzerland.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	114
Number of specimens in cultivation	184
Proportion wild taxa/cultivars	100 % wild
Representativeness	4 %
Manager of the collection	Matthieu Grillet
Scientific advisor	Fred Stauffer

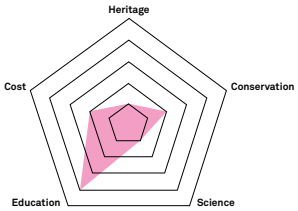
COMMENTS

• **Heritage** part of a tropical tradition in Geneva (2/3 of the herbaria are made up of tropical species). Some palms have been present in the garden since its creation at Bastions *(Phoenix, Washingtonia)*, without yet constituting a genuine collection. The rapid development of the current collection began in the 1980s.
• **Conservation** some taxa are threatened in their native environment. Numerous botanical field studies as well as applied research, notably on reproductive capacity (rattans in Ivory Coast).
• **Science** very strong link with the research of the Conservatoire by way of Fred Stauffer (herbaria, micro-morphology and molecular genetics laboratories, applied research, field collections, etc.).
• **Education** three-part exhibition, over two years (2013-2014), on the theme of palms. Three booklets oriented toward broad audiences, arising from this exhibition. Numerous guided visits and activities as part of "Green workshops" and "Botanical Variations," etc.

PROPOSED IMPROVEMENTS

• Obtain seeds of wild origin with corresponding field data (collections from expeditions).
• Focus the development of the collection on small-statured species (understory), for reasons of space in the greenhouses and sustainability of the plants in the collection over the long term.
• Establish protocols for observing/describing phenology.
• Realize an internship at the Montgomery Botanical Center in Miami in order to deepen practical knowledge on palm cultivation (gardener in charge of the collection).

Artemisia



Description of the collection	Includes all specimens of the genus *Artemisia* cultivated at the Garden.
Location in the Garden	Situated mainly in the *Artemisia* bed of the rock gardens.
History of the collection	In the fall of 1999, Robert Braito brought the collection together in a dedicated bed for *Artemisia*. Rearrangement of the bed in 2015, emphasizing small-sized species.
Principal mode of acquisition	*Index seminum*, wild collections.
The collection in a few figures	
Number of taxa	25
Number of specimens in cultivation	39
Proportion wild taxa/cultivars	100 % wild
Representativeness	5 %
Manager of the collection	Samuel Mathiss
Scientific advisor	Florian Mombrial

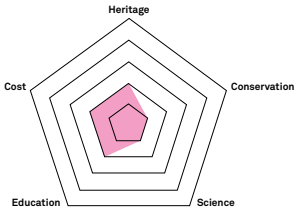
COMMENTS

• **Heritage** a thematic bed in the rock gardens is dedicated entirely to the genus *Artemisia*.
• **Conservation** the alpine species are protected (due to intense harvesting) but not threatened. The plants cultivated at the Garden are 90 % wild origin.
• **Science** –
• **Education** strong potential for popularization (A. annua, absinthe, wormwood, mythology, allelopathy, etc.). Existence of two educational panels on Artemisas, and a third dedicated to absinthe.

PROPOSED IMPROVEMENTS

• Enrich the collection with endemic and/or native species from the Flora of Switzerland and the Flora of the Alps.
• Obtain *Artemisia annua* and *A.douglasiana*.
• Create an interpretive panel for the collection.
• Develop guided visits and/or workshops around this collection, which has strong potential appeal to the public and school groups.

Begonia



Description of the collection	Includes all specimens of *Begonia* cultivated at the Garden.
Location in the Garden	Situated principally in the operational greenhouses at Pregny.
History of the collection	Initiated by Jean Lambert beginning in 1960. Additional contribution from Liliane Stutz-Ortega's work toward her diploma at the end of 1970. Maintenance and replenishment by Pierre Mattille and Yvonne Menneret. During the 2000s, the collection was planted in the ground (in the current *Gesneriaceae* greenhouse), prior to being moved to the Pregny greenhouses.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	75
Number of specimens in cultivation	129
Proportion wild taxa/cultivars	77 % wild
Representativeness	4 %
Manager of the collection	Patrick Dubacher
Scientific advisor	Mathieu Perret

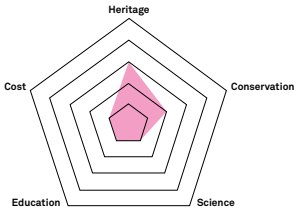
COMMENTS

• **Heritage** small collection in number of taxa, located mainly in the Pregny greenhouses (not accessible to the public). Some specimens in public greenhouses (tropical and winter garden).
• **Conservation** *Begonia salaziensis* War. in critical danger of extinction, according to the IUCN Red List.
• **Science** –
• **Education** intriguing genus for diversity of foliage colors (ex: *B. pavonina* with bluish foliage). Dark pigmentation of leaves (blue, red) typical of tropical undergrowth, a plant strategy for capturing UV wavelengths reaching the forest floor.

PROPOSED IMPROVEMENTS

• Increase the visibility of the collection in the tropical greenhouse, for example on the green wall.
• Enter field data in the database for species collected in the wild (geographical origin).

Betula



Description of the collection	Includes all specimens of the genus *Betula* cultivated at the Garden.
Location in the Garden	Situated mainly in the Arboretum of the Terre de Pregny.
History of the collection	The collection was created and assembled at the Terre de Pregny by Maurice Thomet, following the acquisition of the parcel in 1978.
Principal mode of acquisition	*Index seminum*, nursery.
The collection in a few figures	
Number of taxa	28
Number of specimens in cultivation	61
Proportion wild taxa/cultivars	100 % wild
Representativeness	22 %
Manager of the collection	Jean-Marie Robert-Nicoud
Scientific advisor	Roger Beer

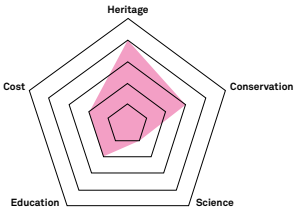
COMMENTS

- **Heritage** relatively old collection (>40 years).
- **Conservation** collection derived from seed of wild origin.
- **Science** –
- **Education** an emblematic genus for the region of Geneva. Limited appeal due to remoteness of the collection (far end of the Terre de Pregny).

PROPOSED IMPROVEMENTS

- Create an interpretive panel for the collection at the entrance to the Terre de Pregny.
- Enrich the collection according to the indications of R. Beer: *Betula albosinensis, B.costata, B.dahurica, B.divaricata, B.maximowicziana, B.occidentalis, B.medwediewii.*
- Remove *Betula pendula* of the Pregny hedge from the Garden database.

Bromeliaceae



Description of the collection	Includes all specimens of the family *Bromeliaceae* cultivated at the Garden.
Location in the Garden	Situated principally in a greenhouse dedicated to *Bromeliaceae.*
History of the collection	Initiation of the collection owes to the Barbey-Boissier bequest in the early 20th century. Expansion of the collection mainly by Jean Lambert, beginning in the 1960s, later continued by Pierre Mattille *(Tillandsia)* in the 1980s.
Principal mode of acquisition	Bequests, then *Index seminum*.
The collection in a few figures	
Number of taxa	236
Number of specimens in cultivation	344
Proportion wild taxa/cultivars	98 % wild
Representativeness	7 %
Manager of the collection	Alexandre Chappuis
Scientific advisor	Mathieu Perret

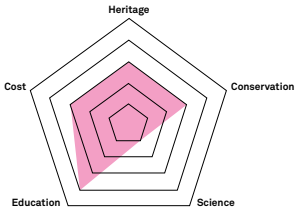
COMMENTS

- **Heritage** a relatively old tropical collection in Geneva.
- **Conservation** the collected plants mostly come from gardens, except for numerous *Tillandsia* originating in Paraguay (field collections).
- **Science** despite considerable potential, no scientific research has been conducted on this family at the CJBG.
- **Education** an emblematic South American family. One greenhouse is almost entirely dedicated to this family, but interpretive information is lacking.

PROPOSED IMPROVEMENTS

- Complete the labeling while determining a system for placing the labels among the rocks.
- Create a thematic panel for the collection.
- Obtain the African species *Pitcairnia feliciana*. Native to Guinea, it is the only non-South American species of bromeliad.

Cactaceae



Description of the collection	Includes all specimens from the family *Cactaceae* cultivated at the Garden.
Location in the Garden	Situated mainly in the temperate greenhouse, the (cold) operational greenhouse, and the Pregny greenhouses.
History of the collection	Created by Jean Lambert in the 1960s, with the aim of showing the different adaptations of succulent plant families to various dry climates. Since 1988, landscaped display in the temperate greenhouse by Pierre Mattille, with important additions from the botanical gardens of Monaco, Zurich and Lyon. Subsequent bequests of the Mügeli, Bourquin and Blanc collections.
Principal mode of acquisition	*Index seminum*, bequests.
The collection in a few figures	
Number of taxa	292
Number of specimens in cultivation	520
Proportion wild taxa/cultivars	99 % wild
Representativeness	13 %
Manager of the collection	Jean-Marie Robert-Nicoud
Scientific advisor	Roger Beer

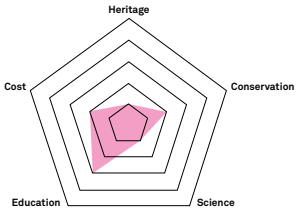
COMMENTS

• **Heritage** cacti were already collected and grown at the Bastions garden (a tradition of the CJBG). A new public greenhouse dedicated to cacti and succulents was opened in 2017.
• **Conservation** technical visit of Jean-Marie Solichon, Director of the Jardin exotique de Monaco, for assistance in making determinations and advice on cultivation in 2017 (expertise in the field).
• **Science** despite considerable potential, no scientific research has been conducted on this family at the CJBG.
• **Education** the collection is accessible and much appreciated by the public. Guided visits are organized every year. («Botanical Variations» and «Green Workshops»), with much success.

PROPOSED IMPROVEMENTS

• Create an interpretive panel for the collection (illustration of the two wings of the temperate greenhouse).
• Check the IUCN threat status of the cultivated taxa at the CJBG.
• Obtain seeds from the wild with field data.

Carnivorous Plants



Description of the collection	Includes all carnivorous plants cultivated at the Garden.
Location in the Garden	Found mainly outdoors in front of the tropical greenhouse, in a caged enclosure.
History of the collection	Collection created by Jean Lambert in the 1960s. Development in the 2000s by Yvonne Menneret, with the creation of an outdoor space. Gift of a *Nepenthes* collection in 2012 from Jean-Michel Perrin. In the public display (cage in front of the greenhouse), there are three families, five genera and 15 species. Other carnivorous plants are present in our operational greenhouses.
Principal mode of acquisition	*Index seminum,* purchases (outdoor collection).
The collection in a few figures	
Number of taxa	67
Number of specimens in cultivation	128
Proportion wild taxa/cultivars	80 % wild
Representativeness	5 %
Manager of the collection	Yvonne Menneret
Scientific advisor	Daniel Jeanmonod

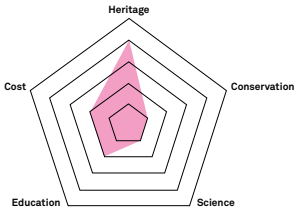
COMMENTS

- **Heritage** –
- **Conservation** threatened status for nearly all carnivorous plants.
- **Science** –
- **Education** every year a "Green Workshop" and "Botanical Variation" is organized, and school groups hosted, around the theme of carnivorous plants.

PROPOSED IMPROVEMENTS

- Need to enhance the collection from an educational perspective.
- Create an interpretive panel on the outdoor cage to explain the different modes of action of carnivorous plants.
- Diversify genera rather than the species within a given genus.
- Obtain the seven species of *Utricularia* native to Switzerland, as well as *Pinguicula corsica*.

Citrus



Description of the collection	Includes all specimens of the genus *Citrus* cultivated at the Garden.
Location in the Garden	Situated mainly in the operational greenhouses at Pregny.
History of the collection	Created by Jean Lambert in the 1960s. Expanded later by his successors.
Principal mode of acquisition	Exchanges with other botanical gardens, Private bequests.
The collection in a few figures	
Number of taxa	17
Number of specimens in cultivation	24
Proportion wild taxa/cultivars	71 % wild
Representativeness	36 %
Manager of the collection	Patrick Dubacher
Scientific advisor	Niels Rodin

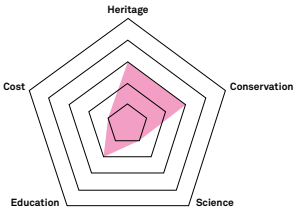
COMMENTS

- **Heritage** illustration of a traditional practice (orangery planters). One remarkable potted example *(Citrus sinensis)* has significant heritage value (>150 years).
- **Conservation** –
- **Science** –
- **Education** collection potentially quite attractive, but little visible or accessible due to location at the Pregny greenhouses.

PROPOSED IMPROVEMENTS

- Future collaboration with Niels Rodin, collector and specialist of Citrus.
- Role for the collection in conserving rare varieties.
- Present remarkable taxa to the public (fruit diversity by geographic origin, at the entrance of the Winter Garden).
- Increase hardiness of citrus fruit trees (attempt to acclimatize varieties).
- Obtain the historical Medici varieties (Florence, 16th century).

Cupressaceae



Description of the collection	Includes all specimens of the family *Cupressaceae* cultivated at the garden.
Location in the Garden	Collection dispersed broadly in the Arboretum and the Garden.
History of the collection	This collection was built up over time, with several well-represented genera such as *Cupressus*, *Juniperus* and *Chamaecyparis*.
Principal mode of acquisition	*Index seminum*, nursery.
The collection in a few figures	
Number of taxa	64
Number of specimens in cultivation	132
Proportion wild taxa/cultivars	66 % wild
Representativeness	21 %
Manager of the collection	Christian Nasel
Scientific advisor	Roger Beer

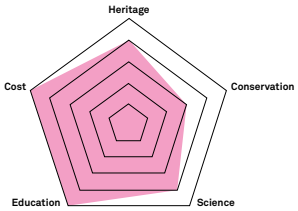
COMMENTS

- **Heritage** many duplicates of rather common species.
- **Conservation** many specimens found on the IUCN Red List.
- **Science** –
- **Education** several emblematic and spectacular species *(Sequoia, Metasequoia)*.

PROPOSED IMPROVEMENTS

- Update the family names in the Garden's digital catalogue *(Taxodiaceae => Cupressaceae)*.

Ethno-botanical Gardens



Description of the collection	Brings together a range of useful plants. It is presented in the form of thematic gardens (medicinal, ethnobotanical, etc.).
Location in the Garden	Situated between the temperate greenhouse and the gardeners' building as terraced, thematic gardens, richly signed with museography (objects in display cases). Part of the collection is located in a warm greenhouse (west wing of the Winter Garden).
History of the collection	A collection of useful plants has existed since the 1940s. Creation of the terraces of medicinal plants between 1997 and 2000. Complete renovation (plants and objects) in 2016 by Didier Roguet, and Jean-Marie Robert-Nicoud and his team. Exchanges with other Botanical Gardens.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	377
Number of specimens in cultivation	412
Proportion wild taxa/cultivars	92 % wild
Representativeness	–
Manager of the collection	Christelle Bacquet
Scientific advisor	Didier Roguet

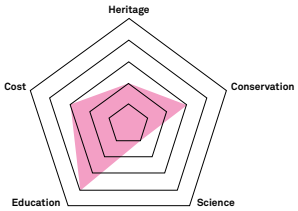
COMMENTS

• **Heritage** collection existing as a thematic garden since 1940.
• **Conservation** –
• **Science** several scientists at the CJBG work on this subject (Didier Roguet, Fred Stauffer).
• **Education** plant list completely revised in 2016, with the support of Philippe Christen (UNIGE) for pharmacy and Dominique Vernat (COTY) for fragrences. Scenography also renovated and altered (interpretive panels, displays, paths, etc.). Inaugurated June 26, 2017.

PROPOSED IMPROVEMENTS

• Completely update the tropical portion (in the Winter Garden) of the Ethnobotanical Gardens, using the same scenographic concept, but adapted to the interior space.

Euphorbia



Description of the collection	Includes all specimens of the genus *Euphorbia* cultivated at the Garden.
Location in the Garden	Located mainly in the *Euphorbia* bed of the rock gardens, as well as in greenhouses (temperate and operational).
History of the collection	In the rock gardens, the collection was gathered into a bed dedicated to *Euphorbia* in 1998.
Principal mode of acquisition	Index seminum, exchanges with other botanical gardens.
The collection in a few figures	
Number of taxa	62
Number of specimens in cultivation	87
Proportion wild taxa/cultivars	100 % wild
Representativeness	3 %
Manager of the collection	Samuel Mathiss
Scientific advisor	Cyrille Chatelain

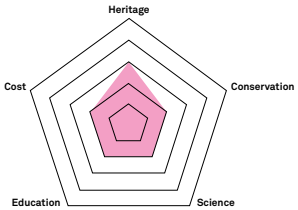
COMMENTS

• **Heritage** a bed is specifically dedicated to the genus *Euphorbia* in the rock gardens.
• **Conservation** –
• **Science** –
• **Education** pedagogic display in the temperate greenhouse (*Cactaceae* vs *Euphorbiaceae*). Two interpretive panels present the Euphorbia bed in the Rock Gardens. Useful for showing great morphological diversity (shrubby, succulent, herbaceous forms, etc.), environmental diversity (tropical and temperate species), and geographical diversity.

PROPOSED IMPROVEMENTS

- Test the acclimatization of species on the CFF tufa wall.
- Display regional euphorbias as plantings of annuals.

Ferns and allied plants



Description of the collection	Includes all ferns and allied plants (Pteridophytes) cultivated at the Garden.
Location in the Garden	Situated mainly in the exhibition greenhouse, the moist tufa wall of the Rock Gardens, and elsewhere in the Garden.
History of the collection	The collection of tropical ferns was initiated by Ernest Shamir in the early 1980s. Recent enhancement with in vitro cultivation trials by Sophie Dunand, and then the laboratory of François Lefort (HEPIA). Numerous hardy ferns placed on the tufa wall outside the tropical greenhouse, given its northern orientation. These can be considered the beginning of the collection of hardy ferns, even if many flowering plants were also planted there at the time by Pierre Von Auw. The collection focused increasingly on ferns beginning in the late 1990s.
Principal mode of acquisition	*Index seminum*, in vitro cultivation.
The collection in a few figures	
Number of taxa	133
Number of specimens in cultivation	265
Proportion wild taxa/cultivars	94 % wild
Representativeness	1 %
Manager of the collection	Emilie Sanchez
Scientific advisor	Michelle Price

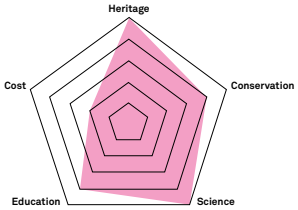
COMMENTS

• **Heritage** the collection contributes to the general aesthetic of the Garden through its high landscape value. Partnership with HEPIA-Lullier (Plants and Pathogens Laboratory) for a project of in vitro cultivation (spore germination).
• **Conservation** *Doodia caudata*, kept in our greenhouses, is an endemic species of Australia and New Zealand.
• **Science** –
• **Education** the collection is little emphasized (by descriptive signing, etc.), despite the presence of ferns across almost the entire Garden.

PROPOSED IMPROVEMENTS

• Check the IUCN threat status of the cultivated taxa at the CJBG.
• Rationalize collaboration with HEPIA-Lullier (choice of species, number of individuals, acclimatization).
• Produce a guide to the ferns at the CJBG.
• Provide living material for Michelle Price's applied research at UNIGE.

Flora of Corsica



Description of the collection	Includes all specimens belonging to the flora of Corsica cultivated at the Garden.
Location in the Garden	Found mainly in the Rock Gardens (beds for Corse/Sardinia, Apennines/Sicily, etc.). Several specimens are also cultivated dispersed in other parts of the Garden.
History of the collection	At David Aeschimann's suggestion, the Corsica-Apennine beds were rebuilt over granite rocks in 1992. In October 1993, Robert Braito and Daniel Jeanmonod brought back many endemic taxa following an expedition in Corsica. This was the true beginning of the current collection. In autumn 1995, the bed on limestone "Caucasus 3" was entirely restored, becoming "Corsica-Sardinia 2."
Principal mode of acquisition	*Index seminum* (principally wild origin), wild collections.
The collection in a few figures	
Number of taxa	675
Number of specimens in cultivation	1425
Proportion wild taxa/cultivars	100 % wild
Representativeness	24 %
Manager of the collection	Marylin Staehli
Scientific advisor	Daniel Jeanmonod

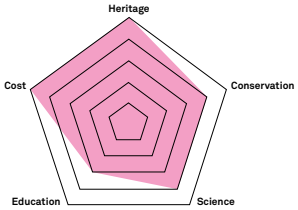
COMMENTS

• **Heritage** beginning in 1900, John Briquet worked on the Prodrome of the flora of Corsica. Gilbert Bocquet relaunched the project in the 1980s, entrusting it to Daniel Jeanmonod. The Flora of Corsica living collection probably began with the first Rock Gardens in 1904.
• **Conservation** several threatened taxa from Corsica are successfully grown in the Garden. The "Corsican" beds are highly representative, with mostly endemic taxa of wild origin (more than 90% of the taxa were collected in the field). The collection is very representative in terms of the diversity of natural environments.
• **Science** the CJBG are the scientific focal point for the flora of Corsica. More than 100,000 specimens are held in our herbaria. Numerous publications, notably ***Flora Corsica***. Collaboration with the Conservatoire Botanique National de Corse (CBNC).
• **Education** the "Corsica" beds are clearly marked and documented with descriptive panels, and are very accessible to the public. Numerous guided visits ("Botanical Variations") led by Daniel Jeanmonod.

PROPOSED IMPROVEMENTS

• Produce an educational booklet on the history of this important collection at the CJBG.
• Enrich the collection with native and/or endemic, though not threatened, species, from Corsica.

Flora of Switzerland



Description of the collection	Includes all specimens belonging to the native flora of Switzerland cultivated at the Garden.
Location in the Garden	Mainly found in the Rock Gardens (beds corresponding to the Swiss Alps, Eastern and Western Alps, Jura, Valais Steppe, Protected plants, etc.). Several specimens are also cultivated scattered elsewhere in the Garden (Arboretum, Ethnobotanical Gardens, etc.).
History of the collection	Collection dates back to the creation of the Rock Gardens at the present site (1904). It probably existed in some form since the establishment of the Botanical Garden at Bastions.
Principal mode of acquisition	*Index seminum* (mostly wild origin), wild collections.
The collection in a few figures	
Number of taxa	1335
Number of specimens in cultivation	3130
Proportion wild taxa/cultivars	100 % wild
Representativeness	42 %
Manager of the collection	Sébastien Pena
Scientific advisor	Beat Bäumler

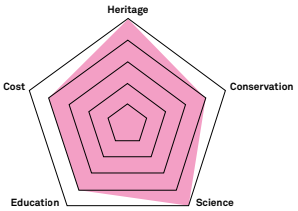
COMMENTS

• **Heritage** the original 1904 rock gardens were planted with taxa essentially drawn from the flora of Switzerland.
• **Conservation** a very high proportion of the plants in the collection were collected in the wild. Several reintroduction programs to natural environments are led by the CJBG, with significant ex-situ cultivation.
• **Science** scientific work on the Swiss flora is intense, but with little connection to the living collection.
• **Education** strong pedagogic potential, but insufficiently used.

PROPOSED IMPROVEMENTS

• Creation of virtual tours for the collection (on smartphones or tablets).
• Offer "Botanical Variations" and/or guided tours oriented to the wider public and dedicated to the flora of Switzerland.
• Increase the number of taxa, emphasizing rare or distinctive plants, and plants of wetlands.

Flora of the Alps



Description of the collection	Includes all the specimens cultivated in the garden belonging to the flora of the Alps.
Location in the Garden	Situated principally in the Rock Gardens (Swiss, Eastern and Western Alps, Jura, Valais Steppe, Protected Plants, etc.). Several specimens are also dispersed elsewhere in the Garden (Arboretum, Ethnobotanical Gardens, etc.).
History of the collection	The collection was created at the same time as the Rock Gardens in the current Garden (1904) and has probably existed in another form since the creation of the Botanical Garden at Bastions.
Principal mode of acquisition	*Index seminum* (mostly wild origin), wild collections.
The collection in a few figures	
Number of taxa	1517
Number of specimens in cultivation	3327
Proportion wild taxa/cultivars	100 % wild
Representativeness	34 %
Manager of the collection	Sandrine Bersier
Scientific advisor	David Aeschimann

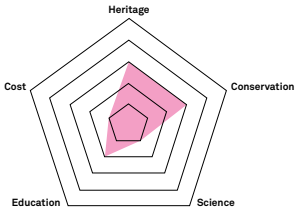
COMMENTS

• **Heritage** historical collection since 1904.
• **Conservation** about 100 taxa in the collection are endemic to the Alps. Most of the specimens are from wild collections.
• **Science** the flora of the Alps has been a specialty of the CJBG for many years through the work of David Aeschimann.
• **Education** the collection is staged in the Rock Gardens and in the La Linnaea Alpine Garden.

PROPOSED IMPROVEMENTS

• Focus the development of the collection on the 514 endemic taxa of the flora of the Alps, the 1261 taxa of the Alps and neighboring mountain ranges, and the 104 taxa of the Alps and Arctic regions.
• Obtain one representative species per genus (for endemics) rather than aiming for completeness.
• Create an interpretive panel for the collection with a distribution map (see *Flora alpina*).

Galanthus



Description of the collection	Includes all specimens of the genus *Galanthus* cultivated at the Garden.
Location in the Garden	Situated essentially among the collection of wild Peonies by the Rock Gardens.
History of the collection	In 1987, Adelaide Stork, a botanist at the CJBG, worked extensively with bulbous plants. She checked the determinations of various species and in instances suggested seeking better replacements. Robert Braito, at the time responsible for the Rock Gardens, was looking for a genus that could be mixed with the peonies in order to fill out the ground these occupied in winter and spring. Adelaide Stork and Robert Braito decided to insert *Galanthus* in this site, where they would be in the sun and visible during their flowering period, and then in the shade of the peonies during the warm season. In 1988, they made a trip to Belgium to collect an endemic species. This was the starting point for the collection, and included transplanting other species already found in the Rock Gardens.
Principal mode of acquisition	Exchanges with other botanical gardens.
The collection in a few figures	
Number of taxa	14
Number of specimens in cultivation	22
Proportion wild taxa/cultivars	93 % wild
Representativeness	67 %
Manager of the collection	Marilyn Stähli
Scientific advisor	Beat Bäumler

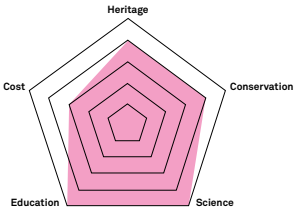
COMMENTS

• **Heritage** a relatively old collection (> 30 years), quite well documented by Robert Braito (advice on cultivation, morphology).
• **Conservation** high representativeness (2/3 of species are in cultivation at the CJBG).
• **Science** –
• **Education** strong appeal in winter, but for a limited duration (relatively short flowering period).

PROPOSED IMPROVEMENTS

• Complete the collection (gather all species of the genus *Galanthus*).
• Use the beds of the Rock Garden beds to cultivate some species (microclimates) and increase their appeal.
• Check the IUCN threat status of the cultivated taxa at the CJBG.

Gesneriaceae



Description of the collection	Includes all specimens from the family *Gesneriaceae* cultivated at the Garden.
Location in the Garden	Located mainly in the greenhouse dedicated to *Gesneriaceae.*
History of the collection	Created by Jean Lambert in the 1960s. Significant growth in the 1970s when an epiphyte collection was assembled (cuttings from other botanical gardens, for an exhibition). Since 1985, major additions by way of field collections (Brazil) by Alain Chautems.
Principal mode of acquisition	*Index seminum,* cuttings from other botanical gardens.
The collection in a few figures	
Number of taxa	295
Number of specimens in cultivation	680
Proportion wild taxa/cultivars	85 % wild
Representativeness	7 %
Manager of the collection	Yvonne Menneret
Scientific advisor	Mathieu Perret

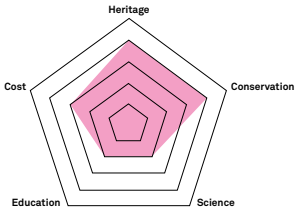
COMMENTS

• **Heritage** this is one of the oldest tropical collections at the CJBG. A unique collection of Neotropical *Gesneriaceae* (Edinburgh and Vienna hold important collections from Asia). A notable and original collection, high maintenance responsibility.
• **Conservation** high proportion of species rare and/or threatened in Brazil.
• **Science** two researchers work on this family at the CJBG (Alain Chautems and Mathieu Perret), with many publications and species descriptions.
• **Education** exhibition "Tropical Plants in our Living Rooms; the Origin and Diversity of Gesneriaceae" in 2016. Publication for a broad public (exhibition booklet). Many guided tours and "Botanical Variations" on this family and, above all, a greenhouse entirely dedicated to the *Gesneriaceae.*

PROPOSED IMPROVEMENTS

• Assess representativeness for Brazil and for some genera *(Sinningia, Nematanthus)*.
• Register field collection data in the CJBG database.
• Connect the cultivated specimens with corresponding herbarium and field data.
• Rationalize the collection in terms of numbers of specimens in cultivation (duplicates).

Heritage Fruits



Description of the collection	Brings together all fruit trees of the Garden (preservation orchards, hardy fruit trees of our regions).
Location in the Garden	Situated mainly in the preservation orchard of the Domaine de Penthes, as well as in the orchard-greenhouses at Pregny.
History of the collection	Creation of the preservation orchard at Penthes in collaboration with Roger Corbaz (FRUCTUS) between 1991 and 1997. Reconstitution of the Rothschild collection by Pierre Mattille in 1988, at the Pregny greenhouses. Some vine stock dates back to the early 20th century. Initiation of an *allée de hutins* (demonstrating an older, regional technique of using fruit trees as supports for grape vines) at the Terre de Pregny in 2015 by Nicolas Freyre, Jean-Marie Robert-Nicoud and Christoph Köhler.
Principal mode of acquisition	Grafting, exchange network.
The collection in a few figures	
Number of taxa	51
Number of specimens in cultivation	77
Proportion wild taxa/cultivars	98 % cultivars
Representativeness	–
Manager of the collection	Pascal Oguey
Scientific advisor	Christoph Kohler

COMMENTS

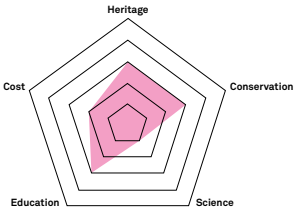
• **Heritage** the very first publication of the CJBG was the 1820 catalogue of fruit trees by Augustin Pyramus de Candolle. Currently, the collection is essentially in traditional cultivation on erect stems of full height.
• **Conservation** preservation orchard, principally with varieties from the French-speaking region of Switzerland. Very active partnership with ProSpecieRara. Choice of varieties oriented toward conservation, a resource for graft collection. Responsibility to maintain this collection within the objective of conserving biodiversity at multiple sites.
• **Science** the CJBG are not an agronomic research center like Agroscope, thus there is limited scientific activity with this collection.
• **Education** lack of interpretive information for the public at the Penthes orchard.

PROPOSED IMPROVEMENTS

• Identify more precisely the variety threat levels according to the FOAG positive list (PAN-RPGAA[8]).
• Establishment of a preservation orchard of *hutins* (heritage grapes trained over fruit trees) at the Terre de Pregny.
• Organize a workshop on orchard pruning and management.
• Organize a "Botanical Variation" on the theme of preservation orchards.

[8]Federal Office for Agriculture, National action plan for the conservation and sustainable use of phytogenetic resources for food and agriculture (PAN-RPGAA), www.bdn.ch/lists/1374/content/

Iris



Description of the collection	Includes all specimens of the genus *Iris* cultivated at the Garden.
Location in the Garden	Wild and calcifuge iris beds adjacent to the Ethnobotanical Gardens; iris cultivars around the ProSpecieRara vegetable garden.
History of the collection	Collection created by Maurice Thomet in 1979, based on donations from M. Bovet (Tour de Peilz). The collection of calcifuge irises came originally from a donation by the Japanese mission. Separation of wild irises from cultivars by Jean-Marie Robert-Nicoud in 2013 and creation of landscaped pools for water irises. The wild iris bed was moved in 2016, allowing for expansion as needed.
Principal mode of acquisition	*Index seminum*, donations.
The collection in a few figures	
Number of taxa	212
Number of specimens in cultivation	278
Proportion wild taxa/cultivars	57 % wild
Representativeness	25 %
Manager of the collection	Vincent Herpailler
Scientific advisor	Fred Stauffer

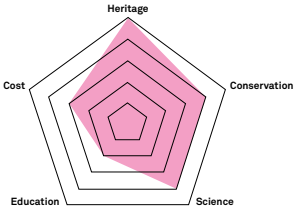
COMMENTS

- **Heritage** –
- **Conservation** excluding cultivars, >60% of collection is of wild origin.
- **Science** –
- **Education** representative of two environments (aquatic and terrestrial), divided into three thematic beds (cultivars, wild, and aquatic). Flowering unfortunately ephemeral (May). Outside of this brief flowering period, the beds hold little interest for the public.

PROPOSED IMPROVEMENTS

- Extend the period of interest by displaying early and late flowering species, as well as some representative species for the family *Iridaceae* (genera *Gladiolus* and *Morea*) to diversify the display for the public.
- Create an interpretive panel to be placed between the terrestrial and aquatic beds.
- Show diversity (blooms, colors, shapes) rather than aiming for comprehensiveness.
- Organize a "Botanical Variation" in May, with a tour of iris cultivars, then wild and aquatic irises, as well as herbarium specimens, with Fred Stauffer.

La Linnaea Alpine Garden



Description of the collection	A thematic collection bringing together all specimens cultivated in the beds of the La Linnaea Alpine Garden at Bourg-Saint-Pierre, Valais.
Location in the Garden	Bourg-Saint-Pierre, in the Canton of Valais.
History of the collection	Inaugurated on July 20, 1889, the La Linnaea Alpine Garden is the oldest active alpine garden in the Western Alps. It owes its name to the famous Swedish botanist Carl Linnaeus and the species *Linnaea borealis*, which was previously discovered in Valais. It was at the impetus of Henry Correvon, a Genevan horticultural botanist, that the energy needed to found the Bourg-Saint-Pierre Garden took form. In 1915 the La Linnea Alpine Garden was purchased by the Société Académique de Genève, which is still its owner. Between the two wars, the Garden had a renowned role in alpine botany and biology, and a number of publications arose from investigations there. A period of decline followed, both for scientific activity and for the Garden. The site was restored between 1989 and 1992, and Raymond Tripod, the Head Gardener of the CJBG, worked to renew the rock gardens. Since then, maintenance of La Linnaea has rested with the CJBG. Our gardeners also use the site as a base camp for the collection of seeds that are then made available in the CJBG's *Index seminum*. An agreement signed in 2012 between the Société Académique de Genève and the City of Geneva has reinforced our partnership.
Principal mode of acquisition	Wild collections, *Index seminum.*
The collection in a few figures	
Number of taxa	316
Number of specimens in cultivation	338
Proportion wild taxa/cultivars	100 % wild
Representativeness	–
Manager of the collection	Esther Zwanger
Scientific advisor	Louis Nusbaumer

La Linnaea Alpine Garden

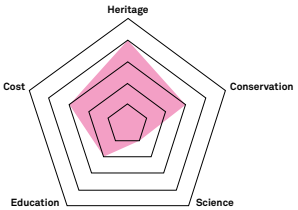
COMMENTS

• **Heritage** the oldest surviving Alpine botanical garden in Switzerland.
• **Conservation** cultivation of threatened plants at altitude, a tool serving the Global Strategy for Plant Conservation. Possibility of reproducing plants for the Rock Gardens at the CJBG.
• **Science** valued for university teaching and scientific research (courses given by CUSO, UNIGE, etc.).
• **Education** popularization of botany for local , national, and international visitors; training and awareness-raising regarding ecology and biodiversity for primary and secondary-school classes in Valais.

PROPOSED IMPROVEMENTS

• Promote the La Linnaea Alpine Garden through the Valais Tourism Office, via social media, and/or Suisse Tourisme.
• Prevent the escape of species cultivated at La Linnaea into the wild.
• Improve the signing in the Garden.
• Reactivate workshops with the schoolchildren of Liddes.
• Identify moss species on the North Trail.
• Create an interpretive panel on the geology of the site.

Orchidaceae



Description of the collection	Includes all specimens of the family *Orchidaceae* cultivated at the Garden.
Location in the Garden	Found mainly in the operational greenhouses of the Garden, the Pregny greenhouses (for tropical orchids) and the Rock gardens (terrestrial orchids).
History of the collection	Beginning of the collection with the Barbey-Boissier bequest, at the beginning of the 20th century. Later, important contributions owing to the expeditions of Albert Zimmermann at the beginning of the 1950s (India). Expansion of the collection by Jean Lambert and his successors. Project for growing terrestrial orchids by in vitro propagation (Sophie Dunand). An important recent contribution with Michel Cornaz's bequest (originating from nurseries of exotics). Relocation from the warm greenhouse at Pregny to the Garden in 2016, giving greater visibility to the collection, and more precise climate control.
Principal mode of acquisition	Exchanges with other Botanical Gardens.
The collection in a few figures	
Number of taxa	371
Number of specimens in cultivation	551
Proportion wild taxa/cultivars	88 % wild
Representativeness	1.2 %
Manager of the collection	Vincent Goldschmid
Scientific advisor	Mathieu Perret

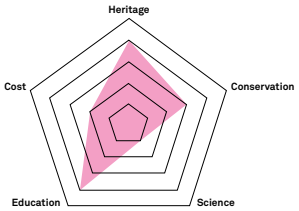
COMMENTS

• **Heritage** third highest represented family in the Garden (325 taxa), continually in cultivation since the creation of the Garden at Bastions.
• **Conservation** all the Swiss species are protected, the tropical species certainly as well (to check). Several projects of rescuing terrestrial orchids, ex-situ cultivation, and reintroductions in the canton of Geneva have been carried out by the CJBG. Low representativeness (1.2%), but an immense family (over 28,000 described species).
• **Science** family not, or little, studied at the CJBG.
• **Education** high appeal for the public. Significant educational potential, not yet sufficiently developed at the CJBG.

PROPOSED IMPROVEMENTS

• Plan an expedition to the Brazilian Amazon with Mathieu Perret and the gardener in charge of the collection.
• Give prominence to spectacular blooms in the window display of the Winter Garden.
• Create an "orchid tree" in the tropical greenhouse.
• Develop the collection in function of public appeal, since no scientist is working on it (demonstrate morphological diversity, habitats, pollination strategies, etc.).
• Check the IUCN threat status of the cultivated taxa at the CJBG.

Paeonia



Description of the collection	Includes all the wild peonies cultivated at the Garden.
Location in the Garden	Found mainly in the wild peony bed below the Rock Gardens.
History of the collection	A small bed of peonies already existed (established in 1981) at the current site. In 1985, a *Paeonia* enthusiast, Leo Fernig, contacted Robert Braito, who was in charge of the Rock gardens, to share some remarks about labeling and to offer help expanding the collection. This was the true beginning of the collection. Over the following 10 years, he put together a large network of amateurs (and a few collectors), and in this way was able to obtain some seeds of wild origin, from which we also benefited.
Principal mode of acquisition	Wild collections.
The collection in a few figures	
Number of taxa	47
Number of specimens in cultivation	67
Proportion wild taxa/cultivars	100 % wild
Representativeness	45 %
Manager of the collection	Marilyn Stähli
Scientific advisor	Beat Bäumler

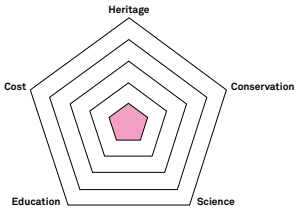
COMMENTS

• **Heritage** detailed documentation of the collection by Robert Braito.
• **Conservation** –
• **Science** –
• **Education** strong appeal to the public; an attractive and showy shrub form. Collection prominently placed at the main entrance to the Garden.

PROPOSED IMPROVEMENTS

• Complete the collection (all species of the genus *Paeonia*).

Pelargonium



Description of the collection	Includes all specimens of the genus *Pelargonium* cultivated at the Garden.
Location in the Garden	Situated mainly in the operational greenhouses at Pregny and in exterior cold frames.
History of the collection	Collection created by Pierre Mattille in the 1980s.
Principal mode of acquisition	Exchanges with other Botanical Gardens (Cote d'Azur, Lyon).
The collection in a few figures	
Number of taxa	45
Number of specimens in cultivation	48
Proportion wild taxa/cultivars	80 % wild
Representativeness	14 %
Manager of the collection	Vincent Goldschmid
Scientific advisor	Louis Nusbaumer

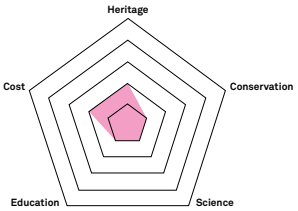
COMMENTS

• **Heritage** –
• **Conservation** 22 endangered species among CJBG taxa. Remediation of biocontaminated soils.
• **Science** –
• **Education** valuable for demonstrating the chemical diversity of plants within a single genus. The aromatic glandular hairs produce essential oils made up of monoterpenes with diverse odors for a single genus, evident by simply touching the leaves. Biological control against mosquito bites. Uses against various illnesses. Traditional consumption of some *Pelargonium* species. Significant economic interest, cultivars with tricolor leaves.

PROPOSED IMPROVEMENTS

• Offer a "Botanical Variation" on the genus *Pelargonium*.
• Offer a "Green Workshop" with the scents of *Pelargonium*.
• Compile a list of priority species to acquire via *Index seminum*, to supplement the collection.

Peperomia



Description of the collection	Includes all specimens of the genus *Peperomia* cultivated at the Garden.
Location in the Garden	Tropical greenhouse, Winter garden and operational greenhouses.
History of the collection	Collection created by Jean Lambert in the 1960s. Amplified later by his successors, with many additions by Ernest Shamir.
Principal mode of acquisition	*Index seminum.*
The collection in a few figures	
Number of taxa	53
Number of specimens in cultivation	90
Proportion wild taxa/cultivars	88 % wild
Representativeness	4 %
Manager of the collection	Yvonne Menneret
Scientific advisor	Louis Nusbaumer

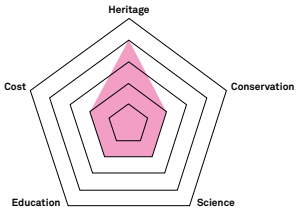
COMMENTS

- **Heritage** difficult to increase the collection by way of the material available in *Index seminum*.
- **Conservation** –
- **Science** –
- **Education** –

PROPOSED IMPROVEMENTS

- Highlight the species with the most spectacular blooms, for example by creating a landscaped display showing the variability of *Peperomia*.
- Evaluate our level of knowledge of the locations of origin for the species obtained in the wild, to evaluate their scientific potential for phylogenetic or population biology studies.

Pinaceae



Description of the collection	Includes all specimens of the family *Pinaceae* cultivated at the Garden.
Location in the Garden	Dispersed in the Arboretum and the Garden in general.
History of the collection	This collection was constituted over time and brings together several well-represented genera including *Abies, Picea, Pinus, Cedrus* (complete collection) and *Larix.*
Principal mode of acquisition	*Index seminum*, nursery.
The collection in a few figures	
Number of taxa	96
Number of specimens in cultivation	266
Proportion wild taxa/cultivars	83 % wild
Representativeness	37 %
Manager of the collection	Jean-Marie Robert-Nicoud
Scientific advisor	Roger Beer

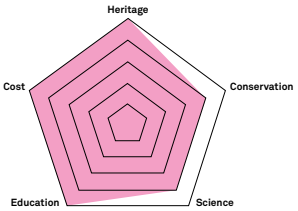
COMMENTS

• **Heritage** several large specimens including some remarkable trees (cedars). Lack of space to expand the collection.
• **Conservation** a significant collection in terms of the diversity of taxa, grown from seed of wild origin.
• **Science** a family studied by our scientists, as it forms part of all the floras investigated at the CJBG (Corsica, Mediterranean, Switzerland, Alps, etc.).
• **Education** family present throughout the Garden, but not clearly referenced for the public.

PROPOSED IMPROVEMENTS

• Create an interpretive panel on the conifers of the Arboretum.
• Diversify the collection following the suggestions of R. Beer : *Larix kaempferi, Pinus breweriana, Pseudotsuga sinesis, Pseudotsuga japonica, Tsuga heterophylla.*

Plants of the Rock Gardens



Description of the collection	Includes all the plants cultivated in the historical beds of the Rock Gardens.
Location in the Garden	Comprised of 110 Rock garden beds, located at the center of the historic Garden, covering about 1 ha.
History of the collection	The move of the Botanical Garden to Ariana Park, which then extended to the lakeshore at the site known as *La Console*, was officially completed in 1904. The *Conservatoire* occupied a building built to house the herbaria, and the garden covered an area of 7.5 ha. The initial work of developing the Rock Gardens was entrusted to Jules Allemand.
Principal mode of acquisition	*Index seminum*, wild collections.
The collection in a few figures	
Number of taxa	2834
Number of specimens in cultivation	3454
Proportion wild taxa/cultivars	99 % wild
Representativeness	–
Manager of the collection	Fréderic Bieri
Scientific advisor	Beat Bäumler

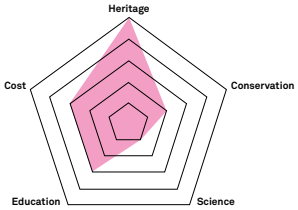
COMMENTS

• **Heritage** the Rock gardens have been emblematic of the Garden since their creation at the current site in 1904.
• **Conservation** reintroduction programs with the unit in charge of Conservation programs, many ex-situ plantings. Almost exclusively wild origin.
• **Science** the collection includes many taxa pertaining to floras studied at the CJBG (Corsica, Mediterranean, Switzerland, Alps, etc.).
• **Education** the collection is used for training; a fabulous site for internships (plants, landscaping, etc.). Many research subjects are represented in the rock gardens (Flora of the Alps, of Switzerland, Corsica, Mediterranean, Africa, protected plants, etc.). A broad diversity of environments illustrated in geographical and thematic beds.

PROPOSED IMPROVEMENTS

• Monitor the growth of trees in the Rock Gardens (they must not become an Arboretum).
• Seek more precise information on the origin of the plants.
• Rationalize signage (there are three signs for the wormwoods, yet none for the flora of the Alps).

Quercus



Description of the collection	Includes all specimens of the genus *Quercus* cultivated at the Garden.
Location in the Garden	Dispersed in the Arboretum and Garden in general.
History of the collection	This collection has been built up over time, and includes several remarkable specimens that represent a true historical heritage.
Principal mode of acquisition	*Index seminum*, nursery, and historical legacy.
The collection in a few figures	
Number of taxa	41
Number of specimens in cultivation	103
Proportion wild taxa/cultivars	98 % wild
Representativeness	7 %
Manager of the collection	Pascal Oguey
Scientific advisor	Roger Beer

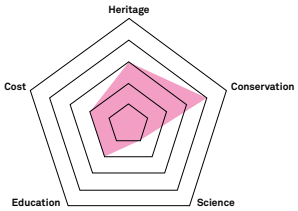
COMMENTS

• **Heritage** several spectacular trees, by their size and age. Lack of space in the Garden to truly increase the collection. Problem of senescence (very old individuals). Entails elevated maintenance and monitoring costs.
• **Conservation** –
• **Science** –
• **Education** high landscape value, emphasis on spectacular individuals.

PROPOSED IMPROVEMENTS

• Replant two Quercus robur at the entrance to the Terre de Pregny, for landscape and heritage value.
• Diversify the collection (American oaks).
• Check the IUCN threat status of the cultivated taxa at the CJBG.

Rhipsalis



Description of the collection	Includes all specimens of the genus *Rhipsalis* (and synonyms) cultivated at the Garden.
Location in the Garden	Situated principally at Pregny and in the tropical greenhouse.
History of the collection	The collection was created by Jean Lambert in the 1960s and has been maintained since by his successors.
Principal mode of acquisition	*Index seminum.*
The collection in a few figures	
Number of taxa	40
Number of specimens in cultivation	70
Proportion wild taxa/cultivars	100 % wild
Representativeness	77 % of the 2002 national Red List (for statuses EX, RE, CR, EN and VU)
Manager of the collection	Alexandre Chappuis
Scientific advisor	Mathieu Perret

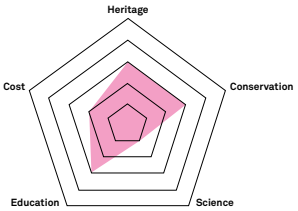
COMMENTS

- **Heritage** collection has been perpetuated since its creation in 1960, grown from garden seed. Inventory and labeling in progress at Pregny.
- **Conservation** four species are on the IUCN Red List: *R. mesembryanthemoides* (CR), *R. oblonga* (VU), *R. pentaptera* (CR) and *R. rusellii* (VU).
- **Science** –
- **Education** significant landscape value in public greenhouses.

PROPOSED IMPROVEMENTS

- Complete the inventory, and seek to add to the collection.
- Check threat status with the Red List for Brazil.

Rhododendron



Description of the collection	Includes all specimens in the genus *Rhododendron* cultivated at the Garden.
Location in the Garden	Represented by a dense planting of rhododendrons in a large trench of peat and heath-mold, traversed by a wooden footbridge that runs parallel to the playground, leading to the restaurant.
History of the collection	Collection created by Maurice Thomet between 1975 and 1980. Significant changes and the creation of the footbridge in 2009, in anticipation of the construction for Bot V.
Principal mode of acquisition	*Index seminum*, purchases.
The collection in a few figures	
Number of taxa	107
Number of specimens in cultivation	390
Proportion wild taxa/cultivars	92 % wild
Representativeness	15 %
Manager of the collection	Stéphanie de Mercurio
Scientific advisor	Louis Nusbaumer

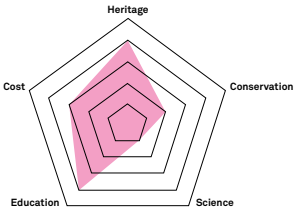
COMMENTS

• **Heritage** various texts with cultivation tips are available in the CJBG library; growth on acidic soil, often requiring significant means for planting.
• **Conservation** 17 out of approx. 100 wild species (not cultivars) at the CJBG are threatened in nature.
• **Science** –
• **Education** morphology is rather uniform, yet with wide variation in flower size and color. Abundant and spectacular blooms; the CJBG footbridge is highly prized by visitors. Educational interests: pollination *(Kalmia latifolia)*, ethnobotany (usage against diabetes, in foliar infusions, consumption of nectar at the base of flowers, consumption of flowers). Toxic compounds in *Rhododendron ferrugineum,* which contains andromedotoxins, and *Rhododendron ponticum* (not in the CJBG collection), which has hallucinogenic effects.

PROPOSED IMPROVEMENTS

• Increase the visibility of the Rhododendron footbridge on social media.
• Improve access to the Rhododendron footbridge to allow passage for walkers and wheelchairs.
• Obtain and plant *Rhododendron ponticum*.

Rosa



Description of the collection	Includes all specimens of the genus *Rosa* cultivated at the Garden.
Location in the Garden	The collection is found principally in the historical Rose Garden in the Terre de Pregny.
History of the collection	In 1992, an initial rose collection was assembled by the Head Gardener Raymond Tripod and Adélaïde Stork, aiming to convey to the public the evolution of cultivated roses from Antiquity to 1867 (the beginning of "modern" roses). Relocation and complete renovation of this garden by Jean-Marie Robert-Nicoud, and his team, in 2013-14.
Principal mode of acquisition	Purchases, cuttings.
The collection in a few figures	
Number of taxa	87
Number of specimens in cultivation	190
Proportion wild taxa/cultivars	55 % wild
Representativeness	–
Manager of the collection	Stéphanie de Mercurio
Scientific advisor	Florian Mombrial

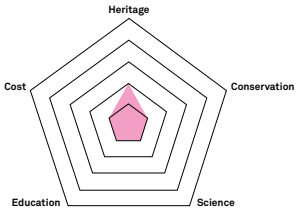
COMMENTS

• **Heritage** enhancement and increase of the collection by Adelaide Stork. The choice of varieties illustrates historical heritage, from the first wild roses to the new roses. Rose gardens are a typically traditional element of European Botanical Gardens.
• **Conservation** conservation of old and resistant cultivars.
• **Science** –
• **Education** rose garden renovated in 2013-14, with new signing. An educational entity in itself, the one flaw is its remoteness from the center of the Garden.

PROPOSED IMPROVEMENTS

• Protect / cultivate the wild roses of the canton of Geneva.
• Expand the collection while favoring taxa of the flora of Switzerland.

Sansevieria



Description of the collection	Includes all specimens of the genus *Sansevieria* cultivated at the Garden.
Location in the Garden	Operational greenhouses.
History of the collection	Collection created by Jean Lambert in the 1960s and maintained since by his successors.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	26
Number of specimens in cultivation	41
Proportion wild taxa/cultivars	90 % wild
Representativeness	38 %
Manager of the collection	Bertrand Guigon
Scientific advisor	Fred Stauffer

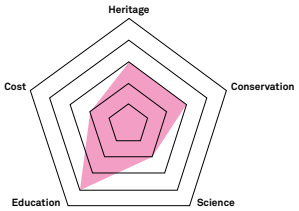
COMMENTS

• **Heritage** collection requiring little maintenance, maintained for 50 years without real dynamism.
• **Conservation** genus not assessed on the IUCN Red List.
• **Science** –
• **Education** collection invisible (or nearly so) to the public, maintained in the greenhouse potting workspace. A few specimens in the temperate greenhouse.

PROPOSED IMPrOVEMENTS

• Demonstrate morphological diversity and gather the collection into a single location.

Saxifraga



Description of the collection	Includes all specimens of the genus *Saxifraga* cultivated at the Garden.
Location in the Garden	Found mainly in the saxifrage bed in the Rock Gardens.
History of the collection	Originally, the saxifrages were divided up in the Rock Gardens. The collection was gathered together and greatly expanded in 1995 under the impetus of Robert Braito and Benoit Clément, giving rise to a bed entirely dedicated to the genus *Saxifraga*.
Principal mode of acquisition	*Index seminum*, wild collections, exchanges with other Botanical Gardens.
The collection in a few figures	
Number of taxa	80
Number of specimens in cultivation	196
Proportion wild taxa/cultivars	100 % wild
Representativeness	17 %
Manager of the collection	Marylin Stähli
Scientific advisor	Beat Bäumler

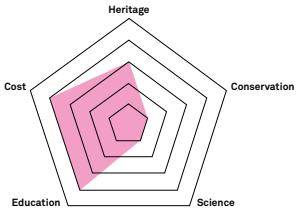
COMMENTS

• **Heritage** –
• **Conservation** the collection displays 75 % of the species of saxifrages of the flora of Switzerland.
• **Science** –
• **Education** the bed dedicated to saxifrages (in the Rock Garden) stands out quite well and is described by an interpretive panel. The rest of the collection is much less identifiable to the public, due to its dispersion.

PROPOSED IMPROVEMENTS

• Complete the collection of species from the flora of Switzerland.
• Point to the great morphological variability of this genus.
• Consider cultivating specimens at altitude at the La Linnaea Alpine Garden (1700 m), for example, *Saxifraga hirculus*.

Scent and Tactile Garden



Description of the collection	A thematic collection consisting of all the plants cultivated in the Scent and Tactile garden.
Location in the Garden	Situated in the Terre de Pregny.
History of the collection	Beginning in 1984, the Société Romande des Amis des Roses approached the CJBG with a garden project destined to the visually impaired. This project took form thanks to the efforts of Head Gardener Raymond Tripod, and it was inaugurated in 1991.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	137
Number of specimens in cultivation	150
Proportion wild taxa/cultivars	81 % wild
Representativeness	–
Manager of the collection	Christian Jenny
Scientific advisor	Didier Roguet

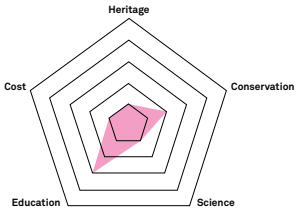
COMMENTS

• **Heritage** a unique thematic garden in Geneva, established for over 25 years.
• **Conservation** –
• **Science** –
• **Education** visiting public has centered more on school groups than the original target (the visually impaired). High attendance when schools are in session. Problem of access, particularly for the visually impaired: the location is remote, at the far end of the Terre de Pregny.

PROPOSED IMPROVEMENTS

• Discuss the distinctive nature of the concept (Braille labels) and the need to improve accessibility to the garden with new technologies for a visually impaired public.
• Develop a smartphone tour for this thematic garden.
• Review the choice of plants, eliminating those that seem less appropriate (especially cultivars and ornamental annuals).
• Propose a range of aromatic plants.
• Enhance communication about this space, particularly on the website.

Sedum



Description of the collection	Includes all specimens of the genus *Sedum* cultivated at the Garden.
Location in the Garden	Collection mainly gathered in the *Sedum* bed of the Rock Gardens.
History of the collection	Collection brought together (and later increased) in a new *Sedum* bed, created in 2014 by Samuel Mathiss.
Principal mode of acquisition	*Index seminum*, cuttings.
The collection in a few figures	
Number of taxa	73
Number of specimens in cultivation	185
Proportion wild taxa/cultivars	97 % wild
Representativeness	18 %
Manager of the collection	Samuel Mathiss
Scientific advisor	Pascal Martin

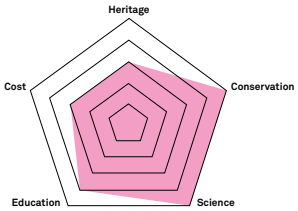
COMMENTS

- **Heritage** –
- **Conservation** existence of a cantonal action plan (GE) for *Sedum cepaea*.
- **Science** –
- **Education** attractiveness of the genus, collection displayed in a bed easily accessed by the public.

PROPOSED IMPROVEMENTS

- Create an interpretive panel about the collection.
- Check the representativeness of the local flora (Geneva, Switzerland).

Threatened Plants of Switzerland



Description of the collection	Includes all specimens cultivated in the Garden and threatened in Switzerland (federal level), according to the 2002 Red List. The statuses EX (globally extinct), RE (extinct in Switzerland), CR (near extinction), EN (endangered), VU (vulnerable) are recognized.
Location in the Garden	Found mainly in the Protected plants bed of the Rock Gardens.
History of the collection	Collection created and grouped into several beds called "Protected Plants" at the end of the 1970s. The initial goal was to display to the public Switzerland's threatened and/or protected plants. In the 1990s, creation of a 4th bed "Protected plants" on granite. In the early 2000s, *ex-situ* cultivation for conservation programs began.
Principal mode of acquisition	Probably originally constituted through wild collections. Today, the collection is expanding mainly through Conservation projects.
The collection in a few figures	
Number of taxa	357
Number of specimens in cultivation	685
Proportion wild taxa/cultivars	100 % wild
Representativeness	36 % of the 2002 national Red List (for the threat levels EX, RE, CR, EN et VU)
Manager of the collection	Céline Buchschacher
Scientific advisor	Florian Mombrial et Catherine Lambelet

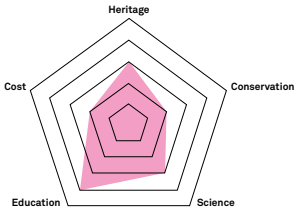
COMMENTS

- **Heritage** collection relatively recent in its current form.
- **Conservation** strong conservation activity (ex-situ planting, seed bank, reintroduction programs, etc.). Partnerships with DGAN, Infoflora, etc. Plants exclusively wild origin.
- **Science** –
- **Education** four beds specifically dedicated to this collection, with two interpretive panels. Documentation for a broad public (BOTANICA 2016/17).

PROPOSED IMPROVEMENTS

- Review the collection in light of the new 2016 Red List.
- Create panels (A5 format) for certain emblematic species and possibly link certain species to online profiles by way of a QR code.

Tufa Wall



Description of the collection	Includes all specimens grown on the CFF tufa wall in the Garden.
Location in the Garden	Located on the dry tufa wall (along the CFF railroad tracks).
History of the collection	The creation of this collection began in autumn 2000, with the construction of the new tufa wall. There already existed, however, a long-standing collection in the holes of the old wall. Though very decorative in spring, it was nonetheless less impressive than the current one due to the low height of the earlier wall.
Principal mode of acquisition	*Index seminum*.
The collection in a few figures	
Number of taxa	172
Number of specimens in cultivation	186
Proportion wild taxa/cultivars	100 % wild
Representativeness	–
Manager of the collection	Samuel Mathiss
Scientific advisor	Cyrille Chatelain

COMMENTS

• **Heritage** illustration of a special knowledge and technique, the cultivation of plants on a vertical wall without soil.
• **Conservation** collection is representative of a unique environment. Many of the specimens in cultivation come from field collections.
• **Science** collaboration between gardeners and scientists on the theme of "Mediterranean flora."
• **Education** substantial interest and appeal to the public. A noteworthy collection. Presence of an interpretative panel explaining hybridization between two *Centaurea*.

PROPOSED IMPROVEMENTS

• Create an interpretative panel explaining the history and concept of this collection to the public.
• Several spots are available (about ten holes), to be filled with plants collected by Samuel Mathiss and Cyrille Chatelain in Morocco.

Cantonal, National, and International legislative context

International

1973 CITES, Convention on International Trade in Endangered Species of Wild Fauna and Flora

1992 CBD – Convention on Biological Diversity– Rio

2000 International Agenda for Botanic Gardens in Conservation

2003 IPEN, International Plant Exchange Network

2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization

2011 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization –Aichi objectives

2012 Global Strategy for Plant Conservation

European

2000 Action Plan for Botanic Gardens in the European Union

2011 Biodiversity Goals for 2020

National

2011 Swiss Biodiversity Strategy

2012 Action Plan “Swiss Biodiversity Strategy”

Cantonal

2012 Biodiversity Act (Loi sur la Biodiversité) of the canton of Geneva

(2018) Geneva Biodiversity Strategy 2030

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