

ASSETS AND LIABILITIES: THE ROLE OF EVALUATION IN THE CURATION OF LIVING COLLECTIONS

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ABSTRACT

The living collections of botanic gardens can be described as dynamic, varying over time to suit the demands of the institute. The majority of gardens throughout the world have insufficient resources to maintain ever-increasing collections. In order to keep collections meaningful to research and conservation activities and to distribute plant material in accordance with the Convention on Biological Diversity (CBD) they need to be carefully directed; a mechanism to facilitate this is the process of evaluation.

Evaluation is the periodic assessment of part of the collection to determine whether it remains fit for purpose. If a garden's aim is to strive at improving the potential usefulness of its holdings then evaluation should be omnipresent. This paper outlines the necessity for evaluation and suggests tried and tested procedures to conduct such analyses. Examples from evaluations carried out at the Royal Botanic Garden, Jordan and the National Botanic Garden of Belgium (NBGB) are cited to illustrate the value of the process.

INTRODUCTION

One of the most important roles curators should undertake in their term of office is to evaluate the worth of the living collections. Yet, despite this, it appears that evaluations are conducted only rarely.

Evaluation can be defined as the process of assessing the value of living accessions (seeds, spores, plants) to the institute. It defines the most and least important acquisitions and can lead managers to make informed decisions about how they direct resources and analyse current and past practices such as plant acquisition methodology, thus enabling discussion and improvement. This process also demonstrates responsibility to the garden's funders.

Evaluation is not about discarding plants; it is about ensuring that high-quality accessions are maintained to facilitate the garden's mission, especially its commitments to science and conservation. In a world of disappearing plants and shrinking resources, knowing what will lead to real success and the real costs of conservation work is essential (Griffith & Husby, 2010). Times such as these increase our consciousness about the actions we take and how we allocate our resources. Cultivating plants in botanic gardens costs a lot of money; this includes the obvious expense of facilities and materials but also the cost of staff. The latter can be substantial and managers need to

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make sure human efforts are directed in the right areas, which is ultimately the mission of the institute. I have observed a number of botanic gardens that have, unwittingly, fallen into the trap of directing horticultural staff efforts towards low-priority pursuits to the detriment of higher-priority work. I call this ‘salary blindness’, and it ignores the real cost of employment and devalues the skills that these staff have.

Evaluation is about assessing situations and taking responsibility to change what needs to be changed. My first evaluation was conducted at the NBGB where I was introduced to a huge cacti collection of some 5,000 pots, which was referred to as a ‘conservation’ collection. The majority of the plants had little or no associated data and were maintained in glasshouses which were not accessible to the public. The results of the evaluation revealed that over 99 per cent had insufficient data and that this rendered them useless for conservation and research. In many instances local garden centres sold the same taxa and were indistinguishable with respect to data quality. Despite this, among the less than 1 per cent with good data there were scientific gems that prior to evaluation were lost among the sea of pots (see Aplin, 2008). It was important to make more of the important accessions, skilled horticulturists and the institution which was externally funded. After all, organisations need to demonstrate good governance and direct funds in a responsible way. With respect to living collections, this means knowing what the assets and liabilities are and the potential to discover a few surprises along the way.

WHEN IS EVALUATION NECESSARY?

An institute that aims to continuously improve the quality and utility of its collections should ensure that evaluation is part of the ongoing curation agenda. Experience of many different organisations suggests that necessity for evaluation has no correlation with the age of an institute. It has been necessary in both new (<10 years) and well-established (>150 years) gardens.

In general, the longer the accession is likely to remain in the garden (such as trees and large shrubs, or seed and spores stored for long periods) the greater the need to ensure it is fit for purpose. The act of planting trees, for example, is a legacy for future generations. Ideally, newly acquired trees should have excellent data and, when many individuals are planted out, should comprise as much genetic variation from the naturally occurring population as possible. A recent evaluation for the Royal Botanic Garden, Jordan revealed that large numbers of native trees had been gifted by the Forestry Commission (Fig. 1). These, however, came without data and on further investigation were derived from mother plants selected (unsurprisingly) for particular economic traits. Consequently, it was decided that the collection should be started again with a programme to acquire new seeds across the entire range of naturally occurring populations (Fig. 2).



Fig. 1 Collection of native trees in the nursery of the Royal Botanic Garden, Jordan. Photo: Dave Aplin.



Fig. 2 Natural populations of *Quercus aegilops* in Yarmouk Highlands, North Jordan. Photo: Dave Aplin.

In some cases, the need to evaluate is apparent. This is when capacity is reached and no more space is available on benches, in beds or in gene banks. More worrying, however, is when capacity is met cryptically. This occurs through a general decline in standards and a reduction in record-keeping due to staff resources being stretched. This may occur as a result of staff cuts or the gradual build-up of accessions. Therefore, in well-maintained collections the rate of deaccessioning is as important as new acquisitions.

Sometimes even well-documented research collections become redundant to a particular institute; this may be for various reasons and can create a dilemma (Blackmore, 2008). Ideally, these accessions should be retained and safeguarded. This is when the curation team needs to be especially creative and use research accessions for educational purposes or cultivate them in interesting ways. A good example of the latter is a project to cultivate a conservation hedge using a large number of wild-sourced and historic *Taxus baccata* accessions at the Royal Botanic Garden Edinburgh (Martin Gardner, pers. comm.). Non-wild collected and undocumented *Ilex aquifolium* (holly) used as perimeter hedging to screen the garden from the surrounding roads will be replaced with wild origin *Taxus* accessions. This approach maximises the use of space that may otherwise have been devoted to non-documented hedging plants and ensures that well-documented and genetically variable material is well maintained and serving a purpose.



Fig. 3 Royal Botanic Garden staff on a collecting trip to Mount Nebo, Jordan. Photo: Dave Aplin.

A recent evaluation of the holdings of a seed bank in the Middle East led to the discovery of wild-collected accessions with insufficient data, making them useless for conservation purposes. This needs to be improved, because if no information is available on stored accessions then the chances of them being used in research and conservation are almost zero (Laliberté, 1997). Naturally, if time and effort are directed to the costly exercise of collecting in the field (Fig. 3) then it is not too much additional effort to collect the data that makes the same acquisition valuable. Fortunately, this situation can be easily rectified by providing best practice training in seed collection (see ENSCONET, 2009) until it becomes part of the routine of seed collection.

Acquiring new accessions via *indices seminum* needs to be done with great care. Many seeds are exchanged annually between botanic gardens, however it can be surprising how little data is attached to them. The information may exist at the donor institute but in many cases it is not automatically offered to the recipient (see Aplin & Heywood, 2008; Aplin *et al.*, 2007). The recipient should remember to ask for it and review it before requesting the seeds.

A large part of an evaluation focuses on collections with poor data quality. It is not surprising that older accessions lack data as many were acquired before the urgency of conservation became apparent and when plant research was a very different discipline. Let us remind ourselves that prior to 1952 there was no confirmed link between DNA and heredity (Hershey & Chase, 1952). I am not advocating the wholesale removal of older plants from gardens; on the contrary, some will have highly valued positions in the collections, not least because some may have genotypes derived from historical populations with alleles that are rare or absent elsewhere. Instead, we need to ensure that more recent accessions are of the highest quality possible to fully capitalise on contemporary research and conservation. In some instances, acquiring and distributing plant material without appropriate documentation may breach international codes of conduct (e.g. International Plant Exchange Network) and conventions (e.g. CBD). Plants (and fungi) and their derivatives collected from the wild after the ratification of the CBD in December 1993 must have appropriate documents showing prior informed consent and mutually agreed terms (Davis, 2008).

The curator also needs to be mindful that there are many instances where plants required for education need not have good associated data. This may include particular features to aid learning (e.g. the movement of *Mimosa pudica*, sensitive plant) or annuals used for display.

THE PROCESS OF EVALUATION

Evaluation is not a quick and easy process. Ensure it is manageable by concentrating on a discrete collection or plant family. From experience there is a series of logical steps to follow to help guide informed decisions. These ten steps are set out sequentially below, although some stages may be skipped or the order changed as common sense dictates.

- 1 Decide on agreed criteria for evaluation
- 2 Talk to stakeholders
- 3 Make a list of what is to be evaluated
- 4 Ensure accessions are correctly identified and verified
- 5 Check nomenclature and synonyms
- 6 Identify threat categories
- 7 Download and research plant record data
- 8 Conduct internet research
- 9 Identify donor restrictions for rejected accessions
- 10 Find new homes for or discard unwanted plants

These ten items are explained in greater detail below:

Decide on agreed criteria for evaluation

A prerequisite to evaluation is having a set of criteria used to judge the merits of each accession. This initial stage requires a mechanism for doing this. This might be a Living Collection Policy (LCP), a set of acquisition criteria and/or a minimum standards benchmark. If no such document exists then the first task is to create one in consultation with the relevant stakeholders. This will almost certainly be guided by the mission and vision of the organisation.

Talk to stakeholders

Plants matter, and so do staff. It is important to inform garden staff prior to and throughout any evaluation process. They may have important information about a particular accession that has not been recorded and will certainly appreciate knowing what the plans are for the plants, particularly if they have cultivated them for many years and they may be discarded.

While management of communication within the organisation is important, it is vital to be mindful of the portrayal of the organisation in the media. After all, it would be difficult to explain the pros and cons of accession data to most news reporters. This situation may be partly addressed in the garden's guidelines for deaccessioning that should reside in the LCP. Depending on donor restrictions, unwanted plants may be donated to a number of causes, for example to schools, and in this way it can be used positively to promote the organisational outreach while making valuable room for better-quality material.

Make a list of what is to be evaluated

List all the accessions and their locations that you wish to include in the review. You may wish to review groups of plants that reside in multiple locations, or simply review

a single area. Discrete groups, such as Cactaceae, trees or the seed bank, provide manageable units to evaluate.

Ensure accessions are correctly identified and verified

Correct identification of a plant may seem to be an obvious priority but can sometimes be overlooked. An institute needs to be sure that the basis of an evaluation is founded on hard facts and the most important one is determining what is being evaluated. When this part of the evaluation was undertaken at the NBGB, a consequence was that an unnamed cactus was identified as *Opuntia stenarthra*, a taxon not knowingly seen since its original discovery in 1898.

Check nomenclature and synonyms

Many plants have changed their classification in the last few decades. If the collection's nomenclature has not been updated then the evaluation is a good point to do this. At this stage it is good practice to search the entire holdings for any synonyms found because there may be duplicate taxa to the ones being evaluated but cultivated elsewhere in the institution under a different name. Take, for example, the cactus *Mammillaria magnimamma* growing at the NBGB. Prior to evaluation there were three specimens on the database, but after synonyms had been applied it was discovered that 75 plants from 20 different synonyms or misidentifications were being grown.

Identify threat categories

It is important to review local, regional and international lists of threatened plants to help make informed decisions about retaining or discarding an accession. It is worth noting, however, that a designation of threat does not necessarily warrant the retention of a taxon in the collection. Take, for example, *Echinocactus grusonii* (the golden barrel cactus). This taxon is listed as Critically Endangered by the International Union for Conservation of Nature. Taking this information at face value it may be considered that this species should be retained at all costs regardless of the availability or not of information on provenance. However, if the accession has no associated data and is of garden origin then its conservation value is likely to be close to zero. In the case of *E. grusonii*, tens of thousands are sold annually in garden centres and supermarkets worldwide because it is a common houseplant. The scenario of *E. grusonii* may be one of the exceptional cases, but it is worth reminding ourselves that they exist.

Download and research plant records data

Downloading and reviewing accession data is a key step in the evaluation process. Data is best downloaded into a spreadsheet because it can be sorted and manipulated easily.

This allows sorting of ‘the wheat from the chaff’ by assessing current and potential value to the institute. It is worth labouring the fact that this can only happen once the set of criteria against which to evaluate has been agreed (see above). If conservation or research is valued by the institute then the important element will be the provenance and genetic information of an accession and the economic viability of maintaining it. Accessions with excellent data will deserve more funds than those with little or no data.

Conduct internet research

It is hard to imagine life without the internet and it can certainly be put to good use when evaluating accessions. One of the most useful search tools for living collections is Botanic Gardens Conservation International’s PlantSearch database which can be accessed at: www.bgci.org/plant_search.php (Botanic Gardens Conservation International, 2011). Currently, this is the best global catalogue of plants held in botanic gardens. Although it is a powerful tool it comes with several caveats: (a) there is no way of determining the quality of output data. In some cases listed taxa may represent accessions that are unverified, misidentified, of garden origin or no longer living; (b) not all botanic gardens have uploaded their data, so it may provide an underestimation of the availability of taxa in botanic gardens. Despite these reservations it does give a good indication of the number of institutes cultivating a particular taxon. At the time of writing, *Echinocactus grusonii* is recorded in 184 botanic gardens worldwide and *Mammillaria magnimamma* in 77, while *Opuntia stenarthra* remains in one solitary botanic garden.

The internet can also facilitate identification. While images are no substitute for the living plant or voucher, quality close-up photographs can aid plant identification and verification. Selected photographs that highlight salient identification features can be sent, by email, to international specialists who are generally happy to tender identification on that basis. This is especially true when good provenance data is available or when the genus has relatively few species.

Identify donor restrictions for rejected accessions

After an evaluation, there is likely to be a list of accessions to be discarded. There are a range of options for doing this that may be outlined in an LCP if one exists. According to the CBD accessions collected from the wild before 29 December 1993 can be sold or donated to institutions other than botanic gardens. However, best practice dictates that institutes should act ‘in the spirit of the law’ and apply CBD principles to all accessions.

Find new homes or discard unwanted plants

In the majority of cases it is curators who decide the eventual fate of the plants. One option is to offer the plants to other botanic gardens. This was an option which was taken for some of the cactus plants at the NBGB. Prior to donation, however, the results of

the evaluation and the reasons the plants were being discarded were made very clear to potential recipients. In this way, a receiving institute is under no false pretences about the quality of material being offered. Unwanted plants with no legal restrictions can be given to public gardens, schools, hospitals and old people's homes. In many cases a reasonable home may not be found, or it is impracticable to offer them. In these instances plants should be disposed of on the compost heap (Cronk, 2001).

CONCLUDING REMARKS

The cultivation of a plant is a cost to a botanic garden. Few have investigated the subject of evaluation, but it is one that warrants further research and helps to define the monetary value of conservation. Griffith & Husby (2010) have developed a model for calculating the curation of plants based on three variables: number of plants, estimated genetic capture and financial investment. This analysis, or a similar one, could provide evidence of good governance within curation departments. This is becoming increasingly important because funding agencies are more circumspect than ever about how budgets are allocated. Most people would not choose to invest money in a bank without some form of financial scrutiny, nor should botanic gardens expect to be funded unless curation is demonstrated to be responsible. Consequently, LCPs and evaluation processes are vital components in all gardens, especially externally funded institutes that concentrate on conservation and research. For those that already have these policy and review mechanisms in place, they should highlight this and 'sell it' as part of their fundraising activities.

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