Botanic Garden Creation and Management: the feasibility and design of new British collections

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PhD Thesis

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10 Conclusion

The objective of this study was to review the feasibility, and design, of a new native-species botanical collection in Britain. It arose from a partnership between the University of Reading and Carymoor Environment Trust, who came together to create a collection of Somerset plants (Somerset Plant Collection).

10.1 Botanical Collections Past and Present

Historically, botanical collections have had to be fluid in their roles, adapting to suit the needs of the time or, as has been the fate of many, becoming redundant. These trends resulted in changes to botanical collections, in both their perception and their physical structure, which still have an influence on them today. These changes do not occur at regular intervals or in succession. Some are short lived and specific to certain geographical areas, others are more widely influential and persist for longer. Invariably two or more trends can be found running concurrently. Pre-1447 monastic gardens grew a wide variety of plants collected together for the purpose of teaching and use in medicine and cooking. In 1447, Pope Nicholas V founded a garden in the grounds of the Vatican for the teaching of botany as a branch of medicine, and from this point on seven major botanic garden eras can be identified. Four of these, the physic era, the taxonomic era, the imperial era and the public enlightenment era, were the result of trends that are no longer influential. At present botanical collections are influenced by three concurrently running eras, the research era, the edutainment era and the conservation era. The periodic changes in the roles of botanic gardens, combined with a range of origins and financing, has resulted in a wide variety of botanical collections. However, in general they share a set of common roles, those of research, education, conservation, and recreation.

The research role has evolved from the taxonomic and imperial eras where its main concern was naming and classifying the plants gathered from around the world. This formed part of an imperialistic cornucopian outlook that viewed all plants and animals as being at our disposal and that Britain had a right to take them. This view of the world has changed and with it the role of research. Through legislation such as CBD and CITES, collecting for collecting's sake has been curbed.

Education has always played some role in botanic gardens. Historically the education role of the collection was limited to a select audience. Following the enlightenment era the educational value of the collections for a wider audience was recognised. However, it is only very recently that consideration has been directed towards ensuring that the educational role of a garden is being achieved effectively. This pattern holds true for recreation as well. Whenever plants are grown together they are usually arranged in a way that is aesthetically pleasing for the people using the collection, be this a select few or a wider audience.

The inclusion of conservation as a role is relatively recent, as it is itself a relatively new concept. At the time when botanic garden staff started to think about conservation, there were already a number of established gardens that, for religious, social and financial reasons, had amassed large numbers of species from around the world. It was felt that continuing to keep them within a collection prevented them from ever becoming extinct (the Ark paradigm). However, as our understanding of ecology has progressed the Ark paradigm has been shown to be less relevant (Maunder 1991). Botanical collections, especially those in non-biodiversity hotspots such as Britain and Europe, have now reached a stage where they should be looking for better ways of fulfilling a conservation role than the curation of species collections.

10.2 Botanical Collection Survey

To aid the process of creating and assessing the feasibility of new botanic collections it was desirable to have a model that illustrates how those already in existence work. To do this a comprehensive and up-to-date set of data was required. Having established that this data was not available 115 botanical collections in Britain were surveyed with the aim of establishing the types of collection they hold, their sizes and staffing arrangements, their reasons for existence and their methods of finance. The results showed that there was a great deal of variation between collections, suggesting that one model would not be able to represent them meaningfully. Instead the collections were classified into seven groups using a combination of their roles.

	Research	Plant Supply	Conservation	Education	Recreation
A	✓	✓	✓	✓	✓
B	✓		✓	✓	✓
C		✓	✓	✓	✓
D		✓		✓	✓
E			✓	✓	✓
F				✓	✓
G					✓

Figure 10.1 - Roles of the seven groups

From these the arboreta were grouped separately (ARB) because of the horticultural and management differences between them and other plant collections. Group A collections were divided into botanic gardens (ABG) and university botanic gardens (AUNI) in recognition of the different funding strategies of these two groups. The results of the survey data were then split into these nine groups for comparison. From this, models illustrating the characteristics of the collections for each category were established. Table 10.1 shows some of the data resulting from this process and demonstrates the variation that exists between the groups.

Type of Collection	Average Size (hectares)	Average No. Species	Average % of Collection Accessioned	Median Annual Budget (£/ hectare)	Average No. of visitors (per annum)
ARB	87.3	1,842	95%	£1,7474	100,000
AUNI	29.3	4,963	90%	£19,768	71,333
ABG	69.6	14,000	95%	£57,034	284,022
B	94.1	3,500	80%	£428,707	891,667
C	5.8	4,000	50%	£107,665	120,000
D	11.8	4,500	60%	£19,768	277,500
E	8.4	2,044	50%	£20,028	164,557
F	17.1	2,000	5%	£45,856	79,878
G	4.9	186	0%	£1,030	2,000

Table 10.1 - Basic characteristics of the nine different types of collection

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It can be seen from Table 10.1 above that the running costs of these collections varies depending on their roles and staffing levels (which account for roughly 70% of the annual budget). Analysis of the results indicates that a number of existing botanic gardens require a per capita funding that exceeds that which would normally be available from a visitor to an attraction. This suggests that some botanical collections are subsidised. The sources of funding were examined and five main methods were identified. These are private funding, visitor sales and admissions, endowment or trust funds, funding from affiliated organisations, and finally funding from government or local councils. The use of these funding streams by collections in each of the nine groups is illustrated in Figure 10.2 below where it can be seen that there is variation in chosen method between the groups.

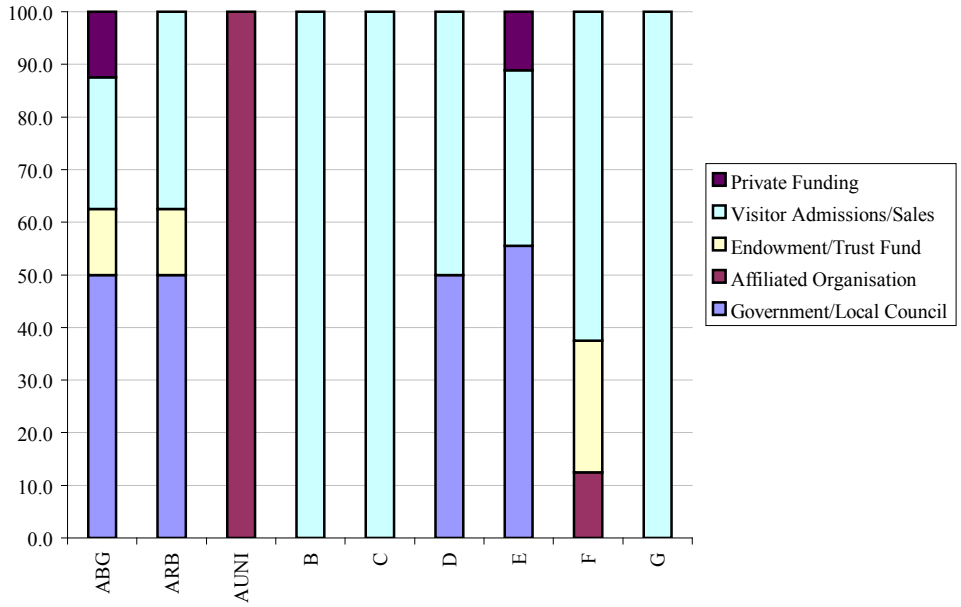

Figure 10.2 - Percentage of collections in each group receiving the majoriy of their funding from one of five sources

Respondents to the botanical collection survey were asked to rank the degree to which they felt that botanical collections were improving or declining. A range of responses was received, the majority expressing a feeling of improvement. However, when the results were sorted by the groups of collections discussed above, it became clear that the perception of decline was centred on university botanical collections and especially those that are not open to the public. A lack of funding is the primary threat to most organisations and it can be seen from Figure 10.2 that the majority of university botanic garden funding comes from the university. Universities in Britain are presently going through a period of financial difficulty that would appear to be threatening the existence of their botanic gardens.

10.3 Case Studies

It was proposed that the differences in character and roles that were highlighted by the survey of botanical collections were caused by the differing histories and methods of funding of the collections. To examine whether this was true, case studies were conducted into ten collections. The results of these appear to support this hypothesis. In addition, analysis of the histories allowed some observations to be made that are applicable to the creation of new botanical collections. These can be summarised as follows.

Botanical collections have a tendency to fill the space allocated for them. When this happens there are several responses, each of which will affect the future characteristic of the collection.

Remain at present size – This would prevent the organisation from overextending itself and then facing financial problems in the future but also limits the total number of visitors received. E.g. Chelsea Physic Garden

Move whole collection to larger premises – This presents the organisation with the opportunity to reassess and redesign the layout of their collections. However, it will invariably result in the loss of mature tree specimens. E.g. University of Bristol Botanic Garden

Acquire satellite gardens – Satellite gardens can be a valuable addition to a botanic garden because they offer the opportunity to acquire land with different soils and microclimates, which can extend the range of plants grown. The addition of a garden that is sufficiently geographically separate may well allow people access to the collection that otherwise were too distant. E.g. Royal Botanic Gardens, Edinburgh

Initial purchase of extra land for future growth – Few existing botanic gardens had land left over from the initial purchase that could be used for expansion. Where this was the case, the gardens have avoided having to consider moving. E.g. University of Cambridge Botanic Garden

In addition to this it was noted that botanical collections benefit from having a clearly defined purpose and set of procedures to follow. These help guide the numerous people who will make decisions over what can be a very long life of a collection.

For those botanic gardens that raise the majority of their revenue from visitors, the movement towards an 'experience economy' means that they will be under greater pressure to sell the idea of visiting a botanic garden.

10.4 Structure, Design and Function of Botanic Gardens

The points raised by the case studies illustrate how specific aspects such as the amount of available land or the presence of a mission statement can affect the character of a garden. Botanical collections can be thought of as being comprised of a number of activities that operate with varying degrees of interdependence but which all influence the resulting characteristic of the garden. By examining each of these individual activities an understanding of their natures can be gained that will aid the decision-making processes when developing a new botanical collection. From these reviews the following points can be made.

Botanic gardens can be thought of as being comprised of two financial units; one is centred on the research collection and is funded by grants and revenue raised from the research facility, while the other is centred on the garden as a public attraction and is funded through visitor revenue. To operate well, both of these financial units have different requirements of the plant collection. As a result, movement of a collection from being predominately research based to being visitor centred, or vice versa, requires significant changes.

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Funding for botanical collections falls into two categories. Firstly, capital funding that is used for one-off expenditure such as new building work. Secondly, there is the day-to-day expenditure, which includes the salaries, services and consumables required to run a garden. For the majority of botanical gardens, raising capital funding is done by appealing to bodies outside of the garden for support, while the money for the day-to-day running is invariably gained from the visitors admission charges and money raised through the sale of items and services.

Marketing is essentially a generic term for a number of activities that result in some form of communication between an organisation and its present or future customers. The object of these communications is to inform, and to a certain degree, alter the audience's perception of the organisation. In response to an economic environment that requires botanic gardens to be financially sustainable and where the customer must be convinced that he will receive an experience beyond that of just purchasing a product or service, botanic gardens must increase their use of marketing to create brands that are appealing to visitors. Part of this process involves having a clear understanding of the purpose of the collection and what it should achieve.

It should also be remembered that botanic gardens do not operate in isolation from everything else. The creation of a new botanic garden will impact on its surroundings, the results of which can be beneficial in the case of job creation and the increase of wealth in the area. However, it must be recognised that there can also be negative impacts and as much as possible should be done to reduce these.

When it comes to locating a new botanical garden, it might be assumed that the location would have a bearing over the size and number of visitors. Results of an investigation into the macro-position of existing gardens did not find this to be true. However, this investigation did not look at the micro-positioning of the garden and it may be found that the proximity to major roads and public transport on a smaller scale is more influential.

Curators of botanic gardens and museums, as well as some artists, are all linked by the fact that they often find themselves trying to convey complex ideas through static displays. Conveying an idea, in such a way that you can be certain that the recipient has the same understanding, is a difficult process because there is often little or no feedback with which to assess whether the audience has interpreted the display correctly. Socratic tuition, where the tutor constantly questions the student to assess their understanding of the subject, has been shown to be a more effective teaching style than didactic methods, where the student is just presented with information. In botanic gardens, the most Socratic method of interpreting a collection is through the use of well-trained guides. However, guide teams can be expensive to run, require co-ordination and only interact with a small percentage of visitors (a median figure of 1.5% was calculated from the results of the botanical collections survey). Therefore, ways must be found to increase the effectiveness of other forms of interpretation. Constructivist theory suggests that we use the knowledge we have to actively construct an understanding of our surroundings. Once established this view of the world, 'the framework', can be difficult to alter. For education to occur during a visit to a botanic garden the collection must be interpreted in such a way that an alternative framework is actively constructed for the visitors.

The written word is the most common method used by botanic gardens to communicate with their visitors but it is only one of many methods available. Media that utilise all five of our senses can be used with varying degrees of accuracy to convey ideas and feelings. The use of more than one medium gives the audience a greater variety of ways to relate to the collection and thus a greater number of ways to access the message that is being told. The recent and continuing advances in computer hardware and software are providing more opportunities for their use as tools for interpretation and

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marketing. Websites are one such technology that is now accessible to all British botanical collections. However, research for this study shows that they are being underused and, where they are used, the full potential of the media is not being utilised, especially when the purpose is education.

There is little contemporary text covering the design of British botanic gardens or their exhibits, but there is literature available that covers the design and effectiveness of museum exhibits, such as Miles *et al.* (1988), Schramm & Porter (1982), Melton (1935) and Lakota (1975), which contain principles that are applicable to botanic gardens. The most specific concept for botanic garden display is that of 'Plant Blindness', put forward by Wandersee & Schussler (2001). This provides five principles of visual recognition, which explain why plants are often overlooked, which can be used to aid the development of exhibits.

Many trends in botanic gardens are seen first in the United States of America before being taken up in Britain. There has been a trend in the United States to provide separate 'children's gardens', and indeed, in 2004 the Royal Botanic Gardens, Kew, built a children's area. However, careful consideration should be given to the implications of this approach before embarking down this route. The botanic garden's desire to create a children's garden may well stem from reviewing its existing interpretation and concluding that it is not accessible to children. This self-assessment is a positive process but solving this problem by creating an obvious division between the children's area and the adult's area may well set up the paradigm that the majority of the botanic garden, the adult section, is not for children. It may also encourage staff to think of visitors in these two categories rather than as a spectrum of personalities that have a diverse range of methods for making sense of their environment. As an alternative, a range of interpretation media aimed at different ages distributed throughout the garden would blur the division between the abilities of adults and children. This would allow visitors to choose at what level they would like to have the garden interpreted to them.

10.5 Eden Project Case Study

The Eden Project in Cornwall is a contemporary botanical collection and was chosen as the subject of a major case study in this work because it provides an opportunity to examine the reasons for, and outcomes of, decisions made by an organisation with similar aims to those of the Somerset Plant Collection.

The Eden Project shares the same core aims as other British botanic gardens. It also shares a similar visitor profile, as well as being equally dedicated to delivering a high standard of horticulture. However, Eden differs from many other botanical collections by not viewing its whole living collection as being of *ex-situ* conservation importance. This means that the long-term preservation of its collection is not central to its operation, which allows Eden to change in response to the desires of its visitors and staff. As a sustainable and self-supporting organisation, there is a requirement to be commercial and Eden's response to this reiterates the need for botanic gardens of this sort to actively market themselves.

Although the Eden Project does not have laboratories dedicated to research or large collections of plants of conservation importance it is active in both areas. Eden works in partnership with a large number of other organisations on a range of conservation and research projects where it provides access to the knowledge and experience of its staff, use of its facilities, its experience at accessing funding and its expertise at marketing.

Eden's recent creation has allowed it to question the direction and purpose of botanical collections and then develop one that the staff feel meets the present requirements. The product demonstrates that humorous story telling through a variety of media can be an effective way of delivering a public

education mission. Eden does not provide a blue print for the establishment of another botanical collection, partly because some of its success must be attributed to its uniqueness. However, the management processes that resulted in the present organisation and functioning of the Eden Project may well prove to be a useful model for future projects.

10.6 Market research

This thesis originated from a project to assess the feasibility, and subsequently design, of a collection of Somerset pants for the Carymoor Environment Trust. Before decisions could be made about the type of collection to be built possible future stakeholders needed to be identified and their requirements for the collection understood. To accomplish this, four possible stakeholder groups were identified (schools, universities, the public, and professionals whose work involves the identification of British plants). Each was sent questionnaires customised for their group. Due to the differing nature of these groups the sample sizes were not the same and as a result and the number of returns from each group differed (150 from schools, 21 from universities, 56 from professionals and 13 from the public). The results showed an interest from all four groups in using a botanical collection. However, as is detailed below the type of collection required differed between the groups.

10.6.1 Schools

In total, 51 schools responded to the questionnaire. Each was responsible for educating between 44-1,700 students with a total of 30,562 students between them. The results showed that, on average, students from these schools are taken on 2-3 trips per year. 51% of headteachers expressed a desire to increase the number of trips with the remainder desiring no increase. There were two main factors that prevented an increase where desired. Financially the cost of taking a trip was prohibitive; there was also the pressure of having to ensure that the curriculum is completed. Of the students at the schools that responded, 10% are taken annually to a botanic garden. However, 65% will never visit one during their time at school.

The results to questions about the use and design of a new botanic garden suggested that schools do not require a comprehensive collection of species but rather, good interpretation of those topics relevant to the national curriculum. They expect to have staff available to lead the visit and help interpret the collections. Their main reservation about using a botanic garden stems from issues of financing the visit rather than the relevance of a botanic garden to the national curriculum.

10.6.2 Universities

In total, 21 university lecturers, representing 12 universities, responded to the questionnaire. All recipients of the questionnaire lectured on plant based subjects. Their responses indicated that 61% of courses they lecture on had a formal plant identification module, and of these, 66% were compulsory. Of those whose identification modules were not compulsory, 83% believed that the correct number of students take the module. 90% of the lecturers believed that plant identification is a skill that their graduates required. Reasons given for not using a botanic garden included a failure of the garden to cover desired topics (such as British plant communities and identification of native species), a lack of facilities (including native plants and labelling), the cost of conducting the visit and the lack of a botanic garden close enough.

The research showed that at present university courses are more likely to use nature reserves than botanic gardens. This would appear to be due to an interest in discussing habitats. This desire for habitats is a preference that schools shared with universities. However, the universities would require

more botanical accuracy with their displays than the schools. Unlike schools, universities would not require a member of the botanic garden staff to conduct tours.

10.6.3 Professionals

In total 53 companies responded, between them they employed 25,600 people. Of these, 43% attend a plant-identification training course at least once a year. Most of the companies (60%) use both external and in-house courses for this training. 72% of the companies had employed a university graduate in the last three years, and of these 70% were not satisfied with the plant identification skills of that graduate. Of those that had not employed a graduate, 29% gave poor plant identification skills as being their reason for not doing so.

This group would use a collection for identification training, particularly in those groups, such as grasses and sedges, which are more difficult to master. Therefore, they require comprehensive collections of these groups rather than a general collection of all species. The research showed that professionals would prefer to attend training sessions that last for at least two days. It would therefore be necessary to be able to offer suitable accommodation onsite or nearby.

10.6.4 Public

The survey of the public yielded a very low response. Therefore the results, and the conclusions drawn from them, are not necessarily an accurate portrayal of the true desires of this group. The majority of the visiting public will be using the collection for recreation and therefore expect to have facilities such as a café and shop. The collection would be compared with other public gardens and as such would have to be aesthetically pleasing. However, once the collection has been identified as a botanic garden the public will then expect to find the plants well labelled and will use the garden for edutainment.

10.6.5 Display

Schools, universities and the public stated that they would prefer to see plants displayed by habitat. However, after this their preferences differ. The schools and universities are interested in seeing plant displays that show the adaptation and evolution of plants as well as their taxonomic relationships, while the public are more interested in the medicinal and garden uses of plants. The professionals were not consulted on this as their reason for using a collection had already been established.

10.6.6 Time & Travel

The results showed that a botanic garden has different sized circles of influence, areas in which people are likely to visit, for each of the groups. Schools have the smallest with 75% of visitors not travelling more than 1¼hrs, while the public circle is larger with 75% not travelling more than $2^{1}/_{3}$hrs. The timing of visits during the year also varies. For schools the least favourable months are August, December and January while the most popular are June, July and October. Universities returned similar results favouring May and October and avoiding the holiday seasons in August and December and January. Amongst the public, weekends are naturally the preferred time for visiting gardens. The opposite is true for schools, with Wednesday being the most popular.

The discrepancy between the level of plant identification provided by universities and that required by the companies looking to employ their graduates suggests that there may be a niche market for offering plant identification courses to these students, perhaps as residential courses during the summer.

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10.7 Carymoor Case study

The results of the market research surveys indicated that all four stakeholder-groups were interested in using a collection of Somerset plants based at Carymoor. It also highlights differences in requirements and use of the collections. The Carymoor case study illustrates some of the problems that were encountered when trying to create a botanical collection such as the lack of a clearly defined role for the collection within the overall business plan of the organisation and the limited parking for potential stakeholders. These factors made it difficult to find a financially sustainable solution.

It is clear from this case study that there is a necessity to clearly establish at the start of such a venture the purpose of the collection and how it will be funded. Only once these are decided can a garden be designed and a schedule for its implementation be drawn up. In the case of Carymoor, it was desired that education be the primary role of the collection but research had shown that this could not generate sufficient funds to support a garden. Therefore, alternative funding strategies to support the garden were needed. Alternatively, a different method of delivering the educational aims, which did not require a garden, could be utilised but these would not result in the creation of a botanical collection in the traditional sense.

10.8 Alternative Solutions

Many of the problems described in the Carymoor case study are unique to that particular situation but they illustrate how the circumstances surrounding the creation of a botanical collection can influence its characteristics. There is, therefore, little point in concluding this thesis by presenting the detailed design of a new botanical collection in abstract. However, the possible ways of achieving the aims of a botanical collection can be reviewed.

Two approaches can be taken to fulfilling botanical collection roles. The first is to attempt to create a collection that participates in multiple roles such as research, conservation, education and recreation. The second is to concentrate on only fulfilling one of the four roles.

As was demonstrated in chapter nine, unless additional financial support is available developing a collection along the first route seems predisposed to producing one type of collection. Without the financial support of a parent organisation the only viable option would be to rely on income generated by visitors to fund the venture. The presence of the public on site, combined with the evidence that formal education programmes can be run at little additional running cost, predisposes the collection towards an educational role. With education and visitor attraction as the primary feature of the garden, roles such as research and conservation can be taken on as secondary roles if desired. The feasibility of such a venture should be judged by comparing the cost of running against the number of visitors and their estimated spend during a visit. While some idea of the running cost can be estimated using the models derived from the botanical collections survey data, the estimation of visitor numbers is a more difficult procedure requiring data gathered specifically for the task.

10.9 Areas Requiring Further Work

It was not one of the specific aims of this study to record or analyse the management styles or structure of the various botanical collections examined. However, in spending time in these organisations it has become clear that the management style and structure can have a large bearing on the way a botanical collection operates. This could be subject to analysis in the future. During the time spent in botanical collections, it was also noted that there was a universal desire for better networking of accession data. Work could be done to assess the requirements of such a network and advise on how best to

implement it. The work conducted on the effect of macro-position of botanical collections found that at the scale used no influence was noted. However, analysing the effect of location at a micro scale on the botanical collections could further expand this work and may well result in a correlation. This study identified a lack of assessment of interpretation in British botanic gardens. Therefore, an investigation into the effectiveness of botanic gardens to communicate with their visitors could identify areas needing attention. Closely linked with this is the suggestion made in this study that the creation of children's areas in gardens might set up paradigms that are detrimental to the way visitors use the garden. Addressing these last two points would raise many interesting questions, and hopefully provide suggestions, about how British botanic gardens do/could communicate with their visitors. The recent creation of two new botanic gardens, and changes in many of the established ones, suggest that British botanic gardens are entering a period of change. Hopefully these changes will result in botanic gardens spending more time assessing how well they are communicating with their visitors and basing future decisions on the findings.

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