

BOTANIC GARDEN
CREATION AND MANAGEMENT:
THE FEASIBILITY AND DESIGN OF
NEW BRITISH COLLECTIONS
[On-line Edition]

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June 2005

Abstract

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1 Overview of Botanic Gardens

1.1 What is a botanic garden?

Initially this would appear to be a simple question to answer but finding a definition that satisfies everyone is far from easy. Below are given the entries from three different dictionaries, whilst they are not identical they do appear to identify similar aspects of what they consider to be a botanic garden; i.e. somewhere that grows plants that are studied in some way.

Botanic(al) garden *noun* (also botanic(al) gardens): a garden, which is usually open to the public, where a wide range of plants are grown for scientific study and educational purposes.

Cambridge Advanced Learner's Dictionary (2003)

Botanic garden *n* a place in which plants are grown, studied, and exhibited.

Collins English Dictionary (1998)

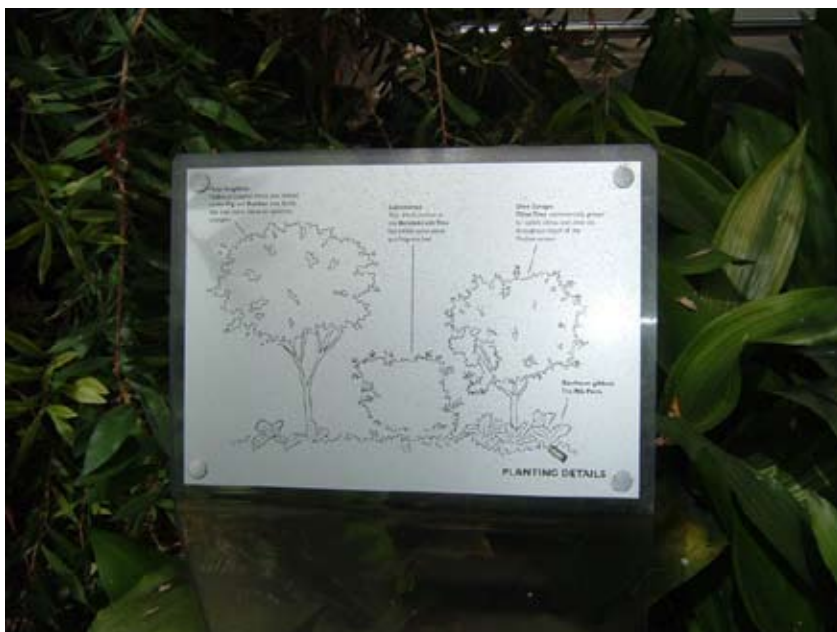
Botanical garden *noun* 1785: a garden often with greenhouses for the culture, study, and exhibition of special plants -- called also *botanic garden* \b&-'ta-nik-\

Merriam-Webster Online Dictionary (2003)

The photographs below (Photograph 1.1 & Photograph 1.2) show a collection of plants that are arranged in beds with interpretation and labels giving their Latin names. These signs clearly indicate an attempt to educate/inform the visitors. However, as can be seen in the next two photographs (Photograph 1.3 & Photograph 1.4) these particular beds are to be found in 'The Centre, Milton Keynes', a large shopping centre. According to the dictionary definitions, this collection of plants could be considered a botanical garden because it is a display of living plants that have an educational element. This classification is unsatisfactory and suggests that there must be another element missing from the dictionary definitions.



Photograph 1.1 - Plant display and interpretation board
(Source: J. Furse-Roberts)



Photograph 1.2 - Interpretation board
(Source: J. Furse-Roberts)



Photograph 1.3
Plant display located within
shopping centre
(Source: J. Furse-Roberts)



Photograph 1.4
Plant display located within
shopping centre
(Source: J. Furse-Roberts)

To identify this elusive element one could turn to botanic gardens themselves and consider how they differentiate their organisation from research stations, public gardens, shopping centres etc. As can be seen from the responses of five gardens from around the world an even broader range of definitions is given.

Belize Botanic Garden

“A botanic garden is a collection of plants--but not just any random selection of plants. The plants are scientifically ordered and maintained, documented, and labelled for public education, research, conservation, and enjoyment.”

Belize Botanic Garden Website (2003)

Tweed Botanic Gardens, Australia

“A Botanic Garden is essentially a specialised park or passive recreation area where visitors can appreciate the intrinsic and botanical values of plants and the use of plants in ornamental horticulture. It also provides facilities for environmental education and specialised botanic and horticultural research.”

Tweed Botanic Gardens Website (2003)

Friends of the Gold Coast Botanic Gardens Inc.

“A Botanic Garden is a recreational and cultural asset where the plant collection is of specific importance. It has special value for education, propagation and preservation of the plant communities of the local area.”

Reilly & Reilly (1999)

Ottawa Botanical Garden Society, Canada

“A botanical garden is a garden, which displays native and foreign plants and trees. It conducts educational, research, and public information programmes which enhance public understanding and appreciation of plants, trees and gardening.”

Ottawa Botanical Garden Society Website (2003)

David Douglas Botanical Garden Society, Canada

“The essential element of a botanical garden is the acquisition and dissemination of botanical knowledge. It is not only a landscaped or ornamental garden, although it may be artistic, nor is it an experimental station or a park with labels on the plants. Each garden naturally develops its own special field of interests depending on its personnel, location, extent, available funds and the terms of its charter.”

David Douglas Botanical Garden Society Website (2003)

These botanic gardens have not accepted the broad definition given by the dictionaries and have tried to refine the concept of what is a botanic garden. In doing so these definitions often end up excluding a type of garden that would be accepted by another's definition. For example, the definition given by the Belize botanic garden gives no reference to a living collection and could be satisfied by an herbarium, whilst the definitions given by the Ottawa Botanical Garden Society and the David Douglas Botanical Garden Society require some form of research or knowledge acquisition, something which is not necessary within the definition given by Reilly & Reilly for the Friends of the Gold Coast Botanic Gardens.

Looking to the organisations that support botanic gardens one finds that they either avoid the issue of definition or have just as much of a problem.

The American Association of Botanical Gardens and Arboreta (AABGA) does not give a definition of what they regard as a botanic garden but do give the following description of the aims of their organisation from which it can be deduced that they expect botanic gardens to be open to the public and probably involved in horticultural display, education, research, and plant conservation.

“The American Association of Botanical Gardens and Arboreta is the association for North American public gardens and their professional staff. Its mission is to serve and strengthen public gardens by supporting their work, value, and achievements in horticultural display, education, research, and plant conservation.”

AABGA Website (2003)

PlantNet, the British equivalent to the AABGA, describes itself as “the plant collections network for Britain and Ireland” (PlantNet Website 2003). By choosing the word collections as opposed to gardens they are implying the inclusion within its remit of public and private plant collections as well as other botanical collections that may or may not consider themselves to be ‘botanic gardens’ in the strict sense.

Botanic Gardens Conservation International (BGCI) is the international network for botanic gardens and as such have produced an *‘International Agenda for Botanic Gardens in Conservation’* (Wyse Jackson & Sutherland 2000). In this booklet a brief history is given of this organisation’s attempts to define the term. Wyse Jackson & Sutherland state that pre-1989 the BGCI used a definition of a botanic garden given by the International Association of Botanic Gardens (IABG) as ‘...a botanic garden or arboretum is one open to the public and in which the plants are labelled’. However, in 1989, *‘The Botanic Gardens Conservation Strategy’* (IUCN-BGCS & WWF 1989) was published and this contained a list of characteristics defining a botanic garden.

- Adequate labelling of the plants
- An underlying scientific basis for the collections
- Communication of information to other gardens, institutions, organisations and the public
- Exchange of seeds or other materials with other botanic gardens, arboreta or research stations (within the guidelines of international conventions and national laws and customs regulations)
- Long term commitment to, and responsibility for, the maintenance of plant collections
- Maintenance of research programmes in plant taxonomy in associated herbaria
- Monitoring of the plants in the collection
- Open to the public
- Promoting conservation through extension and environmental education activities
- Proper documentation of the collections, including wild origin
- Undertaking scientific or technical research on plants in the collections

However, this list does not constitute a comprehensive summary of the activities undertaken by botanic gardens.

IUCN-BGCS & WWF (1989)

It was soon found that this list excluded many gardens that it was felt should be considered as botanic gardens, therefore the BGCI now favour the following definition.

“Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education”

Wyse Jackson (1999)

At the start of his thesis Rae (1996) points out that every botanic garden is slightly different. Rather than giving a strict definition Rae also gives a list of mandatory requirements without which he feels an organisation is not a botanic garden and a supplementary list of activities in which botanic gardens often partake.

Mandatory Requirements

Open to Public
 Keep records of plants
 Have all plants labelled
 Undertake some type of plant research

Supplementary Items

Public education
 Plant evaluation studies (garden use/chemical screening)
 In/Ex-situ conservation
 Horticultural training

Rae (1996)

It is interesting to note that both Rae's list and the list reproduced above from 'The Botanic Gardens Conservation Strategy' document, stipulate that a collection must be open to the public in order to qualify as a botanic garden. As a result, these exclude numerous university botanic gardens, such as the Harris garden at the University of Reading, which whilst fulfilling all the other requirements, are not open to the public. It is surprising to see that Rae is willing to stipulate that public access is necessary for classification as a botanic garden but then places public education on the supplementary list. Why is the presence of the public in a botanic garden seen as a key feature in differentiating it from any other type of garden if when they are there they are not experiencing something different from those other types of gardens? He does however conclude his thesis by stating that "...tightly bound definitions ruling gardens in or out of the 'club' did not seem likely to serve any purpose...Exclusion from the 'club' would effectively weaken the club's total resources" (Rae 1996).

The confusion and subsequent debate arises from the use of the phrase 'botanic garden' in two different situations. Firstly, botanic garden is used in the broad sense (*sensu lato*) to include any plant collection that is more than just a garden, i.e. maintains plant records and may well partake in conservation etc. There is also the use in the strict sense (*sensu stricto*) usually referring to gardens that have the following criteria-

- More than just gardens i.e. they maintain plant records and possibly take part in other activities such as conservation, education etc.
- Are open to the public
- Usually refer to themselves as botanic gardens

The validity of this statement will be tested in the following chapter. To try to avoid confusion, within this thesis a distinction will be made by referring to those gardens that conform to the criteria above as 'botanic gardens'. Those collections of plants that do not conform fully, perhaps because they do not open to the public, but which still are more than just gardens because they maintain records etc. will be referred to as 'botanical collections'.

1.2 The Changing Roles of Botanic Gardens

In 1917 Professor John Merle Coulter of the University of Chicago, during a dedication speech for a new laboratory at the Brooklyn Botanic Gardens, identified “Social, Educational, Scientific” as being what he saw as the three main roles of botanic gardens. Eighty years later Mrs Caroline Hotine (1997) described the roles of the Cambridge University Botanic Garden, where she works, as being “research, education and amenity”. The review of definitions of botanic gardens would seem to agree with these broad terms with the possible additional role of conservation. However, these are only broad banners for a myriad of activities and whilst Hotine’s “research and education” is comparable to Coulter’s “educational and scientific” in broad terms, the activities that constitute these roles have changed vastly. These changes in the roles of botanic gardens have resulted in changes to their design and layout. New gardens have been created and old ones have closed. Figure 1.1, with its accompanying notes, shows the approximate order and duration of the different eras of garden that have existed. However, it should be noted that this is a reflection of the major themes of the time and that it will always be possible to find a garden that has decided to follow a different path. The most notable example of this is probably the Chelsea Physic Garden, which is discussed in more detail in chapter 3.

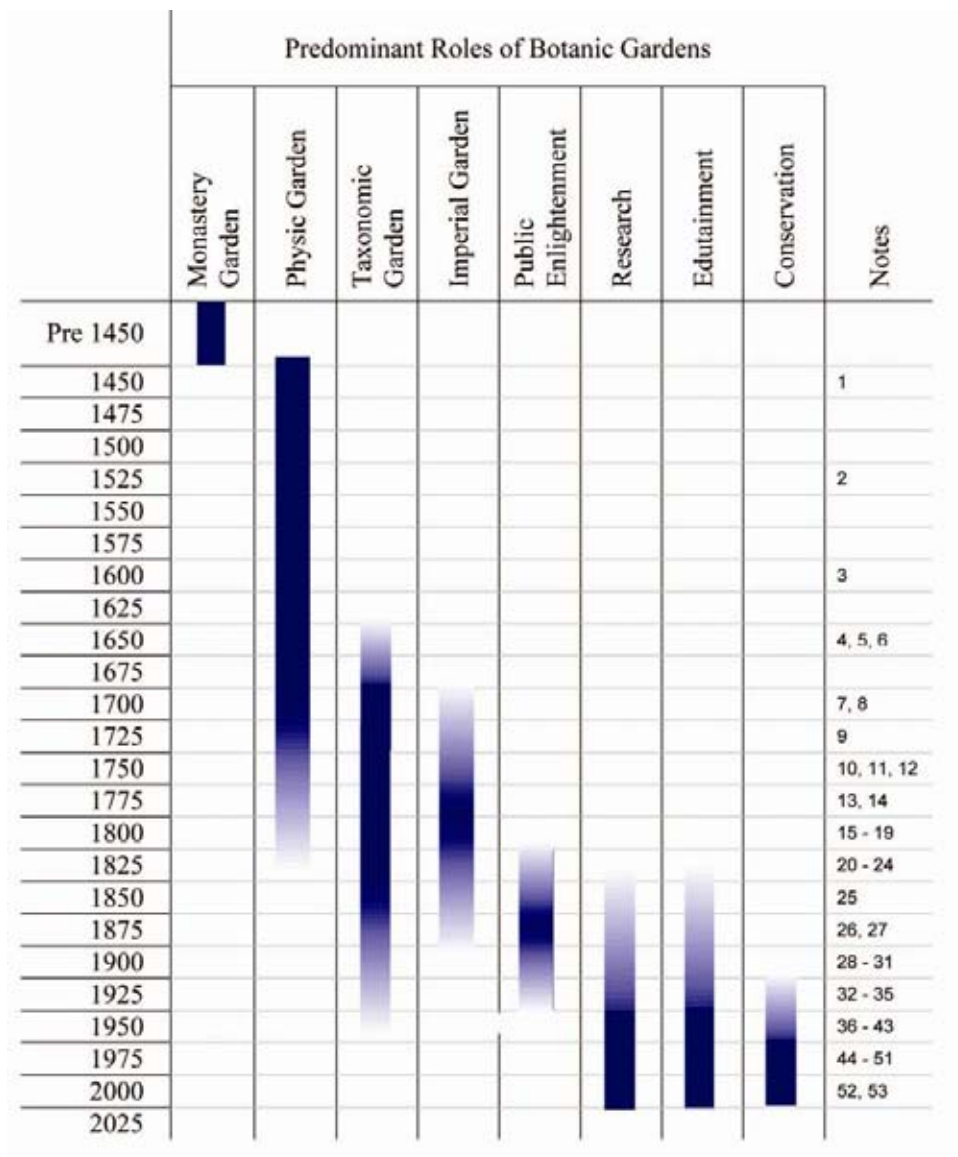


Figure 1.1 - Timeline showing the ascent and decline of various eras of botanic gardens

- 1) 1447 – Pope Nicholas V founds a garden in the Vatican grounds for the teaching of botany as a branch of medicine (Hyams & MacQuitty 1969).
- 2) 1545 – Padua Botanic Garden founded, commonly accepted as being the first botanic garden (Hyams & MacQuitty 1969, Young 1987).
- 3) 1621 – Oxford University Botanic Garden founded for use by the faculty of medicine as a physic garden (Oxford Botanic Gardens 1972).
- 4) 1653 – Uppsala University Botanic Garden founded in Sweden (Uppsala University Website 2004).
- 5) 1670 – Physic garden founded in Edinburgh that eventually became the Royal Botanic Gardens Edinburgh (Fletcher & Brown 1970).
- 6) 1673 – Chelsea Physic Garden founded (Minter 2000).
- 7) 1709 – The Jardin Royal des Plantes Medicinales in Paris, traditionally a physic garden, became the Jardin du Roi and over saw the acclimatisation of plants from overseas and redistributing them for best effect (Sohmer 2001).
- 8) Around 1717 a physic garden was founded at Glasgow University (Young 1987).
- 9) 1741 – Linnaeus takes over the derelict botanic garden at Uppsala University and lays it out according to his own classification system (Uppsala University Website 2004).
- 10) 1759 – William Aiton recruited from Chelsea Physic Garden to manage the physic garden at Kew (Desmond 1995).
- 11) 1760 – Cambridge University Botanic Garden founded (Young 1987).
- 12) 1772 – Sir Joseph Banks made unofficial director of Kew (McCracken 1997). In the same year Kew's first collector, Francis Masson, is sent to the Cape of South Africa (Desmond 1995).
- 13) 1786 – Calcutta Botanic Garden founded followed by Sydney Botanic Garden two years later in 1788 and Jamaica Botanic Garden in 1793 (Sohmer 2001).
- 14) 1789 – First edition of Index Kewensis published following Linnaean taxonomy (Desmond 1995).
- 15) 1800 – Penang Botanic Garden founded followed by Ceylon Botanic Garden ten years later in 1810 (Sohmer 2001).
- 16) 1810 – When the botanical garden at Bangalore failed to meet the economic expectations of the British East India Company, it was quite literally “put to the axe” (Sohmer 2001).
- 17) 1818 – A new botanic garden at Glasgow University replaces the original physic garden (Young 1987).
- 18) 1817 – Bogor Botanic Garden founded followed by Trinidad Botanic Garden in 1818 (Sohmer 2001).
- 19) 1823 – The Mexican botanical garden...had, according to an 1823 visitor, fallen into ruin (Sohmer 2001).

- 20) In the 1830s Professor Daubeny, who was then in charge of Oxford Botanic Garden, was charging a shilling to see the Amazon water lily, installed fountains and pools and wrote a guide to the garden. "For Daubeny the purpose of the garden was no longer to help herbalists in concocting their potions, ...but to discover what plant study could do in all fields of science and industry." (Oxford Botanic Gardens 1972)
- 21) 1832 – Birmingham Botanic Garden founded by a society (Young 1987).
- 22) 1836 – Sheffield Botanic Garden founded by subscription (Young 1987).
- 23) 1838 – Government threatens Kew with closure. This threat was finally abated in 1840 (Desmond 1995).
- 24) 1848 – First economic botany museum opened in what is now Museum No. II (Desmond 1995).
- 25) 1858 – New acquisitions required the building of an additional museum, now Museum No. I (Desmond 1995).
- 26) 1889 – St. Andrews University Botanic Garden founded (Young 1987).
- 27) 1898 – Cruishank (Aberdeen University Botanic Garden) founded (Young 1987).
- 28) 1910 – Hume's South London Botanical Institute founded (Young 1987).
- 29) 1913 – Following the success of a similar scheme at the Natural History Museum, London, a guide-lecturer was trialled at Kew. The trial was abandoned in 1920 (Desmond 1995).
- 30) 1916 – Entrance charge introduced at Kew. Between 1916 and 1938 the entrance charge is abolished and reintroduced several times (Desmond 1995).
- 31) 1920 – Leicester University Botanic Garden founded (Young 1987).
- 32) 1928 – Younger BG given to RGB Edinburgh (Young 1987).
- 33) Some time during the early 1930s Hull University Botanic Garden was founded (Young 1987).
- 34) 1948 – Liverpool University Botanic Garden founded (Young 1987).
- 35) 1950 – Cambridge University Botanic Garden expanded (Young 1987).
- 36) 1954 – A genetic garden is developed at the Oxford University Botanic Garden (Oxford Botanic Gardens 1972).
- 37) 1959 – Bristol University Botanic Garden founded (Young 1987).
- 38) 1960 – Public education at Kew came under scrutiny; this resulted in the reorganisation and labelling of the museum collections as well as reinstating the guide-lecturer scheme that had been abandoned in 1920 (Desmond 1995).
- 39) 1964 – Logan Botanic Garden founded (Young 1987).
- 40) 1969 – Exploratorium, the first science centre, is founded in San Francisco (Exploratorium Website 2002).

- 41) During the 1970s the research for the Agricultural Research Council was relocated outside of London. The Chelsea Physic Garden lost £770 of their total £895 research rentals in one go when they withdrew to the Grasslands Research Institute at Hurley. In addition to this, the University of London set up its own Botanical Supply Unit at Royal Holloway College, Egham to supply its colleges directly although the Chelsea Physic Garden still supplied 29,227 specimens during 1970/71 (Minter 2000).
- 42) 1970 – Durham University Botanic Garden founded followed by Dundee University Botanic Garden in 1971 (Young 1987).
- 43) 1971 – Scanning electron microscopes installed the Jodrell Laboratory at RBG Kew (Desmond 1995).
- 44) 1975 – Kew hosts their first conservation conference (Minter 2000)
- 45) The term biodiversity was first used at the start of the 1980s
- 46) 1984 – Responsibility for RBG Kew was passed from MAFF to the trustees (Desmond 1995).
- 47) 1990 – Prof. Prance, Kew's director, set up Kew Foundation whose sole objective is to raise money for Kew (£2million a year) (Desmond 1995).
- 48) 1992 – Changes in teaching meant that the demand for plant materials dried up and eventually the Botanical Supply Unit at Royal Holloway College, Egham closed (Minter 2000).
- 49) 1992 – Earth Summit held in Rio de Janeiro where the Convention on Biological Diversity was adopted (Secretariat of the CBD 2000).
- 50) 1994 – Kew commissioned its first television commercial (Desmond 1995).
- 51) 1999 – Prof. Crane takes over as the new director at Kew and concentrates on broadening Kew's public appeal.
- 52) 2000 – On May 24th The National Botanic Garden of Wales, Carmarthenshire, opened to the public (Millennium Commission 2003)
- 53) 2001 – On March 17th The Eden Project, Cornwall opened.

1.0.0.1 The Physic Garden Era

A date in the 1540s is commonly cited as marking the start of the botanic garden tradition in Europe (Hyams & MacQuitty 1969, Rae 1996, van Dobbenburgh 1996). However, these first gardens were not an entirely new concept when they appeared, instead they evolved from the medieval monastery gardens. Monastery gardens were working collections used to supply herbs to the sanatorium, for medicinal use, and to the kitchen for inclusion in the cooking pot (DerMarderosian 1996). The first step towards botanic gardens in their modern form came in 1447. It was during this year that Pope Nicholas V set up a garden in the grounds of the Vatican for the express purpose of teaching botany as a branch of medicine (Hyams & MacQuitty 1969). Gardens with this role became known as physic gardens. For “technical reasons”, which they do not expand upon, Hyams and MacQuitty (1969) do not count physic gardens as botanic gardens, instead preferring to use the establishment of the Padua Botanic Garden (Italy) in 1545 as their start date. There is also some controversy over whether the

Pisa Botanic Garden (preferred by van Dobbenburgh (1996)) was actually in existence in 1543 thus pre-dating Padua. This confusion arises because whilst the establishment of the Padua garden is well documented the same is not true for the garden at Pisa, although there is one letter, dated 1543, which discusses a garden at Pisa.

The physic style of botanic garden was long lived as the need to identify herbs accurately for the teaching and practice of medicine was in constant demand and took equally long to fade away or, as in a number of cases, to transform into the taxonomic and imperial gardens of the next era. The phasing out of physic gardens started at sometime around the 1670s when gardens such as Edinburgh started to include systematic beds (Fletcher & Brown 1970), continued through the 1740s, when a greater interest in materia medica (see chapter 2) led to the neglect of gardens such as Edinburgh's (Fletcher & Brown 1970). The nineteenth century saw a change in the approach to medicine that tolled the death knell for the majority of physic gardens. This is illustrated by the replacement of the term "materia medica" by "pharmacognosy" in 1815, the synthesis of urea from ammonium cyanate by Wöhler in 1828, which helped to eliminate distinctions between organic and inorganic chemistry, and Pasteur's microbiological work that brought an end to ideas of spontaneous generation and humoral medicine (DerMarderosian 1996). Despite all this, one physic garden managed to survive, the Chelsea Physic in London has outlived a number of other London physic gardens and, to this day, still has as its remit teaching of the medicinal uses of plants. Indeed, according to Professor Houghton, the Royal Pharmaceutical Society's representative on the advisory committee of the Chelsea Physic Garden, "the garden now plays a role closer to that for which it was originally planted than it has done for most of its history" (Houghton 2000).

1.0.0.2 Taxonomic Garden Era

The taxonomic garden era, which in Britain began around the end of the seventeenth century when gardens such as Edinburgh were laying out areas within their gardens systematically, is really part of an international change of views that started in 1741 when Linnaeus took over the derelict botanic garden at Uppsala University and laid it out according to his 'sexual system' (Uppsala University Website 2004). Linnaeus's new system of classification based on the plant's sexual organs influenced other gardens. For instance, in 1789 the first edition of *Index Kewensis*, a list of the plants growing at Kew, was published following Linnaean taxonomy (Desmond 1995). Sixty years later the process of grouping plants according to taxonomy was taking a more physical form with the creation of the systematic beds at the Cambridge University Botanic Garden in 1846 (Cambridge University Botanic Garden 2004). Shortly after this, in 1850, Professor Daubeny rearranged the Oxford University Botanic Gardens to follow the Linnaean system (RHS 2004). In the 1860s, the order beds at Kew were planted, although their arrangement was based on the Bentham-Hooker classification (Royal Botanic Gardens, Kew 2004a). Taxonomic research has continued through to the present day and as the research has progressed the changes in the way plants are grouped have duly been reflected in the systematic order beds. For example, the display at the Oxford Botanic Garden was changed in 1884 by Professor Isaac Bayley Balfour to follow Bentham and Hooker. More recently, during the winters of 2002-3 and 2003-4, it was changed again to follow the findings of the Angiosperm Phylogeny Group, based on DNA studies and illustrating the latest thinking on the evolutionary relationships of the plants (RHS 2004). However in recent years there has been a decline in the use of order beds for teaching botany. At Kew, despite the fact that the School of Horticulture is situated in a building adjacent to the order beds, these are not used formally during lectures. While those gardens that have order beds maintain them and, in some cases, keep them up to date with modern classification theory, in other areas of botanic gardens there has been a move away from taxonomic display towards other themes including phytogeographical displays. It is of particular note that neither of the two newest major botanical collections in Britain has incorporated order beds into their designs.

1.0.0.3 The Imperial Garden Era

Running concurrently with the taxonomic era was the imperial era. By 1709 the French were starting to use their gardens for the acclimatisation and redistribution of plants from overseas. For example, the Jardin Royal des Plantes Medicinales in Paris, a traditional physic garden, became the Jardin du Roi and oversaw this process (Sohmer 2001). This change of roles for botanical collections marks the start of 'imperial garden' era when the commercial value of plants was exploited with the help of networks of botanic gardens distributed throughout colonies. British collections were slower to take on this new role. Indeed, in 1717, Glasgow University chose to create a new physic garden eight years after the change of role of the Jardin Royal des Plantes Medicinales in 1709. It would be another 55 years before Banks would take over as unofficial director of Kew Gardens and, in 1772, start to dispatch collectors, such as Francis Masson, to expand the collections. The colonial gardens fulfilled three main roles; they conducted scientific work by collecting and documenting the plants and plant products native to their area, they had a social function for the colonists by providing an area where they could relax, and many raised funds by supplying cut flowers. Finally, and probably most importantly for the time, they had an economic role of growing and distributing economic plants, such as sugar cane, coffee, cocoa, tea, sisal, cotton, *Cinchona*, cloves, rubber, tobacco etc., to other countries and assisting the plantations in these countries to grow the best crop (McCracken 1997). As Britain's links with its colonies weakened and changed so did the structure of the imperial garden network although remnants still remained. For instance, it was only in 1986 that Kew formally ceased to be the intermediate quarantine station (Desmond 1995).

1.0.0.4 Public Enlightenment

During the period around the start of the Victorian era, Britain underwent significant changes. Britain was growing into a rich and powerful country whose influence reached around the globe and great advances were made in science and industry. At home these changes were having an effect on everyone but in particular the middle classes found that they had more time to spare and money to spend on activities (Clark 1996). This, combined with a general trend for self-improvement, resulted in the formation of societies dedicated to the improvement of their members. Amongst these societies there were some, dedicated to botanical studies, that clubbed together to raise the funds required to set up their own botanic gardens. For example, in 1832 the Birmingham Botanical and Horticultural Society set up the Birmingham Botanic Garden and in 1836 the Sheffield Botanic Garden was also founded by subscription. Some of these ventures were successful whilst others, such as the first Bath Botanic Garden founded in 1840 after several attempts, were not. Today only the Birmingham Botanic Garden is still run by the society that founded it (Young 1987, Murray 2003 pers. comm.). In 1908, in his guide to the Royal Botanic Gardens, Kew, William Jackson Bean, then assistant curator, made the following observation about the change in the way visitors were using the gardens.

“A certain class of visitor always characteristic of Kew from its early days has in recent years become much more abundant. This is the young man or woman going from plant to plant with a book of botany or plant-lore in hand, and trying to get to the bottom of the mystery of leaf and flower arrangement, or to fix the plant's identity in mind.”

(Bean 1908)

To a greater or lesser extent the demands that resulted in the different styles of botanic gardens described above now no longer exist. However, the contemporary demands have resulted in the development of the following styles of garden and are still influencing botanic gardens today.

1.0.0.5 Research

Experimentation on a small scale has probably always taken place in botanic gardens, even if only in the form of an inquisitive curator striving to push the boundaries of what can be grown in their garden. However, it was around the beginning of the nineteenth century that these experiments became more organised and started to be structured towards a more commercial outcome. A good example of this is the established of experimental gardens and laboratories at the Oxford Botanic Garden where trials were conducted into fertilisers (Oxford Botanic Gardens 1972). The topic of experimentation varied depending on what was of particular interest at the time. For instance, in 1987 the Jodrell Laboratory at the Royal Botanic Gardens, Kew, was awarded grants to participate in the Directed AIDS Research programme (Desmond 1995) and more recently work has been focused on plant DNA sequencing and seed conservation. At the time of writing the Alpine House is being emptied in preparation for its demolition in order to make room for an extension to the Jodrell Laboratory, thus increasing Kew's research facility.

1.0.0.6 Edutainment

Edutainment is a North American term describing “an activity...intended to be educational as well as enjoyable; informative entertainment” (Oxford English Dictionary 2004), which is now becoming popular in Britain. Although first defined in the early 1980s the edutainment movement, as far as British botanic gardens are concerned, could be seen to have its origin in the public enlightenment gardens of the first half of the nineteenth century. This is when education of the visiting public became a major role. After a while it became more difficult for these gardens to fund themselves through subscription so alterations were made to the gardens to make them more appealing. For example, at this time the Oxford Botanic Garden incorporated fountains and other features into the gardens specifically to attract and entertain their visitors (Oxford Botanic Garden 1972). However, it is only recently that the two activities of entertainment and education have been viewed as a continuum. As the origin of the word “edutainment” suggests, this movement started in the United States of America. In 1969 the Exploratorium was founded in San Francisco (Exploratorium Website 2002). This was the first science centre to be created and marked a breakaway from conventional museums, led by Dr. Frank Oppenheimer, which forced American museums to redress their purpose and the methods they were using to communicate with their visitors. This resulted in many changes to American museums, which were later copied by British museums; these in turn have had some influence on British botanic gardens but in general the gardens have been slow to react. For instance, in 1994 the Australian House at the Royal Botanic Gardens, Kew, was emptied and replaced with an exhibit telling the story of the evolution of plants (Desmond 1995). This display consists of audio recordings of spoken word and other effects triggered by proximity detectors; smoke and light effects, a bubbling mud pool, artificial rocks, fibreglass models and different floor textures, finishing finally with a piece of artwork. This extremely advanced exhibit, designed to give the visitor an immersive experience, seemed to go unnoticed and did not seem to influence subsequent exhibit design within Kew or at other botanic gardens. It is only now that the Evolution House is being paralleled by exhibits such as the Wildscreen area of @Bristol.

1.0.0.7 Conservation

Conservation is the newest role that British botanic gardens have taken on and there is still much discussion as to how best the skills possessed by botanic gardens can be used (Synge & Townsend 1979, Maunder 1997, Synge 2000, Wyse Jackson & Sutherland 2000, and the 2004 BGCi Conference entitled ‘Implementing the Global Strategy for Plant Conservation’). Conservation itself is a relatively new subject. The Convention on International Trade in Endangered Species (CITES) was signed by 80 countries and came into force in 1975 (CITES Secretariat Website 2004). During the 1980s the term “biodiversity” was used for the first time and in 1992 the Earth Summit, where the Convention on Biological Diversity was adopted, was held in Rio de Janeiro (Secretariat of the CBD 2000).

The contents of these treaties had a direct effect on way botanic gardens operated (see the 'Legal Requirements' section for more details on this) but in addition to this the international focus on the environment also influenced the focus of their fields of research.

In their book, *'International Agenda for Botanic Gardens in Conservation'*, Wyse Jackson and Sutherland (2000) give the following as the major conservation activities that they see botanic gardens as being involved in-

- City and town planning, resource allocation and land use
- Empowering and building the capacity of local and rural communities for conservation
- Environmental impact assessment
- Field genebanks
- Plant reintroductions and research in habitat restoration
- Pollution abatement and monitoring programmes
- Seed store and tissue banking
- Conservation networks and community groups
- Wild plant species research, conservation and management ex-situ and in-situ

1.3 Global Distribution of Botanic Gardens

The difficulty in defining what is or is not a botanic garden, illustrated at the beginning of this chapter, naturally makes compiling an accurate census equally difficult. There are several estimates for the number of botanic gardens worldwide; these usually fall between over 2,000 (BGCI Website 2004a) and over 1,800 (Wyse Jackson 1999). These gardens are spread over 148 countries worldwide and they maintain more than 80,000 species, almost one third of the known vascular plant species of the world, in living collections comprising of 6.13 million accessions. The herbaria of these gardens contain a total of approximately 142 million herbarium specimens (BGCI Website 2004a).

Of these 2,000 botanic gardens, over a quarter (>500) occur in Western Europe, more than 350 in North America and over 200 in East and Southeast Asia, of which the majority are in China. Most of the southern Asian botanic gardens are to be found in India (BGCI Website 2004a). As well as showing that there is an uneven distribution of botanic gardens, these data also suggest that, worse still, areas of high biodiversity have low numbers of botanical gardens and vice versa. This suggests that the global network of botanic gardens is not working efficiently

This is confirmed by the *'Update of the International Review of the Ex Situ Plant Collections of the Botanic Gardens of the World'* (BGCI 2001), which lists the number of botanic gardens in each country. Italy has almost as many botanical collections as the whole of the South American continent (107 in Italy and 123 in South America). This poses the question of how many botanical collections a country needs. For instance Brazil, Argentina and Columbia each have 25 or more (29, 26 and 25 respectively) and as Rae (Rae 1996) points out non-European botanical collections are far more likely to concentrate on their own flora, unlike European botanic gardens where exotic collections tend to be preferred. However, while on the African continent there are a total of 135 botanical collections there are also eighteen countries without a single collection.

According to the Secretariat of the Convention on Biological Diversity (CBD) the "total number of botanic gardens recorded in the United Kingdom: 80 (+ other non-botanic gardens with major ex situ plant collections)." These collections contain approximately 600,000 to 700,000 living plant accessions of between 70,000 - 80,000 taxa (circa 50,000 species). It is estimated that 70-80% of the collections were acquired before CBD was introduced (Secretariat of the CBD 2002). With 80

botanical collections, Britain ranks fourth in Europe, with Italy (107), France (104) and Germany (102) having more (BGCI 2001). However, when the differing sizes of landmass and population of these countries (as given in *The Times* (2002)) are taken into account the rankings change, as can be seen in Table 1.1. Chapter 2 examines more closely the activities of these British botanical collections.

| | Total No. of Botanic Gardens | Km ² per Botanic Garden | Rank | No. of Citizens per Botanic Garden | Rank |
|---------|------------------------------------|------------------------------------------|------|------------------------------------------|------|
| Italy | 107 | 2,815 | 1 | 537,663 | 1 |
| France | 104 | 5,230 | 4 | 569,596 | 2 |
| Germany | 102 | 3,500 | 3 | 804,676 | 4 |
| UK | 80 | 3,051 | 2 | 745,425 | 3 |

Table 1.1 – Countries ranked by size of landmass and population per botanic garden