

The 'Big Five' gardens of America

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In May 2016, I visited gardens in the United States of America to learn about different plant collection management systems and plant trials. These are both areas of my work that I can influence, develop and enhance to make our processes more efficient and successful.

Chicago Botanic Garden

Chicago Botanic Garden (CBG) is 325 acres (132 hectares) of gardens in the suburbs of Chicago, with six million plants and 10,000 species. The gardens were started in 1965 and opened to the public in 1972. CBG has one million visitors a year, and employs 250 permanent staff and 250 seasonal workers. The garden is open daily, including Christmas (although on that day buildings are closed).

The 27 gardens are maintained to an incredibly high standard with no weeds, all plants labelled and beautiful plant displays (Fig. 1). The butterfly garden is a seasonal attraction with hundreds of butterflies released. The Island of Everlasting Love is a no-access island created as a garden for the Gods. This is where many of the pruned Scots pines, *Pinus sylvestris* (Fig. 2), can be viewed across the water – they are spectacular.

The Japanese garden with its dry gardens has a zigzag bridge which is said to ward off evil spirits as they only travel in a straight line. The building in that garden was assembled in Japan using traditional techniques then reconstructed on site. There is a garden specifically designed for people of all ages and abilities with water features and garden beds at various heights, called the Buehler Enabling Garden (Fig. 3).

Evening Island has 300 crab-apple trees, thousands of bulbs, water plants, perennials and ornamental grasses. CBG wanted to create year-round interest in this garden, hence the range of plants used. Layers of bulbs are planted at differing depths so the flowering display period is increased (Fig. 4).

The Dixon Prairie is a natural, self-sustaining area that is not managed, and where there are a range of prairie types, including sand dunes. Because it is a 'natural' system, the species composition in the prairie garden changes over time with only a couple of trees in this collection, specifically on the edge of the area, because in prairies trees do not survive fires, therefore they are not normally present. The prairie is used as a model study site for prairie ecosystems.



Fig. 1 Floral display in pots at Chicago Botanic Garden.



Fig. 2 *Pinus sylvestris*, Scots pine.

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Fig. 3 The Buehler Enabling Garden was developed with help of veterans to encourage gardening for people of all ages and abilities at Chicago Botanic Garden.



Fig. 4 Spring colour at Chicago Botanic Garden.

Chicago Botanic Garden excels in conducting relevant research and conservation work on the local flora. The plant science centre (Fig. 5) is where research and conservation work is based with many scientific laboratories, an herbarium and green roofs. One aspect of this centre is the plant evaluation area where at least 7000 plants at any given time are trialled for a minimum of three years. Plants may be trialled for longer if their performance has not been consistent during this time.



Fig. 5 Plant trials with the Chicago Botanic Garden science centre in the background.

Plants are assessed on:

- 1) Cultural adaptability (light, wind, etc.) – plants are only watered and mulched, no other treatments are applied
- 2) Winter hardiness (do the plants survive winter?)
- 3) Pests and diseases (what do they get and to what level?)
- 4) Ornamental properties.

Chicago Botanic Garden built a custom database that runs using SQL, and was co-developed by a company called Alligatortek. Horticultural field staff enter requests/plant orders into the database which automatically generates accession numbers every night after information has been inputted into the system. Mapping technology is advanced at CBG. Trees are all mapped individually as single points, and shrubs are also mapped individually unless planted *en masse*. There is a base map of the gardens and each bed has a polygon drawn around it so the bed area is easily available for calculations of plant numbers required. Maps are drawn in ArcGIS and links to AutoCAD which is where the base map originates. This means it is easy to make changes to the map via the database.

There are 90 volunteers for the Living Plant Documentation Department (i.e., the records department), supporting a number of projects including What's in Bloom (website information), the Bloom Cart (a cart with plant specimens at the visitor centre of what is in flower that week), labelling, surveying, mapping data, inventories, photography, DNA collection, herbarium specimens, data entry, slide scanning, accession tags, CO₂ sequestration, weather database and phenology database contributions. There are volunteer team leaders to coordinate other volunteers and answer queries making them almost completely independent of the paid staff.

Missouri Botanical Garden

Missouri Botanical Garden (MBG) is a 30 hectare garden in St Louis and was founded by Henry Shaw in 1859. Missouri BG has 412 staff and 120 research staff; most of the research staff (90 taxonomists) have placements in Madagascar. With a continental winter climate in St Louis, a glasshouse, called the Linnaean House, holds many plants we can grow outside in New Zealand (at least in warmer regions) including camellias, aloes, cacti and citrus. Many of these plants are grown in pots rather than in beds so the display can regularly be changed with other plants from the nursery. The magnolia grove only had one type, *Magnolia × soulangeana* (the saucer magnolia). Other gardens include a rose garden (Fig. 6), Japanese garden, Ottoman garden and Bavarian garden. There was a very impressive collection of daylilies, hundreds of cultivars grouped together based on flowering time or flower type such as singles or doubles. I saw no rust on any of the plants². The Kemper Centre for Home Gardening has a series of small gardens to inspire home gardeners; areas included fruit trees, herbs and other edibles (Fig. 7), a turf comparison area (Fig. 8), ground covers and trees. These gardens are laid out in such a way that there are plenty of different plant combinations and ideas.

² Unlike our *Hemerocallis* trials held at Auckland Botanic Gardens (see the *New Zealand Garden Journal*, 2015, Vol. 18, No. 2, pp. 2–4).



Fig. 6 The rose garden at Missouri Botanical Garden.



Fig. 7 Edibles display fenced to prevent deer eating the crops at Missouri Botanical Garden.



Fig. 8 Turf comparison area in the Kemper Centre for Home Gardening at Missouri Botanical Garden.

The development of the current database used at MBG was funded by a state grant and uses SQL programming. It is web-based so it can be accessed through the internet, with password log-in from any computer, or via an iPad through an app. Missouri Botanical Garden aims to be the leaders in living collections management. This database and the information held on it is the most impressive I have seen to date. This database for the gardens links to

their massive botanical database called Tropicos, which means any wild plant collection records entered into Tropicos will link when the accession is created in the Missouri Botanical Garden database. MBG is developing a propagation module for the database and again they want to be the leaders in propagation information as it provides a basis for their conservation efforts. MBG undertakes many international conservation projects in Madagascar and Mauritius so they need to keep track of how these species from other countries are propagated. They can also produce plant propagation protocols from the database. There are huge international benefits for conservation efforts from this database development.

Longwood Gardens

Longwood Gardens was started by Pierre du Pont and the first garden was built in 1907 with the famous water fountain, which was undergoing major renovations at the time of my visit. Water fountains are key features of many of the gardens (Fig. 9). Today, the gardens occupy an area of 1077 acres (436 hectares). A lot of interpretative signage throughout the gardens explains the history and involvement of the du Pont family. Longwood has 300 permanent staff, 300 part time staff and 800 volunteers.



Fig. 9 One of many small fountains at Longwood Gardens.

The Conservatory is a huge series of glasshouses holding a diverse range of material including Mediterranean plants, bonsai, tropical plants and orchids. The collection of silvery plants was excellent and inspiring (Fig. 10). The way they were displayed was much like a perennial border with drifts and specimens like cacti and aloes integrated into it. This was something I had not seen before and really made me think about how these plants can be used in different settings. The orchid area smelled amazing with a range of species, colours and flower shapes. The Conservatory also houses the bonsai collection along with camellias held for research purposes. Longwood have a breeding programme to breed a year-round flowering camellia by using *Camellia azalea* as the pollen donor. This attractive species has an unusually long flowering period and in the wild is endangered, being restricted to a small mountainous area in Guangdong Province, China. If they are successful, then the selection created will be introduced into the nursery trade for the public to buy.



Fig. 10 Silver garden in the Conservatory at Longwood Gardens.

Another interesting project Longwood is involved in is working with their local conservation agency to return orchids to the wild. Longwood wants to focus on propagating native orchids and working on restoring nearby populations. Five orchid species are prioritised for the year that I visited. Research is underway investigating orchid germination and experiments into mycorrhizae associations. The plants grown during the research will be used in their orchid displays and for reintroductions into the wild.

Longwood uses BG-BASE as their collection management system. 15 volunteers collect phenology data on tablets which are synced to the database. They also use BG-Map which was developed to specifically work with BG-BASE.

Brooklyn Botanic Garden

Brooklyn Botanic Garden (BBG) was founded in 1910 by botanist Charles Stuart Gager, and opened to the public in 1911. It is an urban garden (16 hectares) with a community focus through the programmes they offer and their children's gardens. The plant collections are based on taxonomic groupings, such as peonies, magnolias, roses, orchids and lilacs. The peonies were in full bloom when I visited and were spectacular (Fig. 11). Gardens include the herb garden, lily pool terrace, Shakespeare garden and cherry esplanade. There is also a conservatory with different habitats represented and a separate bonsai collection (Fig. 12).



Fig. 11 Tree peony in full bloom at Brooklyn Botanic Garden.



Fig. 12 Brooklyn Botanic Garden bonsai collection.

Brooklyn Botanic Garden currently uses a database system called FileMaker Pro to manage their plant collections. This is software that can be customised by a developer. Brooklyn Botanic Garden has used it for about three years and prior to this was using BG-BASE and BG-Map. BG-Map is not compatible with anything else so they now have ArcGIS and a base map built in AutoCAD.

Brooklyn Botanic Garden has a wonderful library though visitors must check in if they want to visit as the library is behind a locked door. This restricted access means the library does not get as many casual visitors as they would like, however it is in a beautiful old building which in itself attracts people inside. Two staff work in the library. It is part of the plant knowledge centre so phone calls are directed to the office and volunteers answer these calls. Master Gardeners or experienced garden volunteers help to answer plant queries from the public. Their knowledge is invaluable and extremely useful when answering these queries. The library is part of a network of institutions that have specific horticultural or agricultural based libraries so they are able to help each other with various projects. The network, called the Council on Botanical and Horticultural Libraries, provides excellent regular newsletters. These newsletters are also useful for running horticultural libraries in New Zealand.

New York Botanical Garden

New York Botanical Garden (NYBG) is a 250 acre (101 hectare) garden in the Bronx, founded in 1891. The garden has about 500 staff, half of them seasonal workers. A large number of the staff are researchers that work overseas. The gardens are closed on Mondays, and on other days do not open until 10 am, which allows time for large tasks to be done before visitors arrive. Gardens include an azalea garden, conifer arboretum, family garden, maple collection and wetland trail.

The rock garden and native garden were definite highlights. The rock garden had a number of alpine plants and really captures the essence of a great rock garden. It's one of the best rock gardens I have seen with good use of colour, size and texture. I enjoyed the use of rock planter boxes to make very small plants stand out in a large area where they would otherwise get lost or go unnoticed (Fig. 13). The native garden had only recently been renovated when I visited (Fig. 14). The native garden displays different habitats and has a large water feature.



Fig. 13 Miniature plants displayed in the rock garden at New York Botanical Garden.



Fig. 14 Native flora garden at New York Botanical Garden.

New York Botanical Garden uses BG-BASE and BG-Map to manage their plant collections. There is a team of volunteers who collect phenology data using paper templates. The data is entered by the plant records team, consisting of two full time staff. The volunteers each cover a specific area which includes 20 plants that are part of the national monitoring network. Information collected by the volunteers is then entered into the national recording system for researchers to use, as well as BG-BASE.

Concluding comments

I was able to go on this trip because of the support from the Friends of the Auckland Botanic Gardens. The scale of the gardens, resources and number of staff and volunteers I encountered in these North American gardens is so much greater than here in New Zealand. The key roles of botanic gardens worldwide are conservation, research and education. The gardens I visited often excel in a chosen field and might put more resources in to one aspect of botanic gardens than another. At Auckland Botanic Gardens, the three key roles; conservation, research and education, are equally a priority and we achieve these to a high standard.

It was a wonderful opportunity to meet staff at gardens with similar roles to my own and learn some new skills and procedures to adopt at Auckland Botanic Gardens. I learnt different ways to specifically use the Auckland Botanic Gardens database, BG-BASE, but also things to consider for future database developments. Working at a Botanic Garden is like being part of an international club, where you can visit any city in the world with a Botanic Garden and are immediately welcomed to that place. Staff are always so willing to show you around and share their knowledge. The contacts and networks I made were invaluable.

