

**NELL JONES**

**USA TRIP REPORT 2016**



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**MAPS**  
**EAST COAST OF USA**



Longwood Gardens  
 Bartram's Garden  
 Chanticleer  
 Morris Arboretum

NYBG  
 The Met Cloisters  
 Wave Hill  
 The Highline  
 Brooklyn Botanic Garden  
 Central Park

WEST COAST OF USA



Yosemite National Park

Kings Canyon & Sequoia National Park

- San Francisco Botanical Garden
- San Francisco Tea Garden
- The Gardens of Alcatraz

## INTRODUCTION

I am the Deputy Head Gardener and Propagation Manager at Chelsea Physic Garden (CPG) and my main horticultural experience to date has been within this Garden. I am keen to expand my horizons in horticulture but have no desire to leave CPG as I feel I still have a lot to learn here and am definitely progressing in my career.

Together with my Head Gardener, Nick Bailey, we selected two main gardens in the USA that would expose me to much larger operations than I am used to. These were New York Botanical Garden and Longwood Gardens. In the case of Longwood I would gain experience in a garden is ornamental horticulture.

We chose the USA as we felt there would be many synergies in the range of plants that we/they grow and so I would be able to transfer knowledge back to the UK usefully. Additionally, CPG has a long horticultural connection to America, particularly through Philip Miller and so I was interested in exploring any historical connections.

Overall, I wanted to visit as many gardens and parks as possible during my trip to see different horticultural displays. The purpose of the second part of the trip was to spend time in Yosemite National Park and Kings Canyon & Sequoia National Park observing the native flora of these two amazing areas.

## OVERVIEW OF AIMS AND OBJECTIVES OF THE PROJECT

My aim was to be looking at the gardens from both a horticultural and botanical perspective but also to look at how they stage seasonal displays. In particular, I was interested in Longwood's seasonal displays as this is something that I have less experience of. Historically CPG was closed to visitors during the winter but we are now extending our open seasons and so these displays will become of even greater importance.

Additionally, I wanted to see the operational set up in these gardens including their visitor facilities and interpretation, access to plant database for the general public and management of volunteers.

I stated in my bursary application that I wished to achieve the following:

- **Propagation:** Gain deeper experience within propagation by spending time at both gardens within the propagation team learning and sharing techniques and issues.
- **Operations:** Interview Heads of Departments to understand operations within the individual organisations and observe how we can apply learned best practice at CPG.

- **Horticulture:** Work alongside gardeners to understand how they care for plants and displays and exchange views on our methods at CPG.
- **Glasshouse:** Work within glasshouse ranges to experience different horticultural approaches with curated collections.
- **Interpretation:** Look at the interpretation at both gardens to see if there are lessons to learn on how to connect people with plants.
- **Curation:** Understand how other gardens curate their collections including the day-to-day management of records, database and plant labelling by spending time with the appropriate people.

## ITINERARY

Saturday 3 September	Flight to New York
Sunday 4 September	Visit High Line
Monday 5 September	Visit The Met Cloisters
Tuesday 6 September	Begin placement at New York Botanical Garden
Thursday 8 September	Finish placement at New York Botanical Garden
Friday 9 September	Day visit to Wavehill
Saturday 10 September	Visit Brooklyn Botanic Garden
Sunday 11 September	Travel to Longwood Gardens
Monday 12 September	Begin placement at Longwood Gardens
Thursday 15 September	Finish placement at Longwood Gardens
Friday 16 September	Day visit to Morris Arboretum
Saturday 17 September	2-week self-funded trip to Yosemite and Sequoia National Park. Also visiting gardens within San Francisco
Tuesday 3 October	Depart San Francisco

## GARDENS & PARKS VISITED

### The High-Line



I visited this park at the weekend purely as a visitor so did not meet with anyone who worked there. Years ago I had been to a talk in London by one of the founders of the High Line and so I was keen to experience this unique space.

It is owned by the City of New York and maintained, operated, and programmed by Friends of the High Line, in partnership with the New York City Department of Parks & Recreation.

This raised rail track was opened in 1934 and closed in 1980 at which time some local residents campaigned to have it demolished and some to retain it as a feature of the neighbourhood. Ultimately it was not demolished and over the years it was left disused. Over time a self-seeded landscape grew on the out-of-use elevated rail tracks but it was a landscape that was not observed by many as there was no access. Out of curiosity two residents of the neighbourhood in the late 1990's secretly climbed up to the railtrack. What they found led them to found the Friends of the High Line group to enable them to advocate for the High Line's preservation and reuse as public open space.

In 2009, it opened as a public space. Piet Oudolf was chosen as the Planting Designer. He is renowned for using perennial plants including a strong use of grasses and blending all in a design to appear as a natural landscape. He was a natural choice for this project as it was desired that planting design reflected the feel of the disused rail track as experienced by those two residents in the late '90's – that is, to give the impression to visitors that this was a natural landscape within an urban environment. The species of perennials, grasses, shrubs and trees were chosen for their hardiness and sustainability with a focus on native species (nearly half of the plant species and cultivars US natives). Many of the species that originally grew on the High Line's rail bed were incorporated into the park's landscape.

The High Line has a strong commitment to sustainability and I was interested to see how this is achieved in a relatively difficult environment (although I felt that this tricky environment in many ways meant that sustainability was often the easiest/only option).



Naturalistic planting on the High Line – classic Piet Oudolf.

**Watering:** The High Line's green roof system is designed to allow the plants to retain as much water as possible. In addition, there is an irrigation system installed with options for both automatic and manual watering. The High Line landscape has porous pathways containing open joints, so water can drain between planks and irrigate adjacent planting beds, cutting down on the amount of rainwater that runs off the site into the sewer system. The plant selection favours native, drought-tolerant, and low-maintenance species that often need little supplemental watering.

**Site Specific Landscape:** Varied conditions of light, shade, exposure, wind, and soil depth on the High Line in its out-of-use state led to an incredibly complex variety of growing conditions, or "microclimates." The original, self-seeded landscape reflected this variation – where the High Line was narrow and sheltered by adjacent buildings, water was retained, soil was deeper, and vegetation was thicker, including several groves of tall shrubs and trees. Where the High Line was exposed to winds off the Hudson, the landscape was dominated by tough, drought-resistant grasses and wildflowers.

The current park landscape reflects the original microclimates of the High Line. By basing the planting design on naturally created plant communities, this has cut down on water and other resources needed to maintain it.

**Composting:** The High Line has on-site composting facilities that enable them to process much of the garden waste into compost. This reduces waste and also recycles valuable nutrients back into the High Line gardens soil without the need to add commercial fertilizer. Composting garden waste at the High Line also reduces

the need to have waste material carted off-site, thereby reducing their carbon footprint.

Another aspect that is of great interest is how the High Line organises its large **volunteer** population. They has a strong cadre of volunteers that covers many roles including docents (guides), gardeners, photographers, greeters, on-call supporters (for ad-hoc help), play partners and spring cutback volunteers.

**Spring Cutback Volunteers** – these volunteers help High Line Gardeners cut back all grasses and perennials in the park at one fell swoop between March 2 and April 10.



**The Promenaders!**

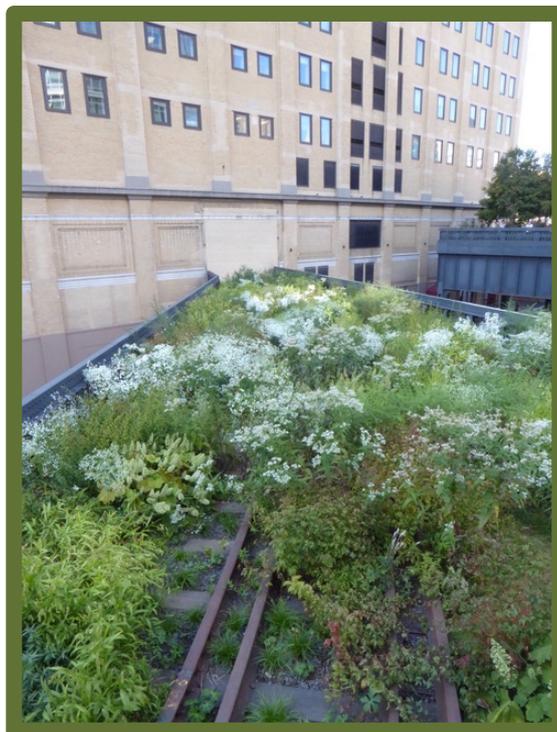
## **OBSERVATIONS**

My observations from this visit were that this was clearly a park and people used it much like a promenade at the seaside in the UK. They were walking through the landscape and because it felt so familiar they didn't really need to stop and look too closely at what they were walking through. This was also probably down to the fact that it is a pretty narrow path so everyone had to keep moving. It was fascinating to me that they felt so comfortable in the park – I felt this was a triumph of the planting design. The movement of the people through the park also, to me, reflected the old use of this space by trains moving cargo across the city. I, being interested in the specific plants, tended to get in the way of the promenaders!

There was very little interpretation and no labels for the plants as it was obviously intended as a wild landscape. I imagine during the high season there are volunteers handing out information and answering questions.

I walked the whole High Line and was impressed with the changing landscapes within it – you could clearly see the different types of planting within the different micro-climates. I would see plants here that I would see time and again in the other gardens I visited within their native plants gardens.

Overall I was really impressed by this park – it was well planned, designed and subsequently cared for. The design took into account the maintenance and sustainability issues excellently – the benefit of designing something in modern times. It was also very busy with average New Yorkers taking a stroll, or sitting on benches and grass areas and so fulfilled its mission as a park.



**Site specific planting.**

## The Met Cloisters



This museum is part of The Met Museum in New York and it is located on four acres overlooking the Hudson River in northern Manhattan's Fort Tryon Park. It is specifically dedicated to the art, architecture, and gardens of medieval Europe.

This is a modern building (dating from the 1930's) that incorporates some original European medieval architecture. The overall effect is not a copy of any specific medieval structure but rather an evocative setting for medieval works of art, objects and architectural elements.

It features gardens within 3 cloisters planted according to horticultural information found in medieval treatises and poetry, garden documents, and herbals.

I visited two of these planted cloisters – The Cuxa Cloister and The Bonnefont Cloister.

**The Cuxa Cloister Garth Garden** - the main ornamental garden, is divided into quadrants by crossed paths. Designed as a monastic garth garden, with a fountain at its centre, it includes modern cultivars as well as medieval species. The cross-walk symbolizes the crucifix and divides the garth into four sections that can represent the four gospels, the four evangelists and so on. The fountain symbolises paradise. This space of natural beauty in a monastery would have invited thought concerning the order of the natural world as designed by God himself and would be of enormous importance for those who rarely left the monastery.

**The Bonnefont Cloister Garden** is home to many species of herbs known in the Middle Ages. They are grown in raised beds according to use in medicine, magic, cooking, and arts and crafts.

In the winter, potted plants, many of them fragrant, remain on display in several cloisters. The Museum is decorated with evergreens, herbs, and fruits from early December until mid-January.



The Bonnefont Cloister Garden

## OBSERVATIONS

This was a relatively quick visit as it was quite a way out of town. I introduced myself to one of the Gardeners and she took me on a tour of the facilities behind the scenes and talked to me about working at The Met Cloisters. They have a very small area for propagation and storage of plants. They are a very small part of this museum which is mainly about the display of artefacts and not horticulture per se.

The gardens overall are very well maintained and particularly the Bonnefont Cloister Gardens which I felt had a strong correlation to the way that plants are displayed at The Chelsea Physic Garden (CPG). I was particularly interested in some of the support structures that they used for some plants that we find troublesome displaying such as *Urtica dioica*.

I felt that they made great use of their trees within a small space; such as an espaliered *Pyrus communis* and a *Cornus mas* grown and trained flat against a wall.



*Cornus mas* trained against a wall.

As with all gardens in this part of the world they have to be creative over the winter months to maintain visitor interest. They do this with Christmas indoor plant displays.

They follow CPG on Facebook and Instagram so knew about us an organisation and said they often drew inspiration from what we were doing. Subsequent to my visit the Head Gardener, Caleb Leech made contact with me and we agreed that we would stay in touch and that I would also make our Index Seminum lists available to him annually. I also hosted one of the Curators from The Met Cloisters in October in London when I returned to CPG.

# NYBG/125

**Length of visit:** 3 days

**Climate:** Zone 7 – temperature ranges from 35°C to -17°C. Winters are cold and summers are hot and humid. Generally precipitation is plentiful with averages of around 1,000mm annually however when I visited they were in the middle of a long period of drought.

**Soil:** Clay and glacial rocks. Generally acidic soil.

**Visitor Stats:**

- Total number of visitors per annum is over 1 million.
- An average day would be around 1,000 visitors.
- At weekends and holidays, they expect 2,000 – 8,000 visitors a day.
- Their low season is summer and they ensure that visitation is maximized at all times with quarterly seasonal displays and exhibitions – such as the Kiku and model train exhibition when they have fewer visitors.



Gardener, John, with praying mantis.

## Background

The Garden began during the 19th-century civic movement in New York City to create a cosmopolitan world capital. City officials, prominent financiers, and corporate citizens created an impressive roster of great cultural institutions, including public libraries, museums, zoos, and this botanical garden.

As a National Historic Landmark, this 250-acre site's landscape supports over one million living plants, including 30,000 mature trees in its extensive collections. Each year more than one million visitors visit the Garden. It has 50 gardens and notable collections including:

- The Rose Garden
- The Azalea Garden
- Children's Adventure Garden
- Conifer Arboretum
- Haupt Conservatory
- Ancient Forest
- Family Garden
- Home Gardening Centre
- Native Plant Garden
- Perennial Garden
- Rock Garden
- Orchid Collection
- Maple Collection
- Lilac Collection
- Wetland Trail.

The Garden is also a major educational institution. More than 300,000 people annually—among them Bronx families, school children, and teachers—learn about plant science, ecology, and healthy eating through NYBG's hands-on curriculum-based programming. Nearly 90,000 of those visitors are children from low income neighbouring communities, while more than 3,000 are teachers from New York City's public school system participating in professional development programs that train them to teach science courses at all grade levels.

NYBG operates one of the world's largest plant research and conservation programs, with nearly 200 staff members—including 80 Ph.D. scientists—working in the Garden's state-of-the-art molecular labs as well as in the field, where they lead programs in 49 countries.

This has always been a botanical garden with a three-fold mission—to conduct basic and applied research on the plants of the world with the goal of protecting and preserving them where they live in the wild; to maintain and improve the gardens and

collections at the highest horticultural standard; and to use the Garden itself as a venue for teaching the public about plant biology, horticulture, and the natural world generally.

In the course of a century-long effort, the institution has amassed over 7,300,000 plant specimens in the research herbarium, now among the four largest in the world; built the world's most important research library about plant science and horticulture; continued to steward this important American landscape; and taught millions of visitors to love and respect the world's flora.

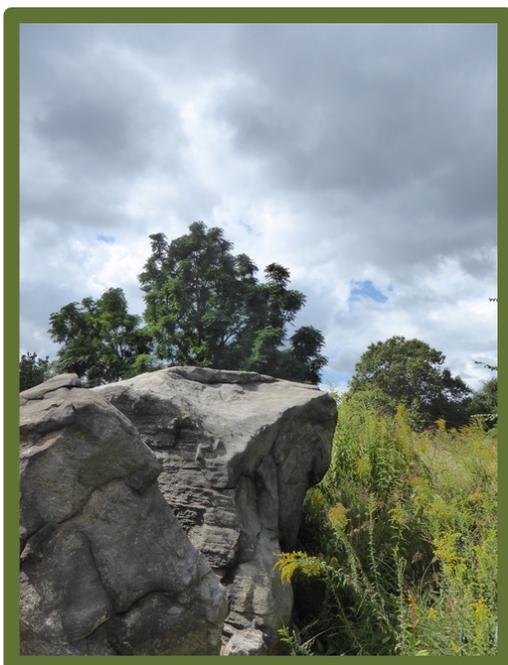
## Daily Notes

### DAY 1

**Kristin Schleiter** – Associate VP for Outdoor Gardens & Senior Curator was my host for the three days. She oversees planning, planting, and maintenance for the Perennial Garden, Herb Garden, Ladies' Border, Azalea Garden, Seasonal Walk, Home Gardening Center, Everett Children's Adventure Garden as well as seasonal plantings in the Visitor Center and entrances and herbaceous collections such as daffodils, peonies, and iris.

Kristin manages 13 Gardeners and many volunteers responsible for different gardens within NYBG.

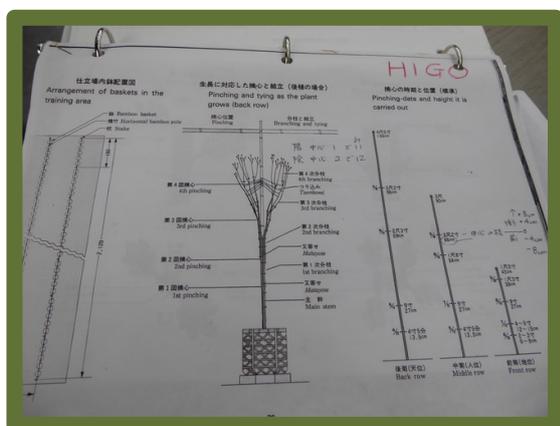
On the first day she took me on tour of the garden for general orientation and told me that the organisation employed 450 staff in total and within that there were about 80 horticultural staff.



**View from Native Plants Garden with a characteristic glacial erratic in the foreground.**

## Kiku

After the tour with Kristin I met with one of the gardeners, Yuki, who was responsible for a very important annual display at NYBG called 'kiku'. This is a Japanese art of training chrysanthemums. She spent 3 seasons in Japan learning the art.



Instructions for Higo style kiku.



Yuki with various kiku styles.

The Japanese art of training chrysanthemums dates only to the 19th century, but the Japanese reverence for the flowers goes a long way back in history. The chrysanthemum has long been associated with the emperor in Japan and for this reason gardeners in Tokyo began training chrysanthemums as a tribute to their ruler in the 1800's.

The original Chinese species (possibly *C. millefolium*) flowers were small and yellow but the Japanese developed larger flowers and trained them in different styles according to the size and habit of the plants. The disc and ray floret shapes are varied from narrow, flat and spoon-shaped, feathery or quill-shaped and this adds to the attraction for visitors. Yuki said that the petals close in different ways – but not every day and that visitors see this and find it interesting. However, I'm not sure I understood her correctly as I can't find any information on this.

Yuki showed me a book of instructions for all the training styles and as expected, it was very precise in terms of flower size, height, number etc. At NYBG, they have, however, begun to do more freestyle forms such as an organic setting on a fallen log. Additionally they are experimenting with new styles where the roots are being

exposed. This is being driven by a volunteer who is an expert in bonsai and so applying his skills to a new art form.

### **Different Styles**

**Cascade** – this is for plants are tall and branching. They will grow one or sometimes two plants in one pot and then grow them onto a frame. These in-house built frames will usually be made of bamboo and chicken wire and can take many forms such as bridges, butterflies or trees. They also grow these types into a standard.

The method is to train them to the end of the frame and pinch out buds and tie in. They then continue to pinch and tie-in over several months.

**Edo Style** – this is for medium sized flowers and the effect is supposed to be like driving rain.

**Higo** – trained like chopsticks. They have to be tied in to a central cane. This is very precise and the heights have to be exact. Apparently, Samurai warriors trained chrysanthemums in the Higo style to teach themselves discipline as it is very complicated and requires high levels of dedication and patience.

### **Timetable**

- Overall, the whole process takes 11 months, the kiku display lasts one month and is then composted.
- Cuttings are taken in the autumn and kept at a long day length all winter to prevent budding and to encourage foliar growth.
- By August of the following year they are shaded to shorten the day to encourage flowering by October.
- This is a resource heavy display –July – October they have 3 people on Kiku full time. From October – January – 2 people and from January – July – 1 person.

At the end of the afternoon I deadheaded and watered the plant displays with The Kristin's second in command, Mobee.

## **DAY 2**

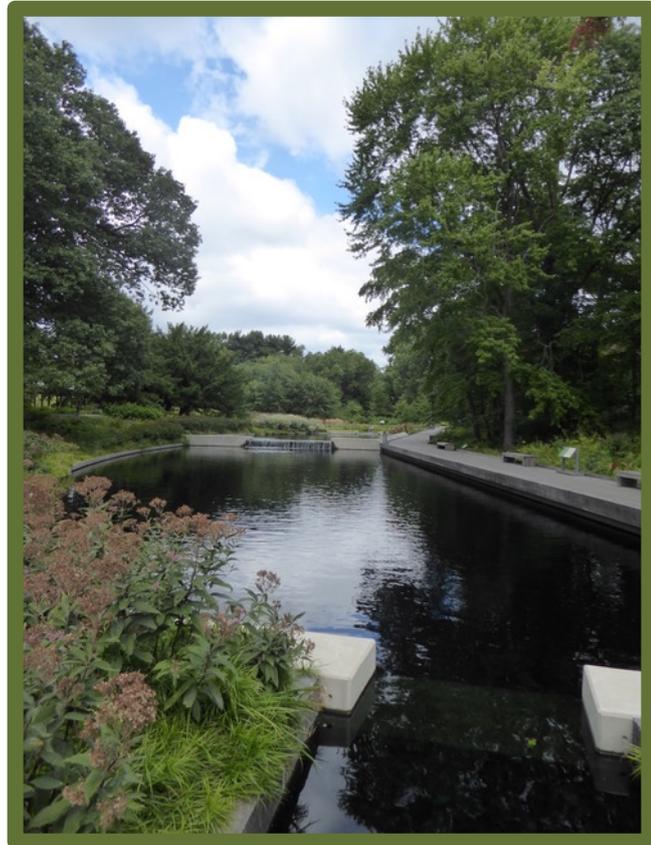
### **Native Plant Garden**

This garden was opened in 2013 and designed by Sheila Brady. It is 3.5 acres and is adjacent to the 40-acre ancient woodland, the Thain Family Forest. It seems great position for this garden because the Forest is a remnant of the forest that originally covered the whole of Manhattan before it was settled. The plants contained within the NativeGgarden are native to northeastern North America (although incongruously there are some mature *Torreya nucifera* that for obvious reasons

couldn't be removed). Nearly 100,000 native trees, shrubs, wildflowers, ferns and grasses were planted in a naturalistic style but with some very contemporary hard landscaping. The garden itself encompasses many different habitats, including shaded woodlands, glades, a sunny meadow and wetlands.

**Pool at centre of Native Plants Garden.**

The pool at the centre of the garden is fed by recycled storm water held in underground cisterns holding 50,000 gallons of rainwater. It is purified by aquatic plants and a sophisticated filtration system before being re-circulated over a series of stone weirs.



The plants and the water make this a hotspot for wildlife in the garden including squirrels, chipmunks, frogs, birds, butterflies and a snapping turtle!

This was the only day that I worked in the garden – for the morning I removed duckweed and algae from the pool with two of the gardeners. Whilst I was working, I met Don Gabel, Director of Plant Health (IPM Specialist). He had come to put HO<sub>2</sub> into the water and this floated up the algae so that it could be fished out. He told me that when they first established the pond there were large amounts of both algae and duckweeds and they had to introduce HO<sub>2</sub> several times. Over two years they had to do this less because they have dyed the pond and removed any remaining weed by hand. By these methods, they are able to keep the weeds in check relatively well.

Don also gave me some very interesting information about Systemic Acquired Resistance. This is an area that he is very interested in and is an organic method to increase a plant's resistance to pathogens.

## **Systemic Acquired Resistance**

There are a number of products being sold in the USA that contain Harpin protein (isolated from the fire blight pathogen *Erwinia amylovora*) that activates the plants' protective systems, similar to the immune system in animals. The plant 'believes' it is under attack and responds with increased vigour and growth.

Firstly, there is what is called the hypersensitive reaction (HR), which induces the few cells that are in direct contact with *Erwinia amylovora* to shrink and collapse, effectively halting the spread of the infection to a small spot on the leaf.

Secondly, the activation of HR then triggers a whole plant immune response called Systemic Acquired Resistance (SAR). This provides long-lasting protection against a broad spectrum of pathogens. It acts a little like a vaccination in a human being.

Thirdly, photosynthesis is increased resulting in more efficient growth with higher nutritional levels. Studies have shown that nutritionally dense plants are not as appetising to insects.

Don said that they used these products particularly within their propagation areas and also with plants that were ailing and it had been very successful. One particular area he had used it was on a very large Paeony display and he felt that it had really improved the vigour and longevity of the plants and consequently the display.

## **Seasonal Displays**

In the afternoon I worked with Mobe Weinstein, on the seasonal display planters that are at both of the main entrances to the garden. These planters are designed by an outside designer and change every year and also seasonally. They are kept pristine and attended to every day for maintenance such as weeding, deadheading, changing out of plants and watering.

There are two main entrances and the displays have a continuity of planting but different colour schemes. In the spring the displays include violas, hyacinths or tulips; in summer, zinnias, passionflower or *Colocasia sp.*; in the autumn, chrysanthemums or salvias and holly berries and evergreen conifers in the winter.

When I visited the containers contained plants such as:

### **Scheme 1**

*Scaveola* sp.  
*Salvia* sp.  
*Lysimachia nummularia*  
*Ageratum* sp.  
*Alocasia* 'Portodora'  
*Bismarckia* sp.

### **Scheme 2**

*Alocasia* 'Portodora'  
*Ipomoea batatas*  
*Lantana camara*  
*Ruellia equisetiformis*  
*Hibiscus acetosella* 'Jungle Red'  
*Zinnia* sp.



Seasonal planters.

### **DAY 3**

This was a day of meetings

**Kristine Paulus** – Plant Records Manager

**Michael Hagen** – Curator Rock & Native Plants Garden

**Kristian Primeau** – Conservatory Manager

**Barbara Corcoran** – Vice President for Continuing and Public Education

**Steven Simon** – Head of Information Services

Lunch:

**Deanna Curtis** – Curator, Woody

**Todd Forrest** – VP Horticulture

**Mark Hatchadorian** – Director of Nolan G House, Propagation & tropical Collection, Orchid Curator

**Kristin Schleiter**

## Plant Records

There is one Plant Records Manager and she is responsible for keeping the records up to date, producing labels and answering external queries about the plant collections – including providing samples for scientific research. She has a volunteer who produces the labels and they have an up-to-date laser engraver from which they produce 1,000's of labels a year.

Everything gets accessioned and is issued with a metal embossed tag. Some plants then get a display label depending on where it is in the garden. They try to inventory each part of the garden every 5 years and this is done by students who are on rotation. One of our issues at CPG is ensuring that records info is recorded by gardeners in terms of plantings and deaths etc. She has the same issue and because their gardeners don't have email, she accepts the information by any method such as text, phone call or email – she's just pleased to get it! However, I got the impression that the levels of change within the garden aren't as constant as they are at CPG so this was probably less of an issue.



Plant records since the garden was established.



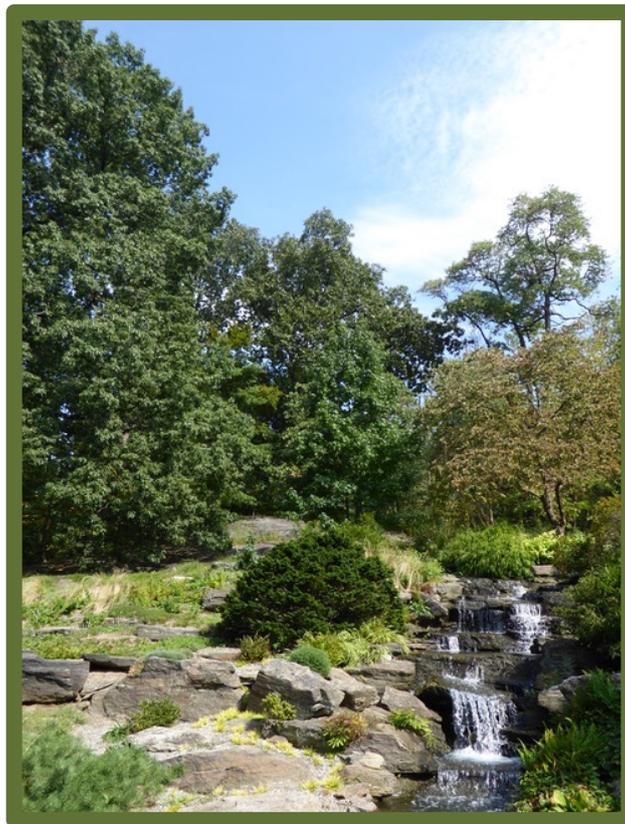
Different labels through the ages.

They use BGBase but are worried that there is no succession planning at that company so what is the future? We discussed IrisBG which we use at CPG. One of the key benefits she feels of BGBase is Garden Navigator – this allows their plant collection to be online and accessible. When they first went live they were worried about not having enough/correct information about the individual plants on Garden Navigator but she said that eventually they had to accept that it wouldn't be perfect but would improve over time. This has been the case. I felt it was excellent and would definitely add to the visitor experience but also to the mission of connecting all people to plants whether they are visiting or not. They have hundreds of external lookups in Navigator every day.

They have collected phenology data since 2013. **Phenology** is the study of the timing of natural events in relation to weather and climate and I had not come across this term before. They have a team of volunteers in every week to do this – they set

up a group of walks on Garden Navigator as a map and then the volunteers do the same walk and observe the same plants every week. Each week they record if a specific plant is in flower or not. These tend to be special specimen plants and they track approximately 400 plants in total – around 200 taxa. As this is ‘Citizen Science’ when the results are entered into the database, they are designated as ‘volunteer’ data as the results are not always the most accurate.

## Rock Garden



The Rock Garden

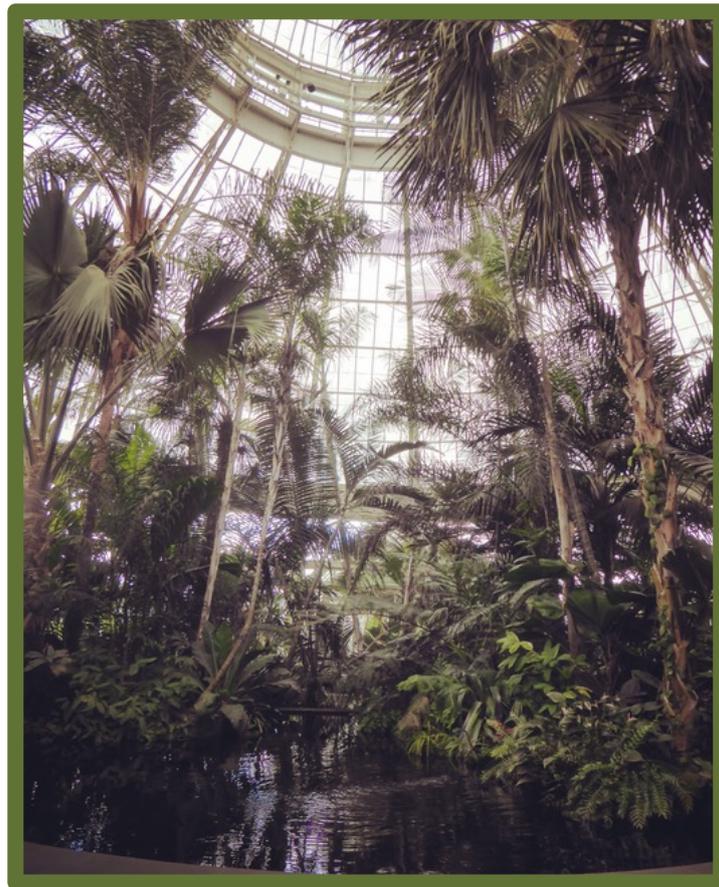
In the afternoon, Michael Hagan showed me around the Rock Garden. This 2.5 acre garden is the oldest garden in NYBG and was built in 1936. The building of it was a depression era works project. During The Great Depression in America in the 1930's a government department was set up to employ millions of out-of-work people to carry out public works projects such as building roads and public buildings.

The design is supposed to represent the journey up a mountain – as you go higher up the mountain, the height of the plants goes down. As he has a strong interest in alpinism and rare Mediterranean plants, Michael is keen to develop the collection. He wants to bring down the overall height of the plants and he has been working on this over the last few years. When he took this area on, it was relatively neglected and overgrown.

The garden displays tens of thousands of flowers from mountainous regions throughout the world. Features include a waterfall, a large alpine meadow and a sand bed for American West alpine species.

To enter this garden you needed a special ticket and so it was quite quiet. The access path ran around the 'valley floor' but there was no access further up the slopes which I imagined meant that visitors would quite often walk on the planted areas to get up close to the plants.

### **Conservatory**



Palm display within The Conservatory.

The Conservatory houses more than 3,000 specimens displayed in four distinct environments. On entering the conservatory, you encounter the largest collection of New World Palms exhibited anywhere under glass. Then you move through The Lowland Tropical Rain Forest, The Upland Tropical Rain Forest, The Desert of the Americas, and The Desert of Africa. Throughout the Conservatory there is good interpretation about the plants and also about the inter-relationships among the species within these different ecosystems. The effects of climate on the evolution of plant life and the interaction of plants with animals and humans is also shown.

In addition to the permanent exhibitions, the Conservatory features two galleries that are dedicated to the changing, seasonal flower shows that have been a long-standing tradition at NYBG. They have large budgets to put on these shows as in quieter times of the year – such as the winter – they really help to raise visitation. For example, for the Christmas Show they have a £125,000 plants budget.

### **Continuing Education**

The Garden teaches people of all ages about plants and the environment through its educational programs in the **Everett Children's Adventure Garden**, the **Ruth Rea Howell Family Garden**, the **Home Gardening Center**, the **Graduate Studies Program**, the **School of Professional Horticulture**, and the largest **Continuing Education** program of any botanical Garden in the U.S.

### **Adult Education**

They run the biggest certificate programme in the US – it is 40 years old and is split as follows:

- Horticulture
- Botanical Art
- Horticultural Therapy
- Botany
- Gardening
- Floral Design
- Landscape Design

These courses will result in a qualification. They also run classes that are not certificated or you can take the certificated classes and not sit the exams.

The non-certificated classes are for amateurs and cover subjects such as photography, yoga, art, crafts, soap making, aromatherapy and wellness.

In addition to classroom teaching onsite, some classes such as Tai Chi are taught outside and they also have a Midtown Centre near to Grand Central where people can take classes. The classroom block at NYBG is extensive.

One of the gardens onsite, The Home Gardening Centre, offers a series of model gardens and display areas designed to demonstrate how a visitor may apply horticultural techniques to their garden at home – including basics of composting, plants for tricky areas, design etc. On select weekends throughout the year, experts offer advice on the best plants for home gardens and demonstrate horticultural techniques. Handouts and tip sheets are always available.

Finally, there is an impressive library containing 578,000 books on horticulture, botany and landscape which has been open to the public since 1900. They also run a public advice service for general gardening from here – anyone can call or email for advice. In addition to this, they also produce leaflets and guides covering many aspects of horticulture.

### **Children's Education**

NYBG has two outdoor spaces for children's education

- **The Family Garden** which is included in the price of the ticket and visitors can drop in and enjoy activities such as cooking demonstrations, family-friendly activities; and hands-on gardening.
- **The Everett Children's Adventure Garden** where nature workshops and other classes are held.

Children's education is split as follows:

1. **Children's Gardening Programme** - where children learn to care for their own garden plot – sessions take place on the weekends and in the holidays. Starting from age 3 and upwards.
2. **School group events.**
3. **Teacher professional development courses** - these teach the teacher to deliver horticultural content within the curriculum.

They plan to increase the gardening programme opportunities, so that twice as many children, parents, and teachers (from 50,000 to 100,000) can learn how to grow organic fruits and vegetables, as well as make the important connections among plants, gardening, nutrition, and the benefits of a healthy lifestyle.

### **Informal Activities**

The Garden puts on many informal activities – whilst I visited, they had a Blues, Botany and Beer event. This was ticketed and had a band, craft beer stalls and lectures on the botany of brewing. Overall, this was pretty low impact on the garden and very well attended. I was told that this type of event is taken up by young professionals who want to attend something 'cool' in a beautiful environment but don't want to do a class. This is part of a diversification in their offering.

Winter is a time where visitation can be low and so the Christmas events are very important to the Garden. The Holiday Train Show attracts thousands of people and the Winter Wonderland Ball is a fundraiser for the Children's Education Programme.

## **Library**

The library is an incredible resource that has been open to the public since 1900. They have 578,000 books on horticulture, botany and landscape and add 4,000 new books each year. They are a reference library and also run the public advice for general gardening from here – online plant guides are available but the public can also call or email.



**The Archive.**

They have an enormous archive with a controlled environment that contains old plant catalogues, botanical art, historical index semina, plant collectors' notes and correspondence between renowned horticulturists. Simon showed me into the Library's Rare Book Collection which contains pre-Linnean manuscripts and printed books including one-of-a-kind works dating back to 1190 AD. He showed me a book from 1739 – *Horti Medici Chelsiani* – which was about CPG and the plants that we grew in the 18<sup>th</sup> Century.

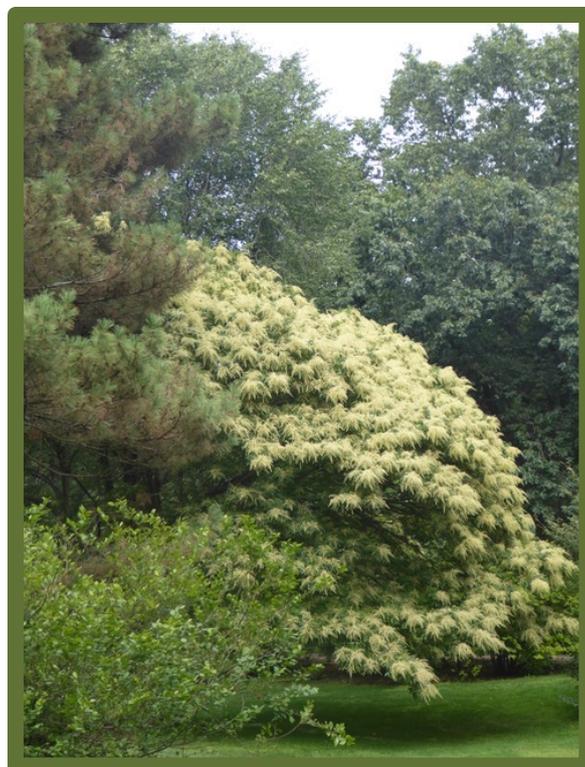
## OBSERVATIONS

I didn't get to work here as much as I would like but actually I think that by meeting so many people I probably did make the best use of my time. I had also wanted to visit The Thain Family Forest but it was closed because of a fire warning.

I found the unionised working environment very interesting and totally different to the set up at CPG. Roles were clearly defined and not to be encroached upon. So, a Curator of a collection would not be able to work with a Gardener to implement a vision in a hands-on way, as that would be a Gardener's job. There was also a clear separation in that the Curator would be deciding the direction of a collection and the Gardener implementing the vision but taking direction from someone other than The Curator. It made me appreciate the level of autonomy and input I have at CPG.

So in some ways the workforce was empowered (in that their jobs were protected) but in many ways I felt they weren't. For example, Mobee who looked after the seasonal displays did not (I believe) have input into their design even though she was an experienced gardener. I was only there for a few days but wondered if development opportunities for the gardeners were perhaps missed.

I was really interested in the Phenology that the records volunteers carried out and felt that this was something we could consider doing to add to our climate records at CPG. It seems like it is something that many American gardens do.



*Rhus chinensis* 'September Beauty'

## Wave Hill



I met Harnek Singh, Gardener from Wave Hill Garden at CPG a couple of weeks prior to my visiting New York and he invited me to spend a day with the team there.

It is a 28-acre estate in the upper section of The Bronx, in New York City. The garden is beautifully located overlooking the Hudson River with views across the river to the New Jersey Palisades.



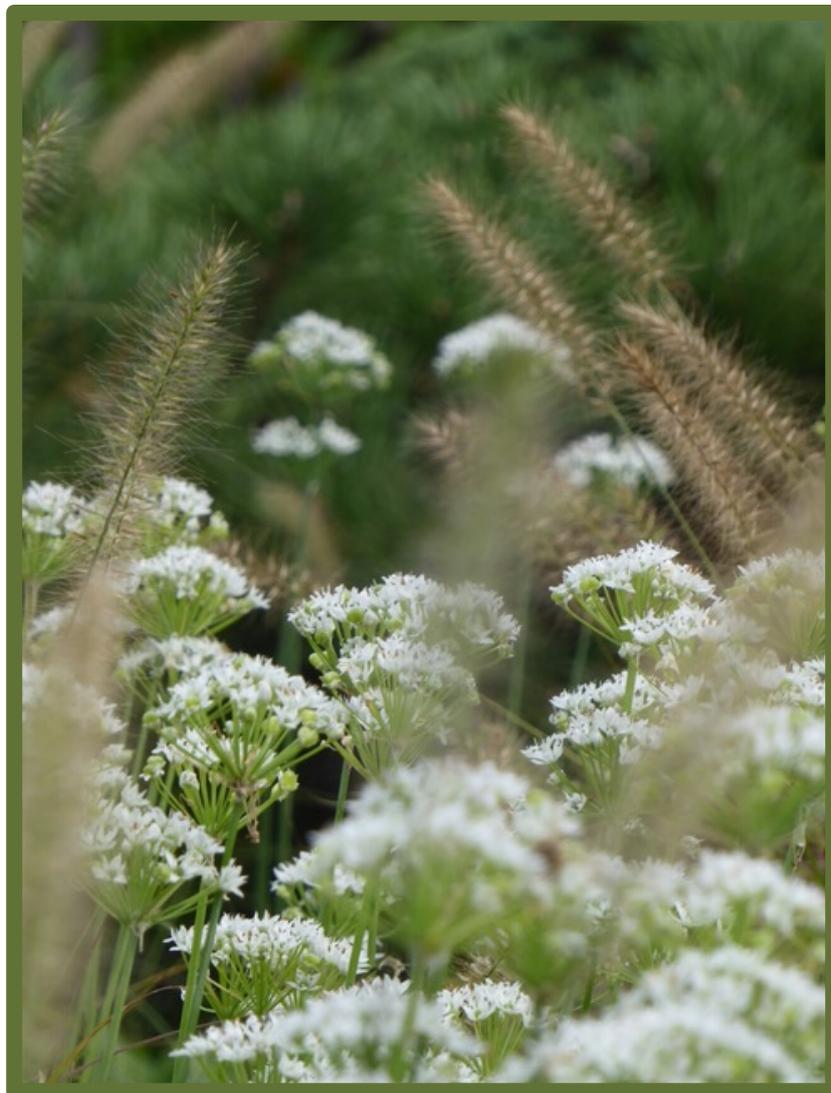
The Flower Garden looking out to the Hudson and the Palisades.

It has a small staff and each team member has a garden area that they look after together with a glasshouse. I worked with Harnek in the morning in the flower garden that consists of a mixed perennial planting that was pretty riotous but within a formal, symmetrical design. I was mainly deadheading and watering. However, for most of the day he kindly showed me around the property.

Other garden areas included The Wild Garden that was a favourite of mine – the plants were allowed to self-seed and spread about to give an informal effect. In some areas I thought that this might have gone too far with some species out competing others. The overall effect was naturalistic and this was enhanced by the views out over the Hudson.

## OBSERVATIONS

It's a really lovely garden with great views and you can see that it has organically grown with separate gardens dotted around the estate and in some cases not really connected to the whole. However, I like that. It had a relaxed feel about it and there were many areas where you could just admire the view or maybe walk amongst the very interesting conifer collection that included *Pinus strobus* 'Torulosa', *Thujopsis dolabrata* 'Latifolia' and *Pinus kwangtungensis*.



The Wild Garden

## Brooklyn Botanic Garden



Brooklyn Botanic Garden was founded in 1910 when New York State legislation reserved 39 acres for a botanic garden. Today the Garden comprises 52 acres in total and encompasses many different garden spaces containing around 20,000 accessions. The Garden is right in the heart of Brooklyn and has very strong links with the community. It runs outreach on projects such as urban greening and provides free gardening tip sheets and a help line. The library and rare books room is also free to experience. BBG has a large visitor centre to help visitors get the most out of their experience. In support of the curation of the living collection, Brooklyn Botanic Garden maintains a herbarium of approximately 297,000 preserved specimens, including approximately 7,000 specimens collected from the grounds, and a botanical library of approximately 56,500 volumes.

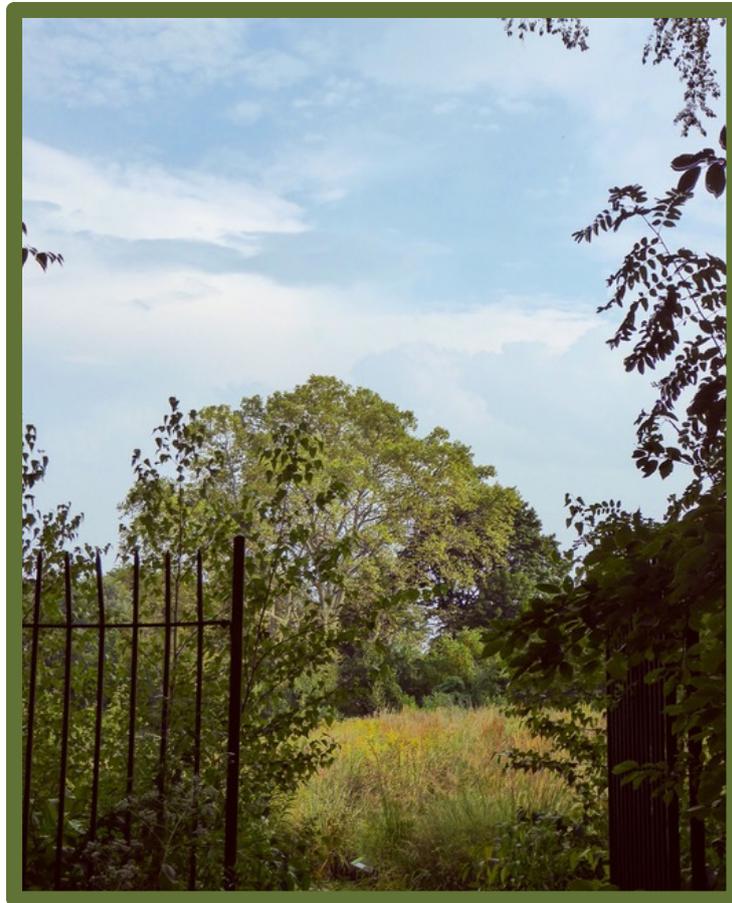
My two favourite parts of the garden were:



**The Rock Garden.**

**The Rock Garden** that was built in 1917, it was the first rock garden of considerable size in an American botanic garden. It was divided into 3 areas – Woodland; Acid-

loving Plants and Scree. There were many mature trees, especially conifers including *Pinus densiflora*. Many of the rocks had been found within the Garden and used when it was built.



The Native Flora Garden.

The **Native Flora Garden** that was opened originally in 1931 but reinvigorated in 2013 exhibits native plants growing in the New York metropolitan area, a region known for its natural diversity. Three main eco-regions are represented in the Garden: coastal plain, piedmont (a plateau area between the Appalachian Mountains and the coastal plain), and highland. Within these eco-regions a variety of plant communities exist, including serpentine rock, dry meadow, kettle pond, bog, pine barrens, wet meadow and stream, deciduous woodland, limestone ledge, and conifer forest.

### **OBSERVATIONS**

The Native Flora Garden is a great example of connecting people to local plants within the context of a botanical garden. Within a few acres I was able to get a feeling for the flora of the local area and also gain some understanding of plant communities. When visitors recognize plants it encourages them to explore more, especially where there is good interpretation (which there was). I felt that BBG had a more intimate and accessible feeling than the larger New York Botanical Garden

## Central Park



Central Park in Manhattan, New York City is the most visited urban park in the US with over 40 million visitors. It was established in 1857 and officially completed in 1873 after more than 10 million cartloads of material had been transported out of the park and more than four million trees, shrubs and plants (around 1,500 taxa) were transplanted into the Park. The park currently covers 843 acres and by the early 20<sup>th</sup> century had fallen into disrepair. By the 1960's was in a chronic state of decay and many parts of it had become a 'no-go' area. However, from the 1970's onwards, improved park management attracted investment and it is now a beautiful landscape for visitors and locals to enjoy.

I hired a bike and cycled around the park to fully experience its diverse landscape but the two areas that really caught my attention were The Mall and The Conservatory Garden.

### **The Mall**

The Mall is a quadruple row of American elms (*Ulmus americana*). It is one of the largest and last remaining stands of American elm trees in North America. The population of *Ulmus americana* was as badly hit by Dutch Elm Disease as the Elm trees in the British (*Ulmus minor var. vulgaris*) and European landscape. The trees run either side of a quarter mile path and form a connected canopy overhead.

### **The Conservatory Garden**

The Conservatory Garden is Central Park's six-acre formal garden. It is divided into three smaller gardens, each with a distinct style: Italian, French, and English.

The **Italianate** centre garden is composed of a large lawn surrounded by yew hedges and is bordered by two allées of spring-blooming pink and white crabapple trees. At the end of the lawn is a very impressive tier of hedges and steps leading up to a magnificent Wisteria pergola.



The Wisteria pergola and tiered hedging.

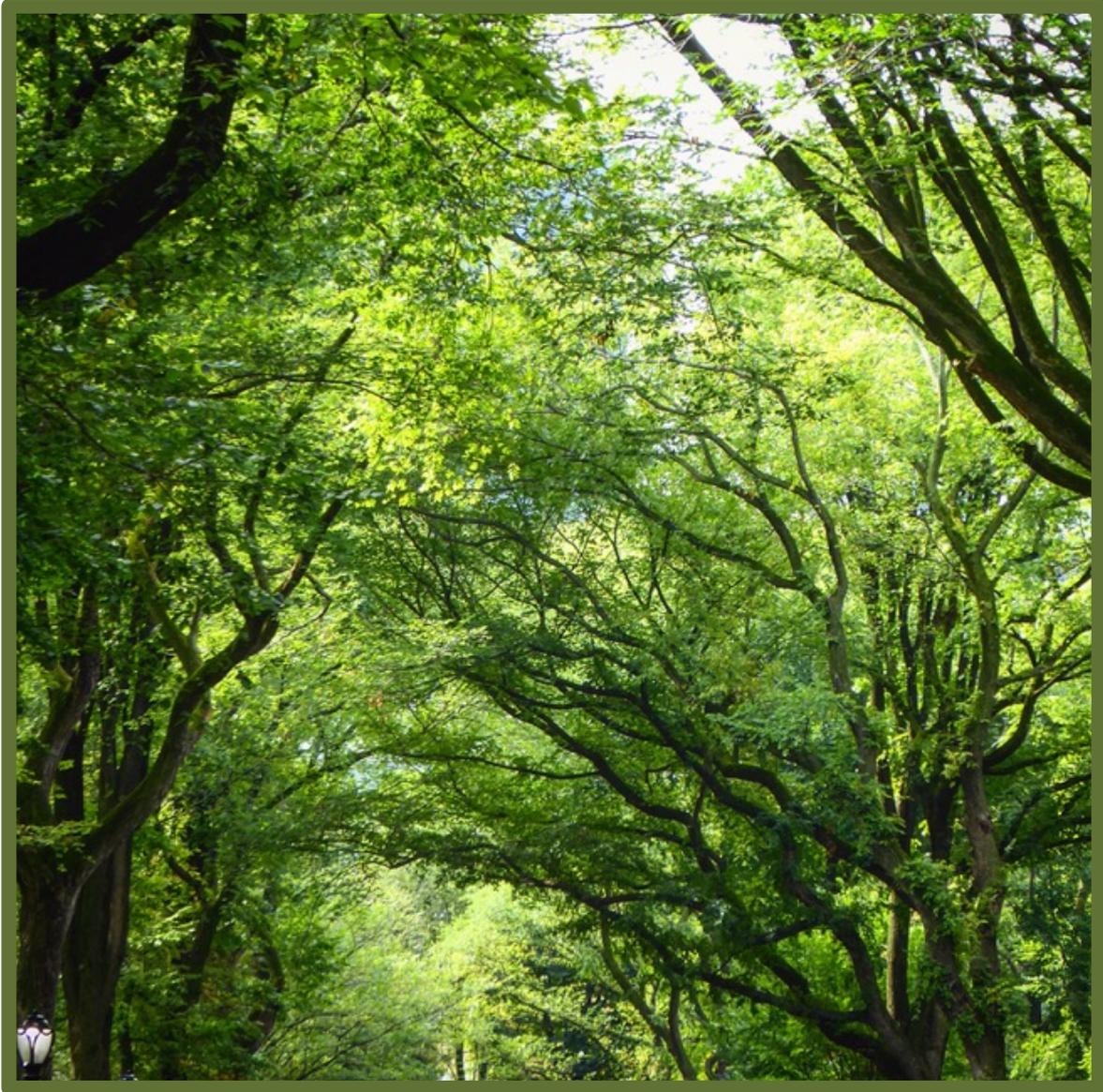
The **French-style** garden is arranged into parterres with mixed perennial plantings including spring tulips, Korean chrysanthemums and Japanese holly.

Within the **English-style** garden, there are five mixed borders of trees, shrubs and perennial plants, and five seasonal beds featuring spring bulbs that are followed by annual flower displays. A slope of woodland plants lines the western edge of this garden.

## **OBSERVATIONS**

The park and the gardens are very well maintained and well used by the public. I did feel that there could have been more interpretation, particularly in the highly cultivated areas. I loved to see the American Elms – I haven't seen a mature Elm of any species before and to see them in such numbers was really dramatic and gave me a very good impression of their mature form and why their loss in the English countryside changed our landscape so much.

Within the formal Conservatory Garden, the Wisteria pergola was incredibly impressive. It was so generously sized and because it was raised up above the rest of the lawns below the height was further exaggerated.



The Mall with rows of *Ulmus americana*.

## Longwood Gardens



# LONGWOOD GARDENS

**Length of visit:** 3.5 days

**Climate:** Zone 7a – temperature ranges from 35 to -17°C. Winters are cold (the coldest months January and February) and summers are hot and humid. Generally precipitation is plentiful with averages of around 1,000mm annually however when I visited they were in the middle of a long period of drought. Snowfall is highly variable but the average seasonal snowfall is around 60cm however, some winters can bring over 2m of snow.

**Soil:** Heavy clay soil.

**Visitor Stats:**

- They welcome 1.4m visitors a year and have a membership of 60 – 70,000.
- They feel that the demographic is changing. Previously it was a more mature horticultural person visiting over long periods of time. Now with events such as Nightscape in the evening, they are attracting younger crowds – date nights, 20 something's.
- The majority of their visitors are from the US but they have many International guests particularly from China, Japan and India.

## Background

This privately funded garden is open to the public and was laid out by Pierre S. du Pont in 1907. It started small and over the next century expanded from 202 acres to 1,077 acres as he bought up surrounding land. It is based near Kennett Square, Pennsylvania and is one of the premier horticultural display gardens in the US. It is open to the public year round and is famed for its seasonal displays; in particular the Chrysanthemum festival and the Christmas lights display. Additionally, they have several renowned plant collections such as *Buxus* sp., *Orchidaceae* and *Rosa* sp. It is funded by an endowment set up by Mr du. Pont and runs on a yearly budget of \$50m with a staff of 1,300 employees, students and volunteers.

The outdoor gardens under cultivation amount to around 200 acres and include diverse areas such as Peirce's Woods, Idea Garden, Flower Garden Walk, Topiary Garden, Fountain Garden (currently being re-imagined and opening in 2017) and the Hillside Garden. These areas are highly managed.



**\$90m Fountain Garden redevelopment.**

In the Natural Lands – which are the less managed areas in the wider estate – can be found a 100-acre American native plants meadow, extensive woodland and a managed wetland area. In total, the publicly accessible areas of the garden amount to 350 acres.

The Garden's mission statement is to inspire people through excellence in garden design, horticulture, education and the arts.

## **DAILY NOTES**

### **Ed Broadbent, Head Gardener – Outdoor Display**

On my first day I was taken on a tour of the garden and orientation with Ed Broadbent who is responsible for outdoor display but not turf and trees. In total, he looks after around 200 acres. He has 15 full-time gardeners looking after 3 sections under him. Each section has a total of 3, 4 or 5 gardeners. They do have some team days but tend to work solely within their sections. Ed doesn't closely manage the teams on a day-to-day basis as he has team leaders that he has worked with for many years. He tends to give them a list of priorities and then checks in with them weekly to make sure they are on track.

There are very focused on seasonal displays – they must have a display for Mother's day, Christmas, Easter etc.

## Kevin Murphy – Nursery production

Kevin has 4 gardeners under him plus 4-5 seasonals and 2 part time members of staff. They grow around 70% of their plants in-house and buy in the other 30%. He has around 8 poly tunnels and 50 acres of nursery space much of which is fenced to protect the plants from the deer. 2 acres of it are fed by drip irrigation and fertiliser can be applied through this. They use an all-purpose fertiliser and a portable Dosatron in addition to the drip lines. This area is in full sun.

The production methods are commercial – they work to a ‘crop list’ that tells him what is required, when it is required by, what size/form of plant and how many plants. This is all electronic and he can update his ‘clients’ within the garden as to progress and any issues.

Within the nursery, they use fibre pots (unless the pot size is very large) and these then get composted.

He is responsible for running the team to produce the Chrysanthemums for the ‘Mum Festival’. This is a highly labour and space intensive endeavour but allows them to have a very interesting display at a time of year when there is less to see in the garden. The horticulturist who is responsible for producing all the Kiku actually taught the horticulturist at NYBG. I found it interesting that they grafted Chrysanthemums onto *Artemesia annua* in April/May/June to get the taller forms. Being an annual, some of the Artemesia actually die before the festival starts so they have to produce many extras in reserve.



Outdoor nursery space.

## Matt Taylor- Research Manager – Indoor Display

There are 5 aspects to the area that Matt is responsible for:

- Plant Trials
- Plant Breeding
- Plant Conservation
- Plant Exploration
- Plant Cultural Research

It is a very technical area and demonstrates Longwood's commitment to conservation and a greater understanding of plants. He has a team of 8 staff covering plant research, soils & compost and IPM.

Before bringing plants into the garden, they will trial them for garden worthiness within Matt's area. Suppliers will send him seeds to grow and evaluate or a gardener might ask him to do so. If they are proved suitable for Longwood and are incorporated into plantings, his team will check back with the garden team at the end of the season to evaluate how the plants actually performed in the Garden.

He also takes part in plant exploration trips and recently came back from Vietnam with Kew and showed me some of the plants that they had brought back.

At Longwood they manage 2 fields for topsoil. All surplus compost and growing media is put onto the fields and any excess water (grey water) is sprayed onto these fields. They process about 6,000m<sup>3</sup> of organic waste on their five-acre composting facility annually and use it in the Gardens as mulch and compost. They are in the process of building a new waste management site that is better laid out and with very modern equipment.

They have a plant-breeding programme and now have a few 'Longwood' cultivars such as *Buxus sempervirens* 'Longwood' and *Camellia japonica* 'Longwood Centennial'. Breeding projects aim at creating superior plant varieties, while focusing on optimising flower production and drawing out recessive traits to create a striking new cultivar.



Tissue culture.

One area that I was very interested to observe was their tissue culture lab. They produce new plants using somatic embryogenesis. This is a process of producing a plant from a single cell or group of cells that are not normally involved in the development of embryos. They tend to use the apical meristems. This has great application for plant breeding, conservation and propagation. Also, it is used extensively at Longwood to maintain their collection of Chrysanthemums of which they have several old and interesting cultivars. This virus prone collection is important to maintain as they are used in their huge annual Chrysanthemum displays. This method enables them to produce clonal plants that are virus free.

### **Bill Haldeman – Natural Lands Manager**

Bill is responsible for all the area outside of the highly cultivated areas and this includes meadows, woodlands and wetlands.

The meadow is around 100 acres of native plants in a meadow setting surrounded by woodland. The major flowering plant at the time of my visit was *Solidago* sp.

### **Meadow plants included:**

- *Ageratina altissima*
- *Asclepias syriaca*
- *Baptisia australis*
- *Eutrochium fistulosum*

Full list here:

[https://longwoodgardens.org/sites/default/files/wysiwyg/Meadow\\_Plant\\_List\\_Wildflowers.pdf](https://longwoodgardens.org/sites/default/files/wysiwyg/Meadow_Plant_List_Wildflowers.pdf)

### Woodland species included:

- Many species of *Quercus*
  - *Q. alba*
  - *Q. rubra*
  - *Q. coccinea*
  - *Q. phellos*
  - *Q. macrocarpa*
  - *Q. bicolor*
  - *Q. palustris*
- *Cornus* sp.
- *Amelanchier* sp.
- *Cercis* sp.
- *Liriodendron tulipifera*
- *Carya* sp.
- *Acer* sp.

### Understory plants included:

- *Acer saccharum*
- *Viburnum prunifolium*
- *V. dentatum*
- *V. acerifolium*
- *Trillium* sp.
- Orchid species
- *Panax quinquefolius*
- *Ilex reticulata*



The Native Plants Meadow

The management of the meadow is light handed. They hand weed rogues such as some of the non-native thistles and maintain the paths through the meadow. He has just received permission to burn the meadow, which would be a natural occurrence in a wild meadow, but this has not been allowed in the past because of environmental concerns. Burning the meadow will suppress the cold-season weeds and help maintain the native diversity. He will only burn 1/3 of the area at a time, as it is essential to leave vegetation for wildlife and migrating birds.

Another area that Bill is responsible for is storm water management. He manages a wetland area around a lake and uses sluices to control the water flow into the lake. He has enhanced the plantings around this area to improve the biodiversity of the area as well as managing storm water. This habitat even has a beaver lodge on the lake.

## **Shaun Lister – Head of Arboriculture, Turf and Grounds**

Shaun has 10 staff under him – 5 responsible for arboriculture and 5 responsible for turf and grounds. Within the cultivated ground they have 85 acres of finished cut turf to look after and outside of this area, they have another 85 acres. The management of this second area is contracted out and less intensively managed.

For irrigation within the garden proper they have a VGML control system, moisture sensors and timers. They utilise treated sewage for irrigation in addition to other water.

There are 5,000 – 7,000 trees within the estate and each arborist on the team has a section that they are responsible for. All the arborists are ISA certified professionals. During December they carry out tree assessments on a rotating basis but for cabled trees they will inspect them every 3 years. All perimeter tree work is contracted out as the trees are lower risk and of lower value to the collection. The Garden arborists actually spend 5 months of each year putting the Christmas light displays up into trees, maintaining the display and taking them down. It is felt that this is a worthwhile investment of time by the Garden as they get 1/3 of their visitation at this time of year and visitors also pay more at this time of year. However, it can make recruitment challenging to find staff that wish to spend a large proportion of their time on this type of work.

The turf in the garden proper is cut with a rotary mower but quite long compared to cutting heights in the UK. This is because of traffic, lack of water and heat. They cut the grass once a week and the sward comprises mainly tall fescue – *Festuca arundinacea* – which is tolerant to heat and drought and disease resistant. During September turf will be aerated and over seeded.

## **Mary Allinson – Section Leader Under Glass**

Mary has 4 staff and 30 volunteers – within the Conservatory they have around 60 volunteers in total. They are currently working on re-imagining the glasshouses including the infrastructure, facilities and presentation of the plant collections.

Mary gave me some interesting insights into how they run their volunteer programme; an area that I am very interested in as we always strive to develop and get the best out of our volunteer team at CPG.

In total, they have around 800 volunteers in the garden, all of whom go through an interview process. When they are interviewed, they are asked what they are capable of doing – including how physically able they are. The volunteers that work with Mary do specific tasks and she develops routines with them. For example when they come in they all immediately go to the Rose display and deadhead. They then move

on to their individual routine tasks. This means that she doesn't have to set them up with tasks each day and so frees up some of her time. They also become proficient at the specific tasks. Some volunteers only work at the garden for specific projects – such as Christmas displays.

The Conservatory where Mary works has 20 separate indoor gardens and around 5,500 taxa within 4.5 acres. This is comparable to the whole of CPG!



Display in The Orangery.



The Silver Garden.

Some important gardens and displays include:

**Orchid Display** – this is an important collection for the garden. They are mostly displayed in pots and are swapped out three times a week to ensure optimum display.

**The Orangery** - highly cultivated display surrounding manicured lawns. Mary told me that during seasons of high visitation in high traffic areas they design with plants, such as ferns, that can deal with damage by visitors.

**Rose Display** – this is an historical display from when Mr Du Pont owned the garden; he loved roses and wanted to grow them year round. This is something that will probably be removed in the re-imagining because whilst it is of great interest historically it takes up a lot of space and does not contribute greatly to the overall display in the Conservatory.

**Cascade Garden** – this small garden is centred around a waterfall and designed in 1992 by Roberto Burle Marx, a renowned Brazilian landscape architect. It is a lush planting design with many of plants native to South America.

**Silver Garden** – this garden mimics the dry, arid landscapes found in Mediterranean and desert regions. It was designed in 1989 by Isabelle Greene and was one of my favourite gardens within the Conservatory because of the structural planting and serene colours. I am also drawn to plantings that reflect specific habitats or phytogeographical representations.

**The Green Wall** – this is around 4m high and 90m long and the largest in North America. It was designed by Kim Wilkie and installed in 2010. It contains 47,000 plants and has to be the most attractive set of public bathrooms I have ever seen.

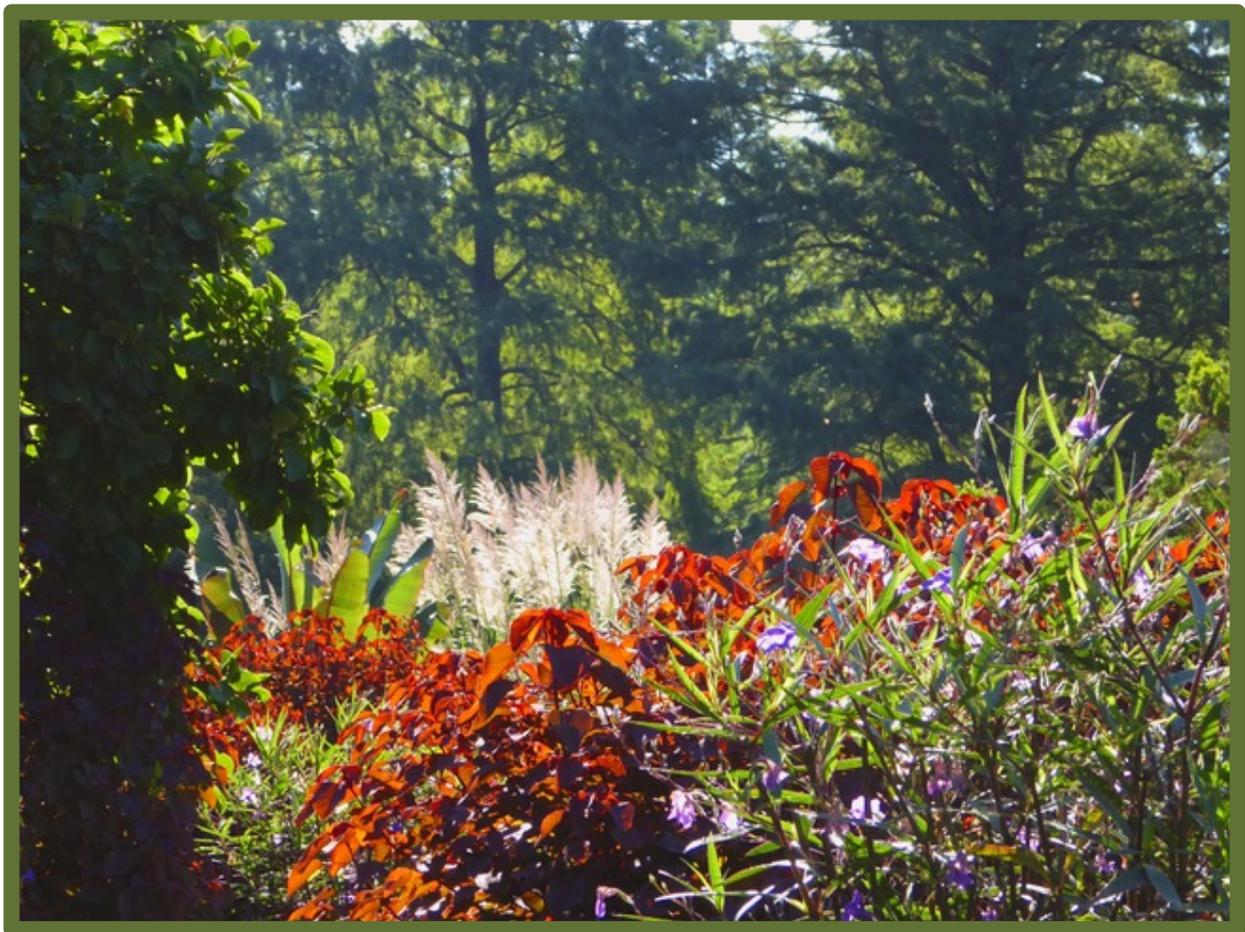
Within the glasshouses their main P&D is thrip for which they use bio controls.

### **April Bevans– Section Leader, Outdoor Display**

I worked with April's team for one morning and I was very keen to understand how they undertake a seasonal display border at Longwood as all my working experience to date has been within a botanical garden.

The Flower Garden Walk is one of their major plant display areas within the garden. The plants are arranged in colour scheme blocks starting at the beginning of the walk and moving through these blocks of colours: blue/purple; pink; mixed; red; orange; yellow; white.

They use many annual plants in the display but they are increasing the numbers of perennials they use, as it is more sustainable. To incorporate the perennials they have deepened the beds to provide room for these larger plants.



The Flower Garden Walk

## Maintenance Timetable

- Early autumn – take out some of the annuals and replace with Chrysanthemums (this is what I helped to do).
- By second week of October (first frost date is October 15), take out the summer plantings of:
  - *Salvia* sp.
  - *Solidago* sp.
  - *Rudbeckia* sp.
  - *Chrysanthemum* sp.
- All plants get composted but they do dig up and overwinter specimens such as *Euphorbia cotinifolius*, *Canna* sp., *Brugmansia* sp., *Panicum* sp. and *Miscanthus* sp.
- Take soil sample
- Rotavate soil and dig in any amendments.
- Plant bulbs.
- Mulch with Probase – aged bark fines – keeps soil light and fluffy. Slightly acidic.
- Typical bulbs that will be planted include:
  - *Tulipa* sp.
  - *Camassia* sp.
  - *Allium* sp.
  - *Narcissus* sp.
- They have to erect a deer fence around the bulbs – it is electrified and they put peanut butter on it to attract them and then shock them. Older deer teach younger ones not to go near the fence and this helps to protect the bulbs.
- When planting the bulbs, they mix all of the colours and then plant in drifts all the way down the beds. Then they add tulips of the right colour for that bed.
- They have to have a selection of late flowering bulbs for Mother's day, which is May 5<sup>th</sup>.
- In total, 130,000 bulbs are planted each year.
- May 15<sup>th</sup> is last frost date.
- Monday after Mother's day (May 5<sup>th</sup>), all bulbs are removed and the whole border replanted with the new season's scheme. This takes 2 weeks and involves other section team members and volunteers.

## Feeding

- When planted a balanced feed is applied to each plant at ½ strength using the dosatron. They are not fed any further.
- *Dahlia* sp., *Brugmansia* sp., *Canna* sp, *Allamanda* sp., *Geranium* sp. and *Begonia* sp. are all heavy feeders so are planted with 6 month osmacote and then fed once a month.
- *Chyrsanthemum* sp. are fed before they open to encourage flowering but not after.

## **Irrigation**

- They use rockers for 3/hrs per position as they find it causes less damage to the plants than using traditional overhead sprinklers.
- Additionally they water many plants by hand as and when required.
- There are two irrigation points for each border.

## **General Maintenance**

- Throughout the season, tasks include deadheading, pinching, watering, staking and feeding.
- Weeding is not too much of an issue as everything is shaded out.
- P&D – if they have a problem they will notify the IPM team. One of their biggest pests is the Japanese Beetle (*Popillia japonica*), which attacks *Hibiscus* sp., *Canna* sp. and *Musa* sp. They tend to hand pick pests but if there is an outbreak they will spray specific plants.
- They put in new plants very regularly to replace plants that burnt out or to put in the next set of plants for the scheme.
- April has 2 staff working under her and 2 volunteers for each area she looks after.

## **Records Manager – Kristina Aguilar**

The set up for Records at Longwood was very similar to NYBG. They use BG Base as their database and use BG map for their electronic mapping. They launched Plant explorer in 2010 to make their plant collection more accessible to both staff and members of the public.

They have two versions of Plant Explorer - one for employees and one for visitors. Visitors get images, flowering date, cultural details and where the plant is on a map whereas employees get more detailed information about that particular accession. The Records team work from the crop list to get display dates of seasonal plants and then change on/off display date on Garden Explorer. Other flowering dates are updated weekly on Plant Explorer using the phenology data collected by volunteers. The Records office will produce a 'What's in Bloom' e-sheet that is updated weekly and includes one feature plant and 9 others. This links in to Plant Explorer, which gets 1,000's of hits online each day.

They currently have 10,000 taxa within their living collection. The Records department sits within Education and they oversee plant nomenclature, the plant collection and disseminate information about it. In any external communications from the Garden the Records team must check all plant nomenclature.

Unlike NYBG, labels are produced offsite but they also produce labels for more temporary displays in-house using photographic paper. They looked just like an engraved label but for a much lower cost.

There is a 7-year plant inventory rotation that includes every woody plant over the 1,000 acres. The Conservatory, because of its ever-changing display is inventoried every year and other special inventories are carried out on request depending on projects. For mapping their garden they use GPS and every 5-6 years a botanist surveys the natural lands and all information is stored on the database.

They have a method of record keeping for seasonal plants that I thought was effective. For bedding, where they use the same cultivars but replace with new plants each year, they have one accession number for the taxa so that they don't have to re-accession it.

### **Jim Harbidge –Head of Floriculture**

Jim is responsible for floriculture under glass, which includes conservatory display and greenhouse production. They grow 70% of their plants in-house with their aim being to produce show quality and unusual plants. For other more standard plants such as bedding, they contract-out the growing. The total of plants grown in-house together with those contracted out amounts to around 100,000 pots. Of the 70,000 pots they produce themselves, 50% are from seed and 50% from cuttings. They also produce around 3,500 plants grown on from plugs.

Longwood have 2 acres dedicated to production under glass and Jim has 12 staff working for him in production plus one crop inventory specialist and around 10 seasonals. The entry level salary for a staff member working in production would be around \$30k – this would be for someone with a degree and 1 year's experience.

Within the propagation spaces, whilst they definitely had a lot of space, Jim said it is just like any production glasshouse in that it's a matrix of bench time/growing temperature/display life/speciality. They have drip irrigation throughout the glasshouse and feed through this too.

To control Pythium and Phytophthora, they use a product called RootShield that contains trichoderma and can be applied as a drench providing up to 12 weeks protection.

Poinsettias are a key display plant for their winter displays. They grow them in Oasis florist's foam, which gives them moisture and air space at the root. Their general growing mixes use different combinations of peat, perlite, vermiculite and pro-race (aged bark).



Production Glasshouse.

I learnt a couple of interesting methods with Jim. Firstly, when rooting cuttings, they generally give them only 10 days on the mist bench and then move them into a sweat-box if they still need higher humidity or straight onto a bench if not. The cuttings are weaned off in sweat-boxes until they don't need higher humidity. He told me that stomata function stops when you take a cutting but is gained back after 7 – 10 days so for most cuttings this process works well.

Secondly, he told me that Mediterranean plants root better if they are taken late spring/early autumn. They respond well to the 10 days on the mist bench and then moving to a sweatbox.

### **Peter Zale – Curator and Plant Breeder**

Peter has a background in plant breeding and genetics and is responsible for:

- Curatorial
- Plant exploration
- Plant breeding
- Plant conservation.

There are 17 core collections including:

- *Victoria*
- *Nymphaea*
- *Camelia*
- *Buxus*

Peter oversees the *Buxus* sp., *Camelia* sp., *Magnolia* sp. and Orchid collections and has to balance display with curatorial.

He is helping to develop their Tier 1 collections such as *Buxus* sp. Some species are on the red list in Georgia and so he has collected there and they are growing ex-situ at Longwood. I learnt that there are around 100 *Buxus* species worldwide but with diversity hotspots in Cuba, which has around 50 species – I was very surprised at that. Otherwise, they are mainly distributed in the Mediterranean and China.

The main focus of the *Camellia* work is in trialling for hardiness both for display at Longwood and for sale. Additionally, he is developing a NE American collection within the genus *Magnolia* and further increasing the collection of Pre-1950's *Cattleyas*.

## **Education**

Longwood has a long tradition of education and learning. It is split out into the following:

- Continuing Education:
  - Internships for US Students
  - International Internship and Training Programme
  - Professional Gardener Programme – similar to Wisley Diploma – 2 yrs
  - Longwood Graduate Programme in Public Horticulture.
- Schools education:
  - Junior School Education
  - High School Programs
  - Teacher Professional Development

A couple of innovative programmes were:

### **Teen volunteer programme**

- 8 week long summer experience for teens.
- Work in the children's garden and interact with children of all ages and provide hands-on activities for them.

### **Virtual Field Trips**

- Longwood educators deliver lessons directly into the classroom remotely and engage the students in discussion and problem solving activities as they explore topics. Topics include plant life cycles, trees, pollination and desert plant adaptations.

## **OBSERVATIONS**

During my visit here I had back-to-back meetings every day. I managed to spend some time working with a team in the garden but the agenda that they had kindly put together for me did not allow for more.

One of the key issues at Longwood, that they are very well aware of and seeking to address, is the fact that a large number of their senior management team are approaching retirement age. The team members have, in some cases, worked there for over 40 years and consequently have a lot of information and experience that needs to be shared to ensure continuity and for the history of the Garden to be recorded. They are addressing this through identifying talented staff to develop and also to start sharing their expertise in certain areas – for example, Mary, Section Leader under Glass is teaching her Bonsai skills to many gardeners (not just those under glass). They also have an issue because unlike the senior management team who have worked there for decades, upcoming talent tends to move on to new organisations, as they want to progress quickly.

The Garden is very well funded through an endowment and it is a pleasure to see this. They can invest in their people, run expensive internships/traineeships (that pay a wage and include accommodation and so not exclude anyone on economic status), invest in the Garden and the environment. It also means they can attract the best designers and so enhance the Garden and the visitor experience.

They are very focused on visitors and also providing displays at key points in the year. This was something that I wanted to learn about, as the Garden I work in, CPG, is now open for longer each year.

As with NYBG, I felt that the Garden was very focussed on connecting with the public through their website, in-garden interpretation, continuing education, outreach and general gardening advice & tips.

## Chanticleer



**The Tennis Court Garden at Chanticleer.**

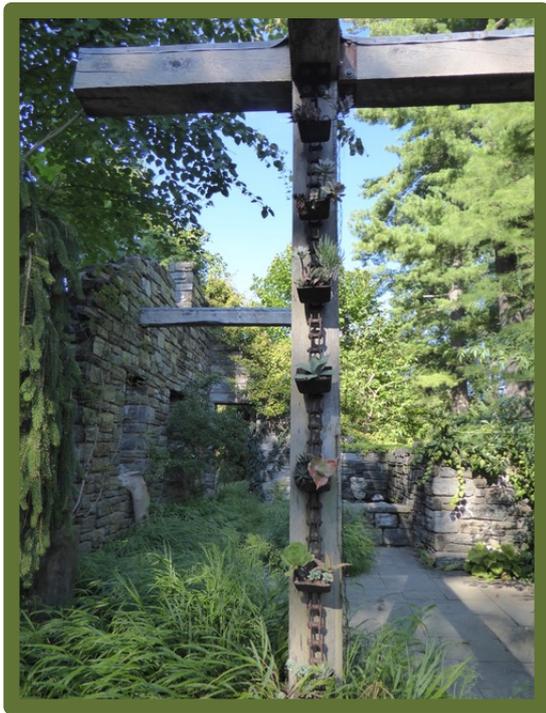
I visited Chanticleer with Kristin Schleiter from NYBG for one day whilst I was at Longwood Gardens. In the early 20<sup>th</sup> Century, Adolph Rosengarten developed The Chanticleer estate as a summer home for his family. He worked in his family's pharmaceutical firm that would later become part of Merck & Company in the 1920s.

The Board of Directors still has many Rosengarten relatives on it, just like at Longwood Gardens where DuPont family members are still involved in the Garden.

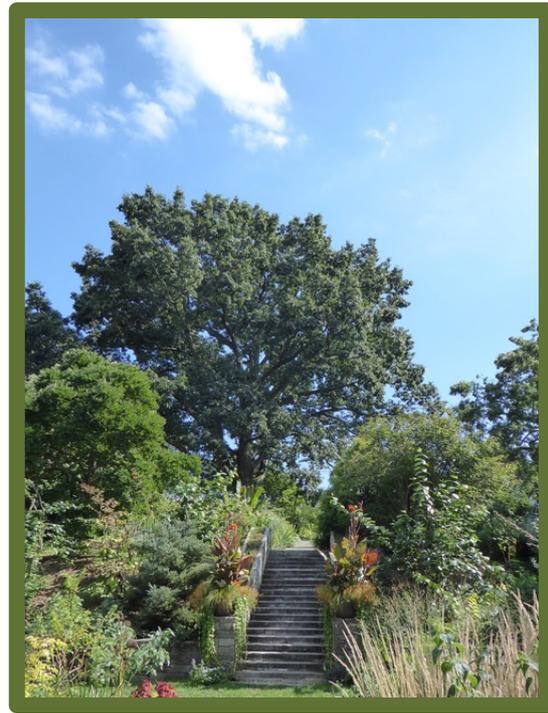
The garden opened to the public in 1993 and has been called the most romantic, imaginative, and exciting public garden in America. The gardeners lead the design including the planting but also the interpretation, garden furniture and buildings. There are no labels as they feel this distracts from the aesthetic but recognizing that learning about the plants is important, they have the plant lists online and plant lists in boxes around the garden.

It is an amazingly diverse garden with a fascinating array of gardens within it. Most of the garden is a series of ornamental gardens where the planting designs are the key feature. The Asian Woodland, however, is more of a plant collection showcasing trees and plants from Korea, Japan, and China. Because there are no labels, it first feels like an ordinary woodland – until you start noticing that the trees are not native.

Other areas of the garden that I enjoyed were a well-maintained dry garden next to a 'fallen down' building/folly and I also came across a pleached curve of Ginkgos which was a first for me!



The Dry Garden & Folly.



Looking up from the Tennis Court Garden.

## OBSERVATIONS

The garden has such a relaxed style and shows the gardeners' love of plants, planting combinations and good horticultural practice. The gardeners were empowered and clearly had autonomy within their section. This really showed in the care and also individuality of the garden areas. I felt that whilst the garden sections were individual because of the autonomy of the gardeners, they were definitely linked by the ethos of the garden and probably by the guiding hand of the Head Gardener. It felt cohesive.

The Garden has a strong connection with Great Dixter in Sussex, a place that I have visited many times. I could definitely see this in the planting and the atmosphere within the team. To me they both share exuberance and breaking the rules type of ethos that is generated by allowing gardeners to experiment (and make mistakes).

## Morris Arboretum



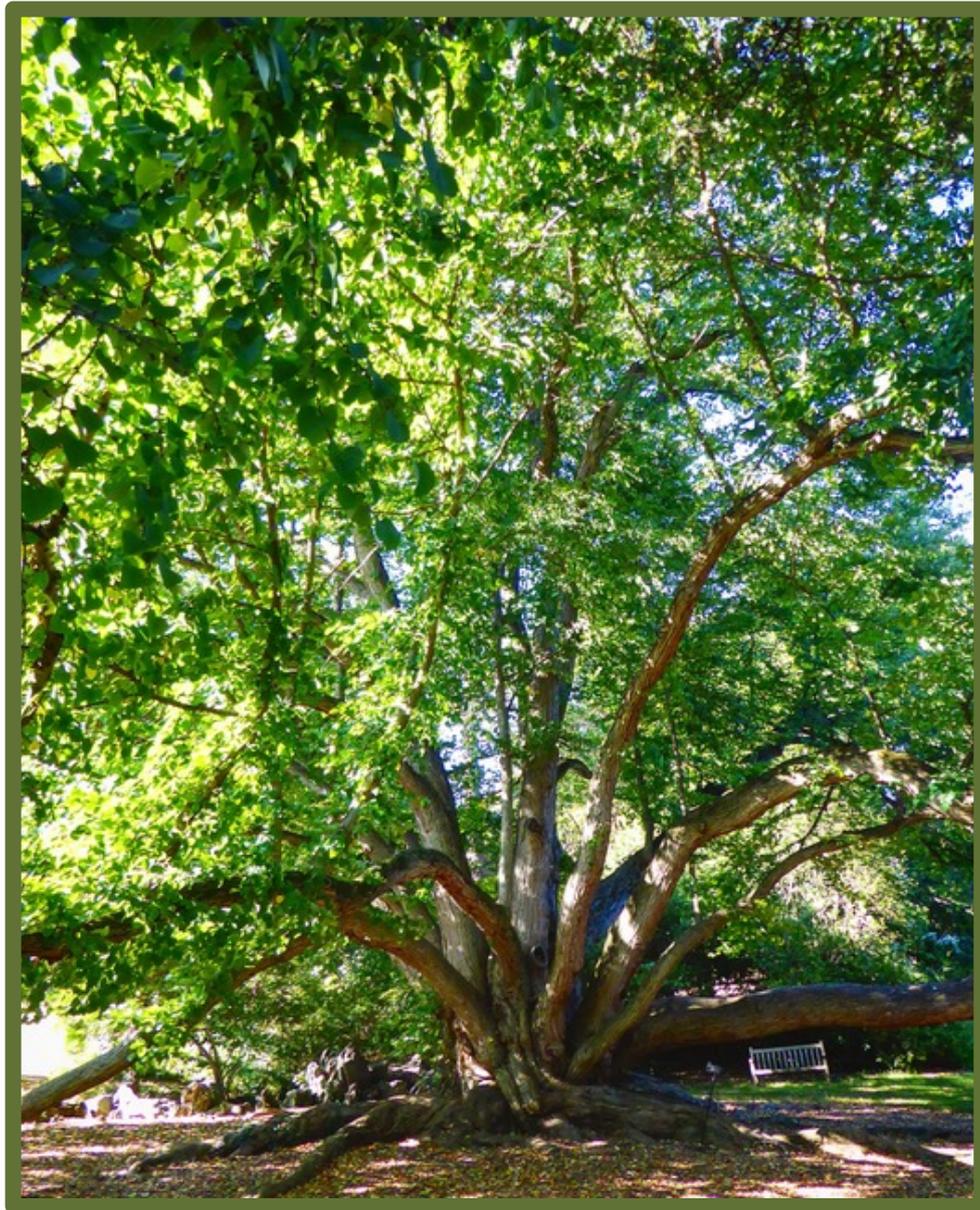
I visited Morris Arboretum for one day having been invited by Tony Aiello, Curator and Director of Horticulture whom I met several years ago at Chelsea Physic Garden. The Arboretum is part of the University of Pennsylvania but started life as the summer home of John and Lydia Morris, brother and sister, whose family iron-manufacturing firm generated much wealth in the late 1800's. John was a noted plants man and they both traveled widely in America, Asia, and Europe bringing many plants back to their property and so developing their plant collection.

The Arboretum has 45 full time employees, which rises to 120 with seasonals. It comprises of 92 acres of public gardens and a 76 acre farm. Tony has 6 section leaders under him. His assistant told me that they have a problem in retaining arborists, as they can't compete with commercial salaries and rates. They have four horticultural interns each year.

The garden welcomes 135,000 visitors a year and their busiest times are April, May, June, October and November. They have approximately 60 – 80 volunteer guides and a team of around 30 horticultural volunteers. The general horticultural volunteers come to the garden en masse once a week and take on tasks such as weeding and mulching together.

The living plant collection contains more than 12,000 labeled plants of approximately 2,500 taxa predominantly including representatives of the temperate floras of North America, Asia, and Europe. It includes plants collected by E.H. Wilson in China at the turn of the century – *Hydrangea serrata*. Many of the Delaware Valley's "trees-of-record" (the largest of their kind) are found in the Arboretum. The most notable is the *Cercidiphyllum japonicum*, which was planted in the early 1900's, and perhaps the largest in North America. Other notable trees are *Quercus x benderi*, *Acer buergerianum* and *Fagus engleriana*.

Staff members have regularly engaged in plant collecting expeditions in Asia and the United States. In fact, when I visited, Tony Aiello was on a plant collecting expedition in China so we were unable to reconnect. Significant plant groups in the Arboretum's collection include maples, magnolia species, native azaleas, members of the witch hazel family, roses, hollies, and conifers.



**Champion *Cercidiphyllum japonicum*.**

The arboretum is part of the University of Pennsylvania and is active in the following areas:

- Plant distribution & collaboration
- Botanical research
- Horticulture research
- Urban forestry consultants
- Plant clinic

They offer a full programme of professional education, continuing education and are also used as a resource by the university.

## **Shelley Dillard**

I spent a few hours with Shelley Dillard, the Arboretum's propagator. She told me that they don't propagate anything they can buy – they are solely focused on propagating their woody collection and any unusual plants.

For her propagation mix for woody cuttings, she uses 6 parts perlite, 4 parts peat and adds in Rootshield as they do at Longwood. She starts her woody cuttings in June to get the growth going and then overwinters them in flats. She stops feeding them after 1 August. She has a couple of glasshouses and some polytunnels.

There is a team of around 30 horticultural volunteers and Shelley has about 3 volunteer day effort per week, plus an intern and a part time team member 3 days a week. Interestingly, because her volunteers are mainly retired people who are less physically able they tend to prick out and re-pot (i.e. the more skilled work) whilst the staff and interns do the more physical work.

Within the Arboretum grounds is a real gem, The Dorrance H. Hamilton Fernery. It is the only remaining freestanding Victorian fernery in North America. Originally built in 1899 as directed by John Morris it fell into disrepair over the years until it was fully restored in 1994. I was intrigued to learn from Shelley that there are rules for a Victorian fernery as below.

The fernery should:

- Be underground
- Be hexagonal
- Contain a water feature
- Have a circular path
- Contain an overlook and tunnel.

## **OBSERVATIONS**

This arboretum was all about the trees (as it should be) and much less focused on the horticulture. It was interesting to see that it is still used as a resource by the university and that they continue to develop and enhance the collection by wild collecting. They were clearly investing money to increase visitation such as a tree top walk, visitor centre and railway display. Hopefully this will generate money to develop other areas of the garden and collection.



The Dorrance H. Hamilton Fernery

## Bartram's Garden



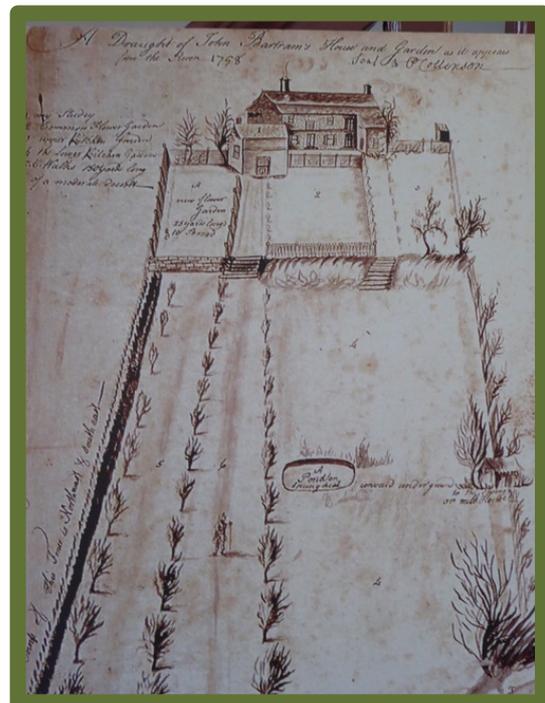
### BARTRAM'S GARDEN

I visited Bartram's Garden briefly at the end of my trip on the East Coast. It is a 45-acre National Historic Landmark, operated by the John Bartram Association in cooperation with Philadelphia Parks and Recreation. It is the oldest surviving botanic garden in the United States. They have around 40,000 visitors each year.

John Bartram (1699-1777) was a self-taught man who amassed the most varied collection of North American plants in the world at that time. He collected seeds and plant specimens, and established a trans-Atlantic hub of plant exploration through his exchanges with London merchant Peter Collinson.



*Cochlianthus caracalla*



A drawing of Bartram's Garden in the late 1700's.

The plant exchange had a significant impact on British and European gardens and landscapes, creating a new palette of colors and shapes. New plants included magnolias, mountain laurels, azaleas, and rhododendrons. Sugar maples, black gums, viburnums, and sumacs created brilliant fall color unseen in Britain until this point.

John Bartram regularly corresponded with Philip Miller, Head Gardener at CPG at that time and Philip Miller certainly received boxes of seeds and plant material from John Bartram.

There were a number of interesting trees at this garden, especially *Franklinia alatamaha*. John and his son William discovered this tree in 1765 when they were exploring in southern Georgia. They brought seeds back and grew it. The plant has not been found in the wild since the early 19<sup>th</sup> century but because the Bartrams propagated this plant, it has been saved from extinction. All current *Franklinia* are descended from those grown by the Bartrams. It is a notoriously difficult plant to grow and it didn't look too happy in Bartram's Garden!

Additionally, there is a male *Ginkgo biloba* that is believed to be the oldest in North America. It was one of three Ginkgos sent to the U.S. from London in 1785. I also loved the *Buxus* sp. trees – there wasn't anyone to ask about them but they were pretty large and so I assume quite old.

## **OBSERVATIONS**

I loved visiting this garden because of the connection it has with CPG and the history of that exciting time in horticulture. I was told that they had spent a lot of money on developing some of the buildings so that they could bring in more money to enable development of the garden. The garden was pretty overgrown and obviously lacking for resources but it was exciting to be at the very house that Bartram lived in.

It was a community resource and entry was free. They had riverfront access that the Garden allowed local people to use and take the Garden's canoes out from. It was located in a pretty deprived area so this was much needed and commendable. However, it does mean they have to generate their income from elsewhere.

I learnt that *Cochliasanthus caracalla* (a plant that I had grown from seed that year) was actually a perennial not an annual as I had thought. So on my return to CPG, I overwintered it in a glasshouse and will hopefully use for display next year.

Finally, I connected our Librarian at CPG with Joel Fry, Curator at Bartram's Garden. Liz had asked me to give him some letters that had faded with time. These letters were between Bartram and Miller and she wanted new copies and to understand what was in the letter. I achieved this through a contact at Morris Arboretum and hopefully made a long lasting connection between our gardens.

## The West Coast



The Golden Gate Bridge.

## San Francisco Botanical Garden



San Francisco Botanical Garden is situated within Golden Gate Park and comprises 55 acres of both landscaped gardens and open spaces, showcasing over 8,000 different kinds of plants from around the world. The Garden was funded by a bequest in 1926 and work started on it in 1930. Just like some of the work at NYBG this was a Depression Era Project staffed primarily by Works Progress Administration workers. Originally it was an arboretum but SFBG opened in conjunction with the arboretum in 1940.

The Bay Area's mild temperatures, wet winters and dry summers, coupled with San Francisco's famous coastal fog, provide a range of climatic conditions that exist in few other botanical gardens in the world. These unique conditions allow it to grow and conserve plants from all over the globe, including plants that are no longer found in their native habitats.

Many of the plant collections were arranged phytogeographically and included:

- Magnolia collection – 4<sup>th</sup> most significant collection in the world.
- Cloud Forest collections – Mesoamerican, Andean & South East Asian
- Redwood Grove & Californian Native plants
- Mediterranean Climate Habitats – Australia, California, Chile, The Med & S. Africa.
- High Elevation Palms - The Garden is host to the most comprehensive collection of high elevation palm species in any botanical garden.



*Ceroxylon quindiuense* - Andean Wax Palm

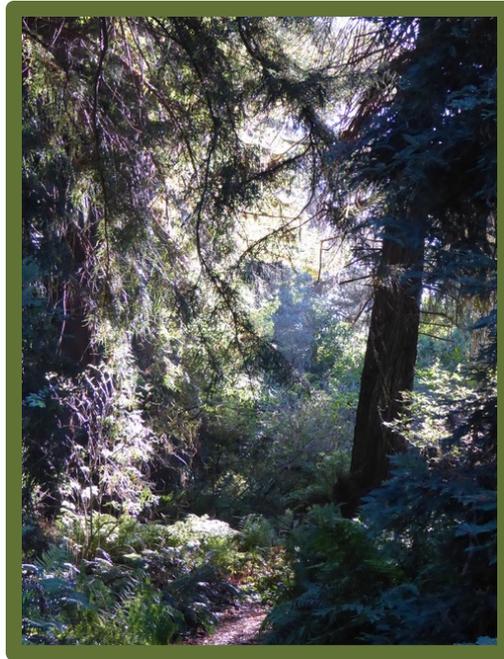
It was in this garden that I first encountered *Sequoia sempervirens*, the Coastal Redwood, before I saw it in the wild further down the coast later on in my trip. The Garden had a grove that was over 100 years old with an interesting understory including *Woodwardia fimbriata* and *Acer circinatum*.

I learnt that if a *Sequoia sempervirens* tree is destroyed by fire or other means, a family circle of trees may sprout and mature around the stump. The new trees benefit from the established root system of the parent. They are clones of the parent tree and share its genetic information.

The Coastal Redwood forest community can only thrive within 45 miles of the coast. In this area, ocean-moderated conditions protect tall trees from prolonged frost, drying winds and ocean salt spray, and offer foggy, wind-sheltered canyons and cool, north-facing slopes.

Depending on soil conditions, most moisture for the redwood community is provided by the frequent Pacific rain systems in winter and by dense fog in summer. Fog condenses on the needle-like leaves of these massive trees and drips into the

ground supplying up to 45% of the trees water needs and creating moist ground conditions. Although the root systems of the largest trees penetrate no more than 10 – 13 feet deep, they can extend to 100 feet to take advantage of the wet ground and forest streambeds. Rather than compete with each other for water, the strong roots of the redwood community form a network to hold water and help support each other.



*Sequoia sempervirens* grove.

The forest's complex system of catching and storing water benefits companion vegetation like evergreens, oaks and chaparral. Many species of birds and mammals also take advantage of the unique and diverse conditions, nesting high in the canopy of the redwoods or burrowing into the soft forest floor.

Coastal Redwoods reproduce in three ways: from seeds, from sprouts and from burls. The seeds, which form in cones along the branches, require fire for germination. The trees are protected from the fire because of the tannins in the bark – however if the bark is penetrated by insects or animals the fire can enter the trunk and cause damage. This means that only healthy trees will remain alive after a fire. The fires are a signal to the seeds that conditions are right to begin germinating. Burnt trees, plants and forest debris enrich the soil that supplies the seeds with nutrients to encourage growth.

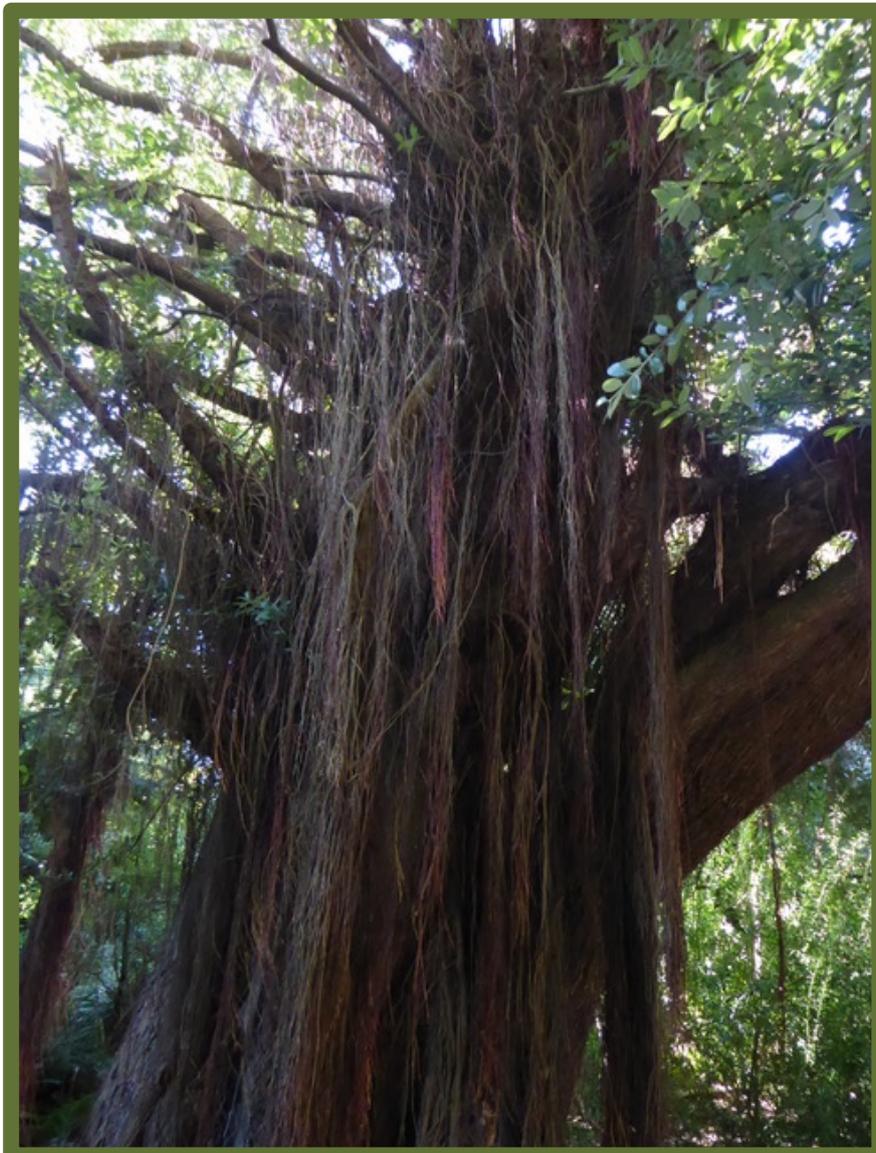
Redwood sprouts are young trees that grow from the roots of a mature tree. They rely on the roots of the “parent” tree for their start. Burls are the knobby mounds of growth tissue that are found along the trunks of redwoods. When an older tree falls, the burls contain all that is necessary to sprout a new tree.

## Conifers

There are over 600 species of conifers currently recognized worldwide and SFBG has over 250. Two trees that I saw all around the outside of this Garden and also out in The Golden Gate Park were *Cupressus macrocarpa* (Monterey cypress) and *Pinus radiata*.

## OBSERVATIONS

This garden had an impressive collection of plants owing to its climate that allows the cultivation of a wide range of plants. I really enjoyed the phytogeographic collections and also the *Sequoia sempervirens* grove where I learnt more about the ecology of this species. I also saw an old *Metrosideros excelsa* for the first time with very impressive aerial roots.



*Metrosideros excelsa*

## San Francisco Japanese Tea Garden

I briefly visited this small garden that is also located within The Golden Gate Park and opposite the San Francisco Botanical Garden.

Originally created as a “Japanese Village” exhibit for the 1894 California Midwinter International Exposition, the site at that time spanned about one acre and showcased a Japanese style garden. When the fair closed, Japanese landscape architect Makoto Hagiwara took on the site and developed it as a Japanese garden expanding it to the current size of approximately 5 acres. During WWII In 1942 he and his family were forced to evacuate their homes and move into internment camps. Sadly, after the war the Hagiwara family was not allowed to return to their home at the tea garden.

Many of the trees are over 100 years old. These include flowering cherries, azaleas, magnolias, camellias, Japanese maples, pines, cedars and cypresses.

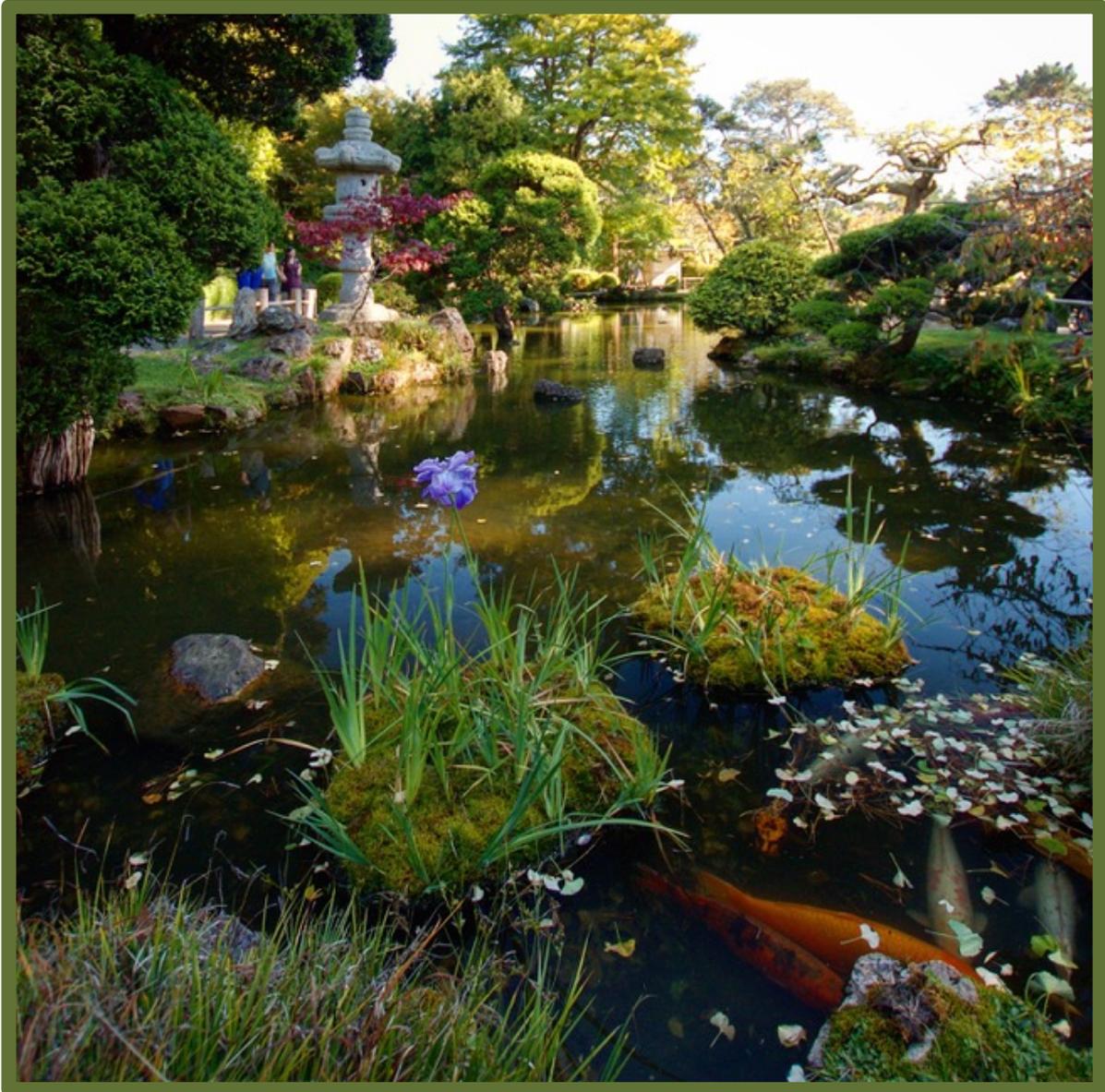
The garden features many classic elements such as an arched drum bridge, pagodas, stone lanterns, stepping stone paths, native Japanese plants, serene koi ponds and a Zen garden. Cherry blossom trees flower throughout the garden in March and April.

The classic element of **water** is well represented in this garden as both still and running water. It represents purity and liveliness. In Shinto, ponds were created as places for gods to roam whilst surrounding stones were utilized by them as seating. Even in the dry garden, the gravel is raked into waves to represent the importance of water and to enhance this impression of water; the rocks represent islands.

**Rocks** are integral components of the traditional Japanese garden. They can mimic mountains, form rock clusters or guide the eye to other parts of the garden. Paths and stepping-stones are irregular to slow people down. This was definitely in evidence within this garden.

The design of a Japanese tea garden is largely influenced by four main aesthetic principles in Japanese culture: miniaturization, concealment, extended scenery, and asymmetry.

One feature that intrigued me was the Steep Stairs (they really were steep). This is a Buddhist notion that Zen can be reached through stair climbing, as movement is often incorporated into meditation.



Pond at Japanese Tea Garden.

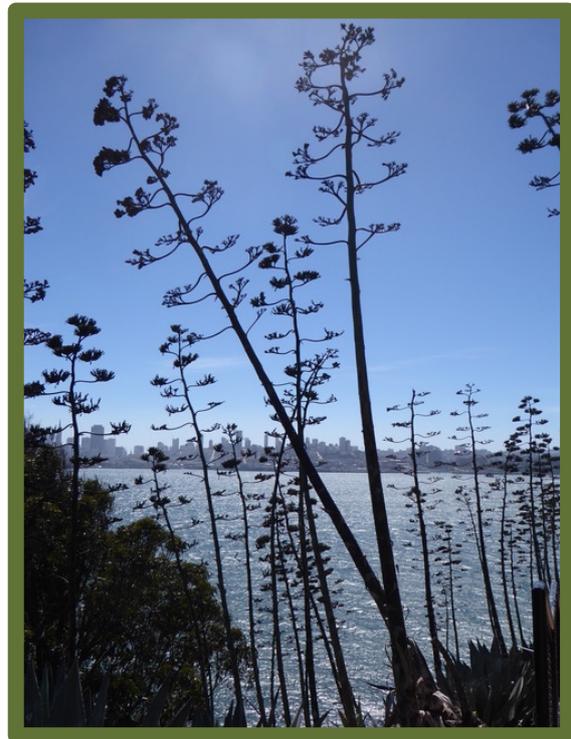
## **OBSERVATIONS**

This was a lovely small garden that despite being very busy was actually quite tranquil. It was very interesting to learn about the different aspects of Japanese garden design and how the elements have very specific reasons for being where they are and that they all represent something. It's an interesting concept that I hadn't considered before – I've always loved the precision of Japanese gardens but hadn't appreciated the meaning that was attached to the design.

## The Gardens of Alcatraz



*Echium candicans.*



A forest of *Agave americana*.

The gardens at Alcatraz have been tended and developed for over 100 years. The rock was originally uninhabited and had very little plant life or organic matter on it. All the soil that created the gardens was imported over the years from neighbouring land until eventually, it created its own ecosystem and the soil built up through the decomposition of plant material.

Families, staff and prisoners gradually built up the landscape of flowering terraces, rose gardens, greenhouses and lawns. When the prison was closed in 1963 the landscape became very overgrown. Owing to the piecemeal way the gardens have developed, Alcatraz has a rich variety of ornamental plants, over 230 taxa, which shows the history of horticulture on the island.

Owing to the lack of water, poor soil and exposed conditions, Alcatraz gardeners through the years realised that they needed tough plants that would survive these harsh conditions. As with all gardeners, they also chose plants that needed more care and were less suited to the environment. However, the plants that survived and flourished, despite the neglect after the prison was closed, tended to be the tough Mediterranean species (but not exclusively). These would include *Ficus carica*; many pelargonium species such as *P. quercifolium*; succulents such as *Aeonium arboreum* and *Carssula ovata*; old roses such as *R. 'Dorothy Perkins'*; and Echiums such as *E. candicans*.

Owing to its position, sustainability is key to these gardens. To counter the lack of water available, a water catchment system was installed in 2009, which delivers 12,000 gallons of rainwater a year. Additionally, all vegetation is composted and then added back onto the beds each year and used for potting.

## **OBSERVATIONS**

The gardens on Alcatraz were a real surprise to me. I had initially visited to experience the atmosphere of this famous prison. It seemed strange to see Echiiums and other exotics in flower around the island of a prison. It felt like an archaeological dig but in relation to horticulture – you were able to see the gardens of the prison officers, the gardens of the prisoners, the propagation area of the current team. As each new set of residents took over the island (military, prison, volunteers) they put their own stamp on it. It was also interesting to see which plants had survived the 40 years of neglect – a real case of right plant, right place! The island also demonstrated to me that as far back as the 1930's horticulture was already providing a therapeutic benefit to some prisoners who went on to live rehabilitated lives in the community because of it.



*Pelargonium* sp. planted on top of a wall.

## LANDSCAPES VISITED

The second part of my trip, after visiting gardens and parks on the East Coast, was a self-funded trip to the West Coast. I spent two weeks in California amongst the landscape of some great National Parks including Yosemite, Kings Canyon and Sequoia National Park.

California was in the middle of a long drought and I was told that the reason it was called the Golden State was because all the huge fields in the state turned yellow by summertime. This certainly was the impression I got whilst driving around the state although there are other stories as to why it is called the Golden State including associations with the gold rush and the proliferation of *Eschscholzia californica* turning the landscape yellow in the spring.

California is a large state with a diverse geography range. I spent time in the Pacific coastal area and also the inland mountainous area of the Sierra Nevada. I also drove through the central valley where the region's major agricultural area dominates the state's centre.

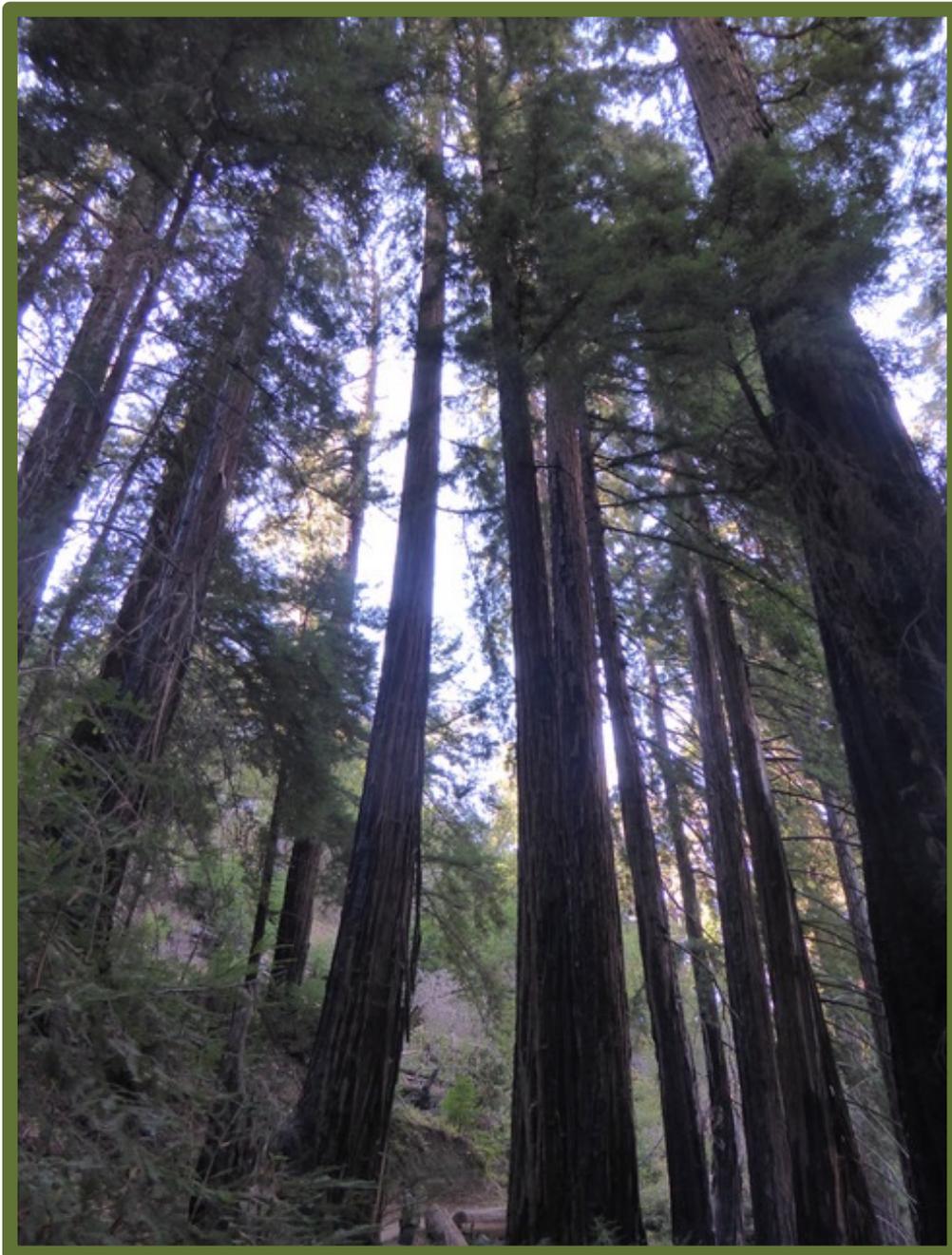
### California Pacific Coast

I spent a couple of days on the Pacific coast, driving up Highway 1 and also time in San Francisco. San Francisco has a Mediterranean climate that is characterized by dry summers and mild, moist winters. Mostly this climate is confined to the Mediterranean basin but I was surprised to learn that it is also found in most of coastal California, in parts of Western and South Australia, in southwestern South Africa, sections of Central Asia and in central Chile.

The warm climate meant that the street landscape was very different to the UK. The predominant street tree was *Ficus* sp – I think *F. microcarpa* but did not have this confirmed – which is native to Southern Asia. *Phoenix dactylifera*, probably native to Iraq but widely naturalised, also featured widely. I really enjoyed seeing plants such as *Tibouchina* sp. growing to such large sizes in people's gardens.

One of the highlights of this area was the Coastal Redwoods – *Sequoia sempervirens* – which I saw just outside Big Sur on Highway 1. These trees in the Cupressaceae family can reach up to 115m in height and are among the oldest living organisms on the planet – some living up to 2,000 years. This monotypic species occupy a narrow strip of land approximately 750km in length and 8 – 75km in width along the Pacific Coast of North America. They typically live at high elevations where precipitation from incoming moisture from the ocean is highest. The fossil record shows that their distribution used to encompass Europe and Asia until about 5 million years ago. Before commercial logging and clearing started in the 1850's the

Coastal Redwood naturally occurred on around 2 million acres along the coast from Oregon to Big Sur. Today only 5% of that original old-growth forest remains.

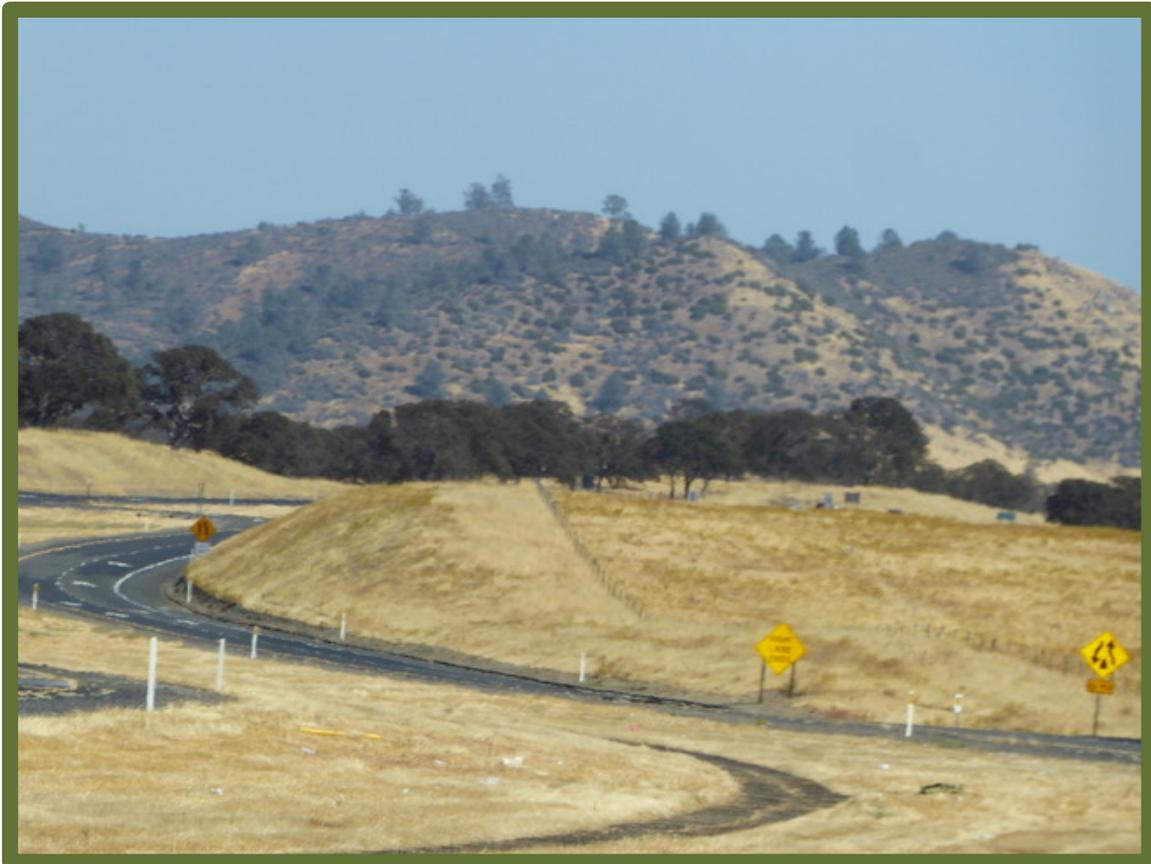


*Sequoia sempervirens* – Coastal Redwood with person in foreground for scale.

Like their close relatives, *Sequoiadendron giganteum*, frequent, naturally occurring fires play an important role in maintaining coastal redwood forests because they rid the forest floor of combustible materials. Forest fires create space for redwood seedlings (and other plants) to grow. In contrast, decades of fire suppression practices usually result in the accumulation of dead plant material that may fuel intense, destructive fires. Redwoods can usually survive natural forest fires because of their thick (up to 30cm), protective bark, which contains tannins.

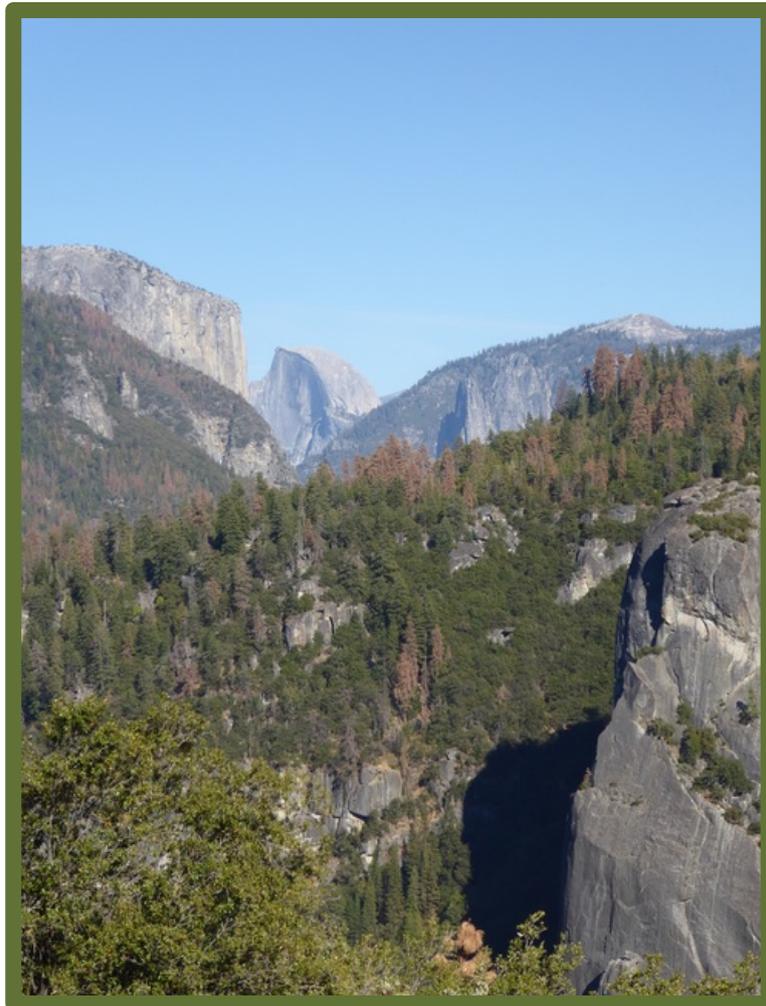
## California - Central Valley

I drove through the heartland of California between the coast and the Sierra Nevada. This was prime agricultural territory where I passed acres upon acres of fruit trees, grape vines and other crops - California is the United States' leading agricultural producer by far. It has a chronic water-supply issues that may be getting worse as climate change affects weather patterns and reduces the Sierra Nevada snowpack that has always acted as the state's biggest reservoir. Agriculture accounts for about 80 percent of the state's water use. I noticed how dusty the area was and also signs in support of agriculture using more water and vice versa. There is an on-going debate as to whether the state should increase the redistribution of water to its large agricultural and urban sectors, or increase conservation and preserve the natural ecosystems of the water sources. Other considerations that have been mooted are growing water thirsty crops in places other than California and growing less water dependent crops in California (e.g. *Alfalfa* sp.).



Central Valley

## California - Sierra Nevada



Yosemite National Park

This mountainous area encompasses several national parks that I visited including Yosemite, Sequoia and Kings Canyon National Parks. In September of 1964, President Lyndon B. Johnson signed the Wilderness Act, which made the preservation and protection of wild places a national priority. As a result of that act and subsequent state and federal legislation, much of the Sierra Nevada is protected from development or strictly managed – in total 808,000 acres of designated wilderness are protected in this area.

This wilderness includes glacial canyons, broad lake basins, lush meadows, and sheer granite peaks. Elevations range from 412m in the foothills to 4,417m at the top of mountains and this creates a multitude of environments (and plant communities) from the hot dry lowlands along the western boundary to the alpine high country.

This topographic diversity supports over 1,200 species (and more than 1,550 taxa,

including subspecies and varieties) of vascular plants, which make up dozens of unique plant communities. These include not only the renowned groves of massive giant sequoia, but also vast tracts of montane forests, alpine habitats, and oak woodlands and chaparral.

### **Plant Communities**

**Blue Oak Savanna:** This is a habitat of lightly forested grassland where *Quercus douglasii* is the dominant tree. Along the western edge of the wilderness, the Great Central Valley gives way to blue oak savanna and a mosaic of chaparral types. Much of the foothill grassland is primarily non-native annual grasses that were introduced to California during the mid-19th century and have subsequently become naturalized. The slow-growing, gnarled blue oaks that dot this landscape can be hundreds of years old.

**Chaparral:** This describes a plant community that is dominated by dense thickets of sclerophyllous (thick-leaved) shrubs. It is found in the foothills of the Sierra Nevada. It is characteristic of lowland Mediterranean climates, it grows where winter rains provide most of the precipitation and, but for the hot dry summers, temperatures are relatively mild. Many chaparral species have specific adaptations to fire and drought, both of which have a strong influence on life in this habitat.

**Mixed conifer forests:** This plant community dominates the lower and middle slopes of the Sierra Nevada. Unlike many of the coniferous forests of the world, which are dominated by a single species of tree, these communities are diverse. Species include *Pinus ponderosa* (ponderosa pine), *Calocedrus decurrens* (incense-cedar), *Abies concolor* (white fir), *Pinus lambertiana* (sugar pine), and scattered groves of *Sequoiadendron giganteum* (giant sequoia). These trees form some of the most extensive stands of old-growth coniferous forest that remain in the world.

**Upper montane:** This plant community occurs at higher elevations characterized by deep snow accumulation during the winter months and a dense canopy that prevents sunlight reaching the forest floor. This means that the forest lacks a diverse herbaceous component as only the most shade tolerant can thrive. The diversity of trees is much less and consists mostly of *Abies magnifica* (Red Fir) and *Pinus contorta* (Lodgepole Pine).

**Subalpine Woodlands:** These occur above the upper-most edge of the montane forests, and define the limit of tree life in the Sierra. Tree species include *Pinus balfouriana* (foxtail pine), a close relative of the long-lived bristlecone pine (*Pinus* subsection *Balfourianae*), which can be found in the White Mountains to the east and *Pinus albicaulis* (whitebark pine).

Where soils are too saturated or shallow to support tree growth, numerous meadows can be found in the montane, subalpine and alpine zones. Wet meadows support a

remarkably diverse range of grasses, sedges and wildflowers, which provide essential habitat for many small mammals, birds, and insects. Dry land meadows, too, are an important source of food and shelter for animals of the higher elevations.

**Rocky alpine:** This region is characterized by a short growing season and harsh winter conditions and so plant communities include only the hardiest of plants, stunted trees and low-growing, perennial plants. Here plants often form ground-hugging mats or hummocks to take advantage of the warmer surface temperatures. In winter, the snowpack provides insulation from sub-freezing temperatures and desiccating winds.

## **Fire**

Fire has been a natural part of the Sierra Nevada ecosystem for centuries. Natural fires swept through these plant communities at intervals that provided conditions for many plant species to regenerate. Fire thins competing species, recycles nutrients into the soil, releases and scarifies seeds, and opens holes in the forest canopy for sunlight to enter. All of these are critical to forest health and natural cycles of growth and decomposition.

Before this was known, in the past century, people feared and suppressed fire whenever possible. However, this means that there is now an accumulation of dead forest litter and detritus which serves as fuel, feeding bigger, hotter blazes that are more dangerous to the health of the trees, soil, and wildlife and humans living in these areas.

The Parks Service still puts out fires that threaten life and property but when and where it's appropriate, they ignite prescribed fires or allow lightning fires to spread naturally, reducing fuels and improving conditions for growth.



Landscape after uncontrolled burn, Yosemite.

## Yosemite

I spent 3 days in Yosemite walking trails and observing the different plant communities as described above.

### Day 1 – The Mist Trail

This was a short hike but with a 580m elevation gain. The area was very crowded with people as this is one of the most popular hikes. However as I climbed higher, the crowds (and the air) noticeably thinned. From the lower elevations I walked through mixed coniferous forest but most of the hike was within the rocky alpine area. Plants that heavily featured were *Gaultheria* sp., *Sambucus caerulea*, stunted *Quercus chrysolepis* and *Zauschneria* sp.

The landscape also featured many water features such as waterfalls and fast flowing rivers and streams.

### Day 2 – Inspiration point

This was another hike that was relatively short but with sharp elevation gains and amazing views up the Yosemite Valley whose steep sides and flat bottom clearly showed its glacial origin.



Forest Clearing

This took me up through chaparral, mixed coniferous forest and upper montane habitats.

Predominant plants were:

<b>Chaparral:</b>	<i>Arctostaphylos</i> sp.
<b>Mixed Coniferous/Upper Montane:</b>	<i>Pinus contorta</i> ; <i>Calocedrus decurrens</i>
<b>Forest Clearings:</b>	Woodland edge plants such as <i>Lupinus</i> sp., <i>Epilobium</i> sp., <i>Symphoricarpos</i> sp.

On this hike I clearly saw the change in plant communities as we climbed higher. Most stark was the Upper Montane where there was very little under-storey plant life.

### Day 3 – Big Flat Oak Road

This was a pretty flat walk at a relatively high elevation. It was very interesting to see developing plant communities arising in this recently burnt area. The fire, known as the 2009 Big Meadow Fire was a prescribed fire that escaped out of the predetermined 91 acre fire perimeter to ultimately burn a total of 7,425 acres.



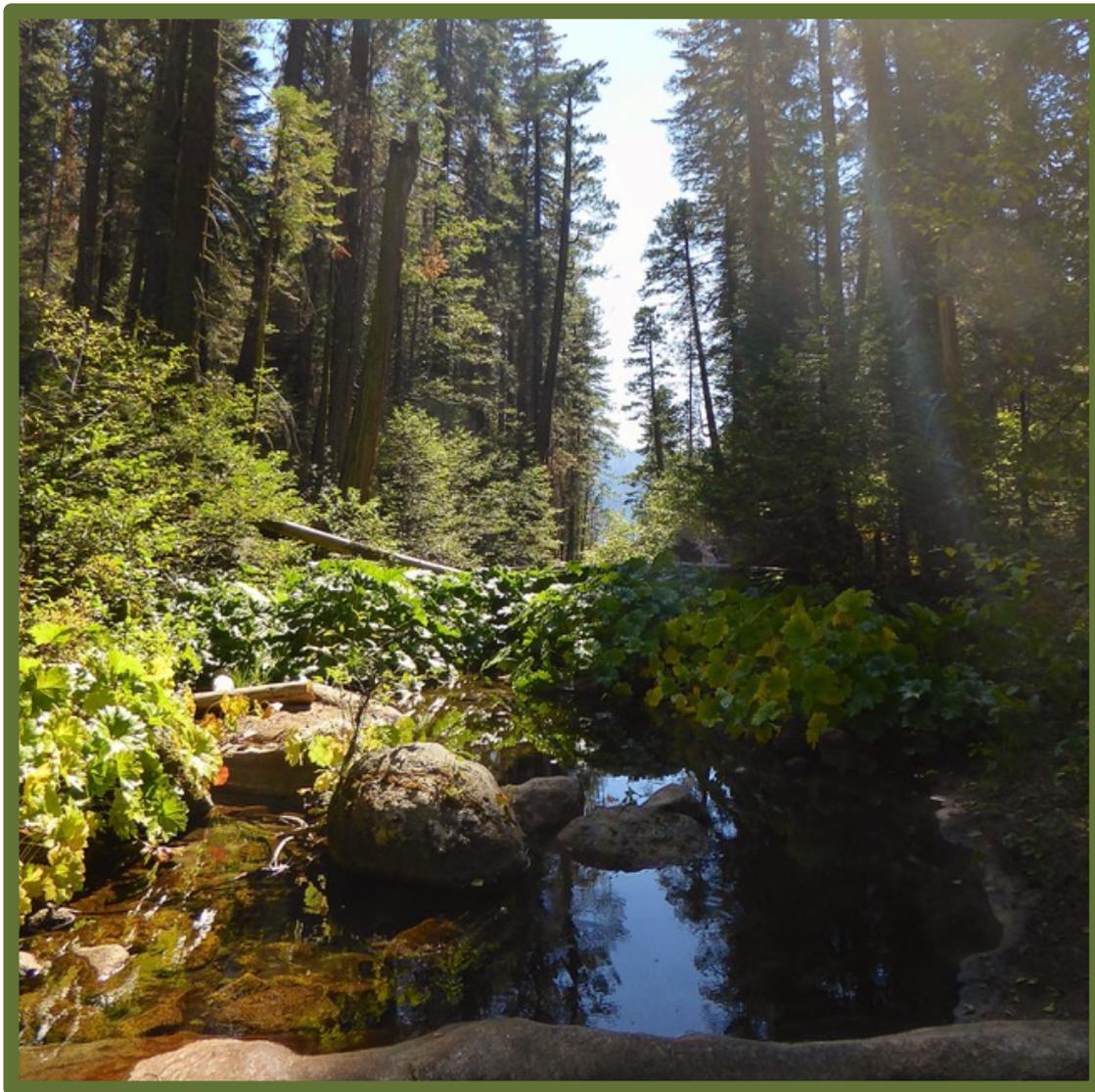
New plant communities establishing after wildfire.

The plant community at the start of the walk was meadow but changed to riverside communities and then mixed coniferous forest.

Predominant plants were:

**Meadow:** *Arctostaphylos* sp., *Quercus velutina*, *Artemisia* sp., *Helichrysum* sp., *Lupinus* sp. (*breweri* I think), small lilac asteraceae plant and various unidentified burnt tree trunks.

**Riverside/wet areas:** *Darmera peltata*, *Equisetum* sp., *Rubus* sp., *Pteridium aquilinum*.



Riverside plant communities.

I loved seeing how distinct the plant communities were on this walk and also how they were developing. So in the newly burnt area that was predominantly various species of grass, some more shrubby plants were growing such as *Arctostaphylos* sp.. These shrubby areas would often have saplings and larger trees growing through them – obviously benefiting from the shade at the start of their life.

## Kings Canyon & Sequoia National Park

Kings Canyon is the most significant canyon in the Sierra Nevada. For the most part it is a wide glacial valley featuring spectacular tall cliffs, a meandering river, green vibrant meadows and beautiful waterfalls. However for a short distance it is possibly the deepest canyon in North America. I drove through this landscape and the plant communities I observed were savannah, meadows, mixed coniferous forests and montane forests. On the steep canyon walls I noticed *Yucca whipplei* growing – I had not realized this was a native plant.



Driving through Kings Canyon.

I mainly visited this area to see the impressive groves of *Sequoiadendron giganteum* at both the General Grant Grove and the Giant Forest.



*Sequoiadendron giganteum* – with person for scale at base.

As in the rest of the Sierra Nevada these giant sequoia groves are subject to fires as a natural part of the ecosystem. Fire creates openings in the forest canopy through which sunlight reaches the forest floor for seeds to germinate. Heat from fires causes giant sequoia cones to dry out and scatter their seeds. Unlike the coastal redwoods, they only reproduce sexually (coastal redwoods can also reproduce from roots or cut stumps). Fire damage is often greatest on the uphill side of the tree as this is where most of the forest debris accumulates. However, the fire rarely kills the giants as they have a fibrous, fire-resistant bark that can grow up to 60cm thick. When there is a large build up of combustible forest floor material, this can cause the flames to rise higher and then damage the crown – this is why it is important to allow the fires within these forests.

These trees reach an average height of about 75m and as they grow, low branches die back from lack of sunlight. The sun-drenched crowns take on the characteristic rounded shape. The groves are typically populated by giant sequoias growing in distinct groups of even-aged trees, since many seeds are dispersed at the same time after a fire. Seeds that land where a fire burned long and hot have a much better chance of surviving after germinating. The sterilized ground and deep ash bed support the seedlings during critical early years of growth when mortality is high. Whenever entire logs are consumed by flame, the extra thick ash beds stretch a long way across the forest floor. The results are often seen as long, straight rows of seemingly planted giant sequoias.

It is not unusual to see giant sequoias joined together to a considerable height. When two seedlings germinate together in close proximity, the gap between the trees shrinks through the years as they grow and finally meet. The two trees fuse and then share their limited space, soil nutrients, sunlight and water.



Typical fire damage on the uphill side of a living *Sequoiadendron giganteum*.

## SUMMARY & CONCLUSION

This trip really exposed me to the operations of many horticultural institutions and also the ideas and designs within many gardens on both the East and West Coasts of the USA.

Overall I visited 13 urban parks and gardens and several landscapes. The landscapes helped me develop my understanding of plant communities within the Sierra Nevada and also my knowledge of the ecology of *Sequoiadendron giganteum* and *Sequoia sempervirens*.

I made many connections on my visits and have subsequently hosted visitors from these gardens at CPG. I have shared information gathered on my trip with other US gardens and also my colleagues at CPG. For example, I put one of the nursery managers at Longwood Gardens in touch with Don Gabel at NYBG to explore the concept of Systemic Acquired Resistance. I was also really pleased to put our Librarian in touch with the Curator at Bartram's Garden and re-establish a link that first existed several hundred years ago.

Since I have been back in the UK, I have shared many of my experiences with the team at CPG – including information about plant records, interesting plants, new methods and plant labelling. I have really felt the benefit of seeing how other gardens work and approach issues that we also have at CPG.

I learnt a lot about seasonal displays and their importance to maintain high visitation during quieter times in the Garden. There are many species that I saw in America that we will be incorporating into new designs in 2017, including seasonal displays.

I spent a good amount of time with the Plant Records operations at both NYBG and Longwood and picked up some good ideas from them. I was very interested in the recording of phenology data and also on a practical level the photographic paper labels for short displays. Additionally, I concluded that it would be a very good achievement for CPG to get our plant collection online and accessible to the public. I was impressed with the way both NYBG and Longwood reached out to the public and I observed at most gardens they provided free advice on gardening to the general public as a way of engaging them.

I didn't get to spend very much time in learning new propagation techniques but I did learn a couple of things regarding the Mediterranean plant propagation. Overall, I didn't get to spend as much time working in the gardens as I had anticipated but I feel that ultimately it was probably a better use of my time meeting with many people and seeing as much as I could.

In many of the gardens I visited there was a strong emphasis on having an area devoted to native plants and this reminded me of the book by Andrea Wulf called the Founding Gardeners. She said that the original founding fathers in America were strongly supportive of growing American plants and eschewing plants from other countries so as to solidify their identity away from the mother country (England). It certainly felt that there was a movement towards this in many gardens and in this context I thought it was a great tool to help Americans to understand their own country's ecology and environmental issues.

The time that I spent in the National Parks I think would have been greatly enhanced by having a guide. Obviously I did a lot of research prior to visiting and subsequently but I'm sure I missed a lot because it was an environment that was completely new to me.

#### **FINAL BUDGET BREAKDOWN**

Air Fare to USA:	£ 730.68
Train in NYC x 5 days:	£ 45.00
Train to Longwood:	£ 120.50
Taxis to/from Wilmington	£ 75.00
Accommodation NYC	£1,087.00
Accommodation Longwood	£ 239.00
Accommodation Philadelphia	£ 162.00
Subsistence:	£ 540.00
Insurance:	£ 100.00
TOTAL:	£3,099.18

**Signed:** .....

**Date:** .....

## PLANT LISTS

Notable plants from Gardens visited that are not mentioned in this report.

### New York Botanic Garden

<p><i>Stachyurus salicifolius</i>  <i>Prunus 'Mume'</i>  <i>Impatiens repens</i>  <i>Acer henryii</i>  <i>Brilliantasia subuglinaria</i>  <i>Salvia leucanthema</i>  <i>Rhexia virginica</i> – Melastomiaceae  <i>Hibiscus 'Summer Storm'</i>  <i>Stewartia pseudocamellia</i>  <i>Foquara</i> sp.  <i>Rusellia equisetiformis</i></p>	<p><i>Hibiscus acetosella 'Jungle Red'</i>  <i>Bouvardia ternifolia</i>  <i>Begonia luxurians</i>  <i>Comphrena globosa</i>  <i>Pinus strobus 'Pendula'</i>  <i>Agave ferdinandi-regis</i>  <i>Cryptostachys renda</i>  <i>Comphrena globosa</i>  <i>Rhus chinensis 'September Beauty'</i>  <i>Pinus thunbergii</i></p>
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### Brooklyn Botanic Garden

<p><i>Phellodendron amurense</i> var. <i>lavallei</i>  – Lavelle's Cork Tree  <i>Pinus densiflora</i>  <i>Magnolia tripetala</i> – Umbrella  Magnolia  <i>Chelone glabra</i></p>	<p><i>Eupatorium dubium</i> – Coastal Plain  Joe-Pye Weed  <i>Pterocarpus officinalis</i>  <i>Rhizophora mangle</i> - Red Mangrove  <i>Lagerstroemia 'Natchez'</i> – Crape  Myrtle</p>
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### Chanticleer

<p><i>Ludwigia sedioides</i></p>	<p><i>Actaea pachypoda</i></p>
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## Wavehill

<p><i>Lepechena hastata</i> <i>Angelica stricta</i> 'Purpurea' <i>Justicia betonica</i> <i>Asplenium nidus</i> – Bird's Nest Fern <i>Dryopteris cristata</i> - Crested Fern <i>Polygonum virginianum</i> <i>Pollia japonica</i> <i>Smillocina stellate</i> <i>Pelargonium xerophyton</i> <i>Alluandia procera</i> <i>Gleditsia triacanthos</i> 'Ruby Lace'</p>	<p><i>Phlox paniculata</i> 'David' <i>Lagerstroemia fauriei</i> 'Townhouse' <i>Pinus strobus</i> 'Torulosa' <i>Thujaopsis dolabrata</i> 'Latifolia' <i>Pinus kwangtungensis</i> <i>Eryngium leavenworthii</i> <i>Euphorbia marginata</i> <i>Euphorbia cyathophora</i> <i>Gomphrena globosa</i> <i>Panicum amarum</i> 'Dewey Blue'</p>
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## Longwood Gardens

<p><i>Euphorbia cotonifolia</i> <i>Euphorbia fulgens</i> <i>Eupatorium barttelinia</i> <i>Eupatorium hyssopifolium</i> – Hyssopleaf Thoroughwort <i>Asclepias verticillata</i> – Whorled Milkweed <i>Begonia</i> 'Cotton Candy' <i>Dypsis decaryi</i> – Triangle Palm <i>Brahea armata</i> – Big Blue Hesper Palm <i>Beaucarnea recurvate</i> ' Ponytail Palm <i>Kalanchoe beharensis</i> – Felt Bush</p>	<p><i>Hibiscus rosa-sinensis</i> 'Nightfire' – Chinese Hibiscus <i>Eustoma grandiflorum</i> – Lisanthus <i>Persicaria orientalis</i> – Kiss-Me-Over- The-Garden-Gate <i>Elymus hystrix</i> – Bottlebrush Grass <i>Toxodium distichum</i> var. <i>imbricatum</i> 'Prairie Sentinel' – Pond Cypress <i>Sansevieria cylindrical</i> – Cylindrical Snake Plant <i>Dombeya wallichii</i> <i>Begonia</i> 'Crestabruhii'</p>
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## San Francisco Botanical Garden

<p><i>Acacia pravissima</i> – Ovens Acacia <i>Cupressus macrocarpa</i> – Monterey Cypress <i>Metrosideros excelsa</i> - New Zealand Christmas Tree <i>Picea sitchensis</i>- Sitka Spruce <i>Leucadendron linifolium</i> – Mini Silver Balls <i>Leucadendron</i> 'Safari Sunshine'</p>	<p><i>Wachendorfia thyrsiflora</i> – Blood Root <i>Furcraea parmentieri</i> <i>Bocconia arborea</i> <i>Malvaviscus arboreus</i> var. <i>arboreus</i> – Sleeping Hibiscus <i>Fremontodendron californicum</i> – Flannel Bush</p>
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**Morris Arboretum**

**Bartram's Garden**

<i>Lindhera salicifolia</i>	<i>Franklinia alatamaha</i> <i>Toxicodendron radicans</i>
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Hummingbird feeding on *Echium candicans* at Alcatraz.



Tree pruning in Kennett Square, PA.



Herbal Medicines in a general store just outside Sequoia National Park