

A Study Tour of The Pacific Northwest:

Horticulture's Role in the Health and Wellbeing of Plants and People

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July - August 2019

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Introduction

I began my career in horticulture as a volunteer at the University of Bristol Botanic Garden. It quickly became clear to me that horticulture would be a fulfilling career and was something I would love to pursue. I went on to spend a year working at Jekka's Herb Farm, where I learnt about the many uses of plants and developed a love for the satisfying and nurturing nature of nursery work. I am currently a horticultural apprentice at the Royal Botanic Gardens, Kew. As an apprentice I was encouraged to complete a travel scholarship project to broaden my studies and explore an area of my own particular interest. This amazing opportunity led me to travel to the Pacific Northwest of the USA to undertake my project 'Horticulture's Role in the Health and Wellbeing of Plants and People'.

The Pacific Northwest is home to diverse flora, beautiful landscapes and a variety of exciting horticultural projects that encompass my key interests. I visited sites which utilise horticulture to restore and preserve plants and the environment. The sites strive to educate and encourage people to develop a connection to nature, and grow in a responsible and environmentally sustainable way, working in harmony with the natural ecology. Plants are vital to so many aspects of our lives, as sources of food, medicine, beauty, inspiration and knowledge, and I am fascinated by their implicit life-giving qualities. I chose to explore horticultural work that promotes the benefits of protecting plants and being in nature, and highlights the intersection of environmental and social justice.

Understanding the interconnectedness of our ecosystems can enable us to interact with nature in a positive way, no longer viewing ourselves as separate from it. When all elements are supporting each other, this can sustain the health and wellbeing of the entire ecosystem. Observing the remarkable cooperation within natural ecosystems can help us to work harmoniously with nature rather than dominate it and can even inspire us to be more cooperative as a species in other aspects of life.

Aims & Objectives

- To visit nurseries, natural environments and a variety of gardens including botanic, ornamental and community gardens
- To learn about sustainable horticulture, the promotion of the health and wellbeing benefits of horticulture and plants, and to observe the impact of the sites on communities and the environment
- To study native flora and ecosystems and see how this knowledge can improve cultivation
- To improve plant knowledge and identification skills, particularly of native and useful plants
- To observe the cultivation and display of plants, design techniques used and their impact
- To observe horticulture applied to conservation and restoration projects and learn about relevant techniques
- To create links with other horticulturalists and organisations
- To broaden my future study and career opportunities and to implement knowledge and skills I learn in my current role and in my future career

Itinerary

20 July	Fly from London to Seattle
21 July	Rest Day
22 July	Society for Ecological Restoration - University of Washington Native Plant Nursery
23 July	University of Washington Medical Herb Garden
24 July	Washington Park Arboretum - University of Washington Botanic Garden
25 July	Beacon Food Forest
26 July	Bloedel Reserve
27 July	AM: Olympic National Park - Matt Albright Native Plant Nursery PM: Elwah Dam Restoration
28 July	Olympic National Park - Obstruction Point trail
29 July	Olympic National Park - Sul Duc Falls trail
30 July	AM: Olympic National Park Herbarium PM: Olympic National Park - Rialto Beach
31 July	Olympic National Park - Hoh Rainforest
1-2 August	Drive to Portland
3 August	Portland Japanese Garden
4 August	Rest Day
5 August	Mount St Helens National Volcanic Monument - Lava Canyon
6 August	Mount St Helens National Volcanic Monument - Johnston Ridge Observatory
7 August	AM: Mount Rainier National Park - Reflection Lakes trail PM: Mount Rainier National Park - Silver Forest trail
8 August	Oxbow Farm and Conservation Centre
9 August	Bastyr University Gardens
10 August	Fly from Seattle to London

Sites Visited

Instead of recounting my trip chronologically I have chosen to theme my report under 3 sections – Nurseries & Ecological Restoration, Natural Areas, and Gardens. I feel this provides clearer comparison of the sites and a more logical structure.

Nurseries & Ecological Restoration

Society for Ecological Restoration- University of Washington Native Plant Nursery- Centre for Urban Horticulture - SEATTLE

The SER-UW Native Plant Nursery was the very first stop on my trip and was an excellent place to start. The nursery is within the University's 'Centre for Urban Horticulture', which also houses research conservatories, a student run farm, a horticultural library and herbarium. The grounds include demonstration gardens and the Union Bay Natural Area which are free and publicly accessible. It is situated on the north shore of Union Bay of Lake Washington and sits on top of a reclaimed landfill which was transformed into a wildlife haven, making it the perfect outdoor laboratory to research restoration.

The nursery's purpose is to educate students in horticultural skills, to encourage practical application of their studies, and to produce plants for research and in-situ restoration projects. This includes many student-led restoration projects, ongoing restoration within the Centre for Urban Horticulture and some offsite projects. I met with Helen and Will who are the sole employees who run the nursery, along with help from other student volunteers. Both students at the university (Helen studies Urban planning and Will studies Plant Physiology), they spend as much time working at the nursery as they can fit within their busy schedule.



*SER-UW Native Plant Nursery – Newly potted Red Alder - *Alnus rubra* on left*

Helen and Will were very knowledgeable and helpful, introducing me to how the nursery operates, many of the native species in the area and how the restoration process works. They explained that the first step will often involve the removal of invasive species. Species which cause problems in this area include English Ivy - *Hedera helix*, Himalayan Blackberry - *Rubus armeniacus* and Scotch Broom – *Cytisus scoparius*. These plants out-compete native understory vegetation and can prevent the establishment of native trees that require light for germination such as Pacific Madrone - *Arbutus menziesii*, Douglas Fir - *Pseudotsuga menziesii* and Western White Pine - *Pinus monticola*. These invasive species form dense, impenetrable, monocultural thickets which reduce habitats and block access for wildlife, causing many knock-on effects to the ecosystem. In addition to this, they can also inhibit people from enjoying natural areas.

It was fascinating to learn how they select native species for reintroduction. Red Alder – *Alnus rubra* makes a good reintroduction species as it is fast growing and is often an early successional plant. It can also improve disturbed soils as it hosts *Frankia* bacteria within its roots which fix atmospheric nitrogen into the soil, making it available to plants. Lack of nitrogen is the most common limiting factor for plant growth in the region.

They will also pick plants which are considered bioremedial. This includes trees in the genus *Populus* which help remove toxins from polluted areas, such as the landfill waste buried not far beneath the surface in the Centre for Urban Horticulture. *Populus* are well suited for this purpose due to their rapid growth, extensive root systems, high water uptake, and ability to remove and degrade toxins such as trichloroethylene and carbon tetrachloride.

All techniques used within the nursery promoted the plants continued survival and health, as well as the health of the whole environment. Most plants in the nursery are propagated via seed as this will create the greatest genetic diversity, leading to a variety of characteristics in the produced plants which will increase survival rates. Tree seedlings are grown within special long ‘cone-tainers’ to encourage extensive root systems helping them to establish quickly and become sturdy, healthy plants. During my visit I also had the chance to assist with some seedling repotting and fertilising. Organic methods are used throughout the nursery – such as soaking the cones in a ‘Liquid Fish and Guano’ feed and using disease treatments such as horticultural soap and bicarbonate of soda for mildew. It was very rewarding to think that the little Red Alder seedlings I was potting will one day be planted back out into a natural habitat to help regenerate the environment.



Healthy root system of Red Alder – *Alnus rubra* grown in ‘Cone-tainer’

Matt Albright Native Plant Centre & Elwah Dam Restoration - OLYMPIC NATIONAL PARK

The Matt Albright Native Plant Centre is run by the Olympic National Park and works to propagate and grow on native plants to reintroduce within disturbed sites in the park and surrounding areas. I met with Dave Allen who is the Nursery Manager and very kindly showed me around the nursery and spent his weekend showing me different areas of the park, teaching me so much about the plants, ecology and history of the area.

The nursery works on a larger scale than the SER-UW Native Plant Nursery, with a capacity to produce over 120 thousand plants a year. However, they currently only have the means to plant out 60 thousand. The nursery is run with 6 core staff members, with additional seasonal workers and community volunteer help for large planting projects. Similarly, much of their stock is also grown from seed, mostly collected from the park. This is then grown on in the nursery's field and seed is harvested in order to bulk up the quantities. The seed produced can then be direct sown in-situ or is grown on within the nursery to produce plants for restoration plantings.

Sites proposed for restoration are assessed thoroughly to determine the soil type, what was growing before the disruption and whether it is possible to achieve a similar plant community with restoration. It is important to consider if the soil conditions have been altered so severely that the same plants may no longer be able to thrive there. Seed is collected nearby the sites to be revegetated so that plants produced possess the same beneficial adaptations, enabling them to survive in that same habitat. Plants are grown to be as hardy as possible. There are limited resources for after care such as watering, so it is essential that the plants establish quickly. A large and healthy root system is vital and smaller plants with less leaves are beneficial as this will reduce transpiration pressure, increasing the chance of survival. Many of the restoration sites are not accessible via vehicle and require plants and tools to be carried through all kinds of terrains and up to high altitudes. It is therefore best to bring as few plants as possible, which will have the highest chance of survival and further colonisation. Plants which produce seed abundantly are favoured such as Suksdorf's Sagewort - *Artemisia suksdorfii*, which is an early successional plant and can grow on a wide range of soil types.



Suksdorf's Sagewort - Artemisia suksdorfii growing at the Elwah Dam Restoration site

Dave explained some of the environmental factors effecting the area and how this effected their work. The Olympic National Park has a multitude of ecosystems and extreme weather conditions that vary hugely in a relatively small area. Dry conditions are caused by a pronounced rain shadow east of Mount Olympus but areas further away (and particularly in the west) receive up to 4 metres of rain a year. There is also a huge variety of elevations. Correctly timing planting or sowing in-situ is vital, as at high elevations growing seasons are shorter meaning lower success rates. They aim to time planting and sowing to benefit from Autumn rains, when conditions are wet enough to allow the plants to establish and seeds to germinate. This can prove to be difficult as it is often a short window between the summer heat and winter snow, especially with increasingly hot, long summers.

During my visit I had the amazing opportunity to see their work in action, as Dave led me on a hike to see the Elwah Dam restoration project. The hydroelectric dam was removed gradually in stages beginning in 2011 and was the largest dam removal in US history. It created huge changes to the surrounding areas both upstream, where the drained dam reservoir revealed a huge barren lakebed, and right down to the mouth of the river, where years of built-up sediment was deposited, creating a whole new stretch of beach. This dramatically increased natural habitats and restored and reconnected the natural ecosystems throughout the entire area.

The revegetation project played an important role in controlling erosion, moderating stream temperatures, soil generation and delivering nutrients to the watershed. It sped up natural processes and prevented invasive species from establishing, with the aim of creating a self-sustaining native ecosystem. The Matt Albright Nursery produced and planted nearly all the plants for the revegetation in these new areas. Around 320,000 plants were planted, and 6,500 pounds of seed were sown in the lakebeds to boost natural revegetation. Interestingly this was less than was estimated to be required, as there was more natural revegetation than expected. Black Cottonwood - *Populus trichocarpa* seeds from the surrounding forests were quick to establish naturally.



Drained reservoir of the Elwah Dam. Significant Black Cottonwood - Populus trichocarpa populations establishing at edges

The restoration team wanted to create as much diversity as possible to increase the resilience of the ecosystem: the more species present, the better the chances of success. They considered many factors when choosing plants and how they would affect the ecosystem. The lakebed had various types of sediment, the lower areas nearest to the river were very fine and moist – 30% silt, 70% clay. The higher terraces had higher quantities of coarse sediment, mostly sand and gravel, and were therefore more prone to drying out. Species selected to better tolerate the coarse substrate conditions include Pacific Madrone - *Arbutus menziesii* and Western White Pine - *Pinus monticola* which is known to be more drought resistant than some conifers. Douglas Fir - *Pseudotsuga menzeisii* did better on the moist, fine sediments closer to the river. Species such as Grand Fir - *Abies grandis* often colonise naturally after disturbances like fire and can also grow in a variety of substrates with lower organic matter. Bigleaf Maple - *Acer macrophyllum* grows well in riparian areas and can grow in coarse substrate. As a deciduous tree it aids soil formation by contributing to organic matter via its leaf litter. Riverbank Lupin - *Lupinus rivularis* was very useful as it is nitrogen fixing and flowers readily, kick starting natural succession by stabilising and improving soil.

The dam removal project was often focussed on the specific goal of increasing the salmon population, as this was a ‘flagship species’ whose deterioration had a very direct and clear link to the dam (the dam blocked their passage up stream to spawning grounds). There was also a clear monetary gain (fishing) from restoring population numbers. However, many saw the dam removal in a wider context and as an opportunity to benefit in other ways. Many different people were involved in utilising this momentous potential to learn and restore life on multiple levels.

From the beginning of the dam construction, the Lower Elwah Klallam Tribe warned about the wide spreading, damaging effects of the dam, and have been advocating for dam removal for many years. This indigenous tribe have sustained themselves from this area for many generations and have a deep connection and understanding of it. They did not benefit from the electricity created by the dam as most could not afford it, their livelihood was ruined by the dam and it forced many tribes people to move away from their ancestral home. Their sacred creation site, where they believe their tribe began, was buried under the lake created by the dam.

It is devastating that our natural ecosystems are manipulated by people for monetary gain at any costs. It only took 80 years to destroy this area but may take centuries to be fully restored. What I took away from visiting this site was its deep interconnectedness. This is not only about salmon, not only about plants, or about sediment or about people, but about how all these things rely on one another.

Oxbow Farm & Conservation Centre – CARNATION

Oxbow Farm & Conservation Centre is a non-profit organisation which researches and practices ecological horticultural and farming methods to improve and protect the ecosystem. The 240-acre site bordering the Snoqualmie river contains forest and natural areas, regenerative organic farmland, a native plant nursery, and outdoor education facilities. The various teams at Oxbow are pursuing the shared goal of promoting sustainable, healthy living and growing, and connections between people and natural systems. During my visit I was very lucky to meet with people from 3 of the different teams: Bridget McNassar - Native Plant Program Manager, Kevin Haggerty - Farm Manager and Matt Distler - Conservation Program Manager.

I was shown around the native plant nursery by Bridget, which shared similarities to the others I had visited in terms of their methods of growing and the plants species. Seed is collected and grown on

for restoration projects working within their own site and projects partnered with other organisations. They are also involved in growing for retail and special landscaping projects such as demonstrative gardens at the University of Washington which showcase natural planting schemes. Salal – *Gaultheria shallon* and Sword Fern – *Polystichum munitum* were commonly grown in the nursery as they are good for covering ground, preventing invasive species from establishing.

Kevin gave me a tour of the farm and highlighted Oxbow's aim to show that farming and restoration does not need to be antithetical. Farming can work both for people and the environment. The farm uses techniques such as crop rotation and leaving fallowed fields which allow soil to recover and regenerate, protect the watershed and increase biodiversity. All crops are chosen to be suitable for their climate and they grow interesting varieties including the Ozette potato which was grown by the Makah indigenous people. The farm is situated on a flood plain, so using winter cover crops with large roots such as Rye - *Secale cereale* which catches silt from the flooding river, helps with soil building. They use organic fertilising methods and pest management techniques such as beneficial insect release and insectary habitat plantings. Working closely with the other teams at Oxbow, they ensure the surrounding land is benefiting the farm and vice versa, in terms of biodiversity and sustainability.



Edible flowers grown on the farm- supporting pollinators and humans alike

The certified organic farm supplies produce to local grocers, restaurants, hunger relief agencies, and schools, as well as directly to shareholders of the CSA (Community Supported Agriculture) program, who subscribe to get access to the produce throughout the season. Kevin explained that they have moved away from the traditional box delivery scheme and changed to a market-style scheme where shareholders visit the farm and pick their own produce. This allows people to connect with where their food comes from, see how the farm works, and better understand the seasonality of produce. Eating locally is not only important for the environment but also helps support a healthy food economy and provides fresher, more delicious food. The process of 'shopping' becomes more of an experience and food less of a commodity. Some of the best feedback has been from parents who say the 'U-pick' scheme has had a hugely beneficial impact on their children, engaging them with many important concepts surrounding food, plants, the environment and society, whilst also being one of their favourite activities in the week.

Matt explained how their conservation program works and showed me some of the research they were conducting on site. One example was work looking into different organic vegetation suppression methods, such as plastic matting, or willow. This is extremely useful in the beginning stages of restoration where existing vegetation must be managed to allow for regeneration. Monitoring of the wildlife and diversity is conducted to assess the impact of their restoration. Animal faeces is genetically analysed to determine which plants they are eating and therefore whether the revegetation is useful to them. Local school children have been involved in a project monitoring waterholes and the effect of buffer planting on the water table, nutrients and water movements.

It was very inspiring to see a project that cohesively encompasses many of the amazing things horticulture can achieve. Ideas of sharing knowledge and connecting with the local community is embedded throughout the organisation. Education of all ages is key to their mission as is the promotion of stewardship and people working symbiotically with nature.

Natural Areas

During my trip I also explored natural environments to observe plants growing in habitat. Understanding the conditions in these complex ecosystems is vital for restoration work, and for replicating natural systems to grow sustainably in any situation. In terms of aesthetic beauty and horticultural inspiration, visiting these areas was truly awe inspiring. Throughout my time in the US I was struck by the epic scale of the landscapes and plants. Of the many places I visited I would like to discuss two in particular: Hoh Rainforest and Mount St Helen.

Hoh Rainforest - OLYMPIC NATIONAL PARK

The old growth forests in Olympic National Park are particularly spectacular. The Hoh Rainforest has looked much like it does today for 5000 years and is some of the last remaining protected temperate rainforest in this area. Previously stretching from southern Oregon to southeast Alaska, the temperate rainforests were mostly destroyed due to commercial exploitation.



Big Leaf Maple - Acer macrophyllum has deeply furrowed bark and spreading boughs which hold moisture and support the huge amount epiphytes.

The temperate, moist conditions support a lush and vibrant ecosystem which is considered the most productive place on earth with 500 tons of biomass per acre (compared to tropical rainforests which contain 300 tons per acre). Conifers such as Western Hemlock - *Tsuga heterophylla* and Sitka Spruce - *Picea sitchensis* dominate this rainforest. The forest receives up to 4 metres of annual precipitation which allows the trees to grow enormous, some reaching 7 metres in diameter and 95 metres high.

The forest exemplifies the cycle of life and death. Decaying and dead matter is vital for the continued health of the community and increases opportunities for habitat and new life. Fallen trees decay slowly and support new life as 'nurse-logs', which can result in lines of trees which look mysteriously straight. Many trees are over centuries old, meaning dense epiphytic growth is abundant. Bigleaf Maple – *Acer macrophyllum* and Vine Maple – *Acer circinatum* are often host to many mosses and ferns, giving a magical appearance of being dripping or draped. Along the trail, signs educate visitors about the ecosystems and invite them to explore the sensory experience of the forest. The park promotes an appreciation and fascination of the beautiful, tranquil and humbling environment. Developing deeper connections to the world around us can allow people to understand the importance of protecting these places.



Straight line of Western Hemlock - Tsuga heterophylla & Sitka Spruce - Picea sitchensis growing on a 'nurse-log'

Mount St Helen National Volcanic Monument – GIFFORD PINCHOT NATIONAL FOREST

Mount St Helen is an active volcano which erupted in 1980, causing devastating destruction to the surrounding areas. During my visit I was able to observe some of the areas affected by the eruption and attended a ranger talk where I learnt about how the forest service and scientists approached the situation after eruption. This natural disaster provided a unique opportunity to study natural succession and regeneration, therefore most of the areas affected did not receive human intervention in terms of replanting or seeding. This ongoing research can teach us about how ecosystems respond to disturbance and can inform how to best replicate the successful processes of nature in situations where human intervention is necessary.

The fact that most of the destruction was surrounded by natural areas significantly helped revegetation as these ecosystems supplied the essential seeds and organic matter. It is important to consider the surrounding land of any area you aim to revegetate to determine how much 'human help' will be required. However, succession was not limited to the edges of the eruption zone. Biological legacies (surviving plants/organic components/nutrients) also played an important role in repopulating the central areas. This example can be found even in areas such the Elwah Dam removal, which had hardly any biological legacies apart from the huge piles of driftwood left behind. These logs provided organic matter and shady moist microclimates, benefitting young plants in their vicinity.

Like the Elwah site, Lupins (in this case Prairie Lupin - *Lupinus lepidus*) were also found to be thriving in the eruption zone. This was the first plant to be found growing on the Pumice Plain created by the volcano, an area lacking nutrients which the Lupins had the ability to obtain through its association with the nitrogen fixing bacteria. These pioneer plants initiated the chain of succession which involves all aspects of the ecosystem. Sun-loving plants such as Pearly Everlasting - *Anaphalis margaritacea* and Rosebay Willow Herb - *Chamaenerion angustifolium* (known as Fireweed in the US as it is a common coloniser after fire disturbances) were also early colonisers due to their ability to thrive in the lack of shade and at the sub-alpine altitude. Pearly Everlasting seeds have silky hairs which aid wind dispersal and once established it will also spread extensively via rhizomes. These 'weedy' characteristics are very beneficial in early succession and it will often become a dominant species in disturbed areas. It will typically reach its peak colonisation after 5 years at which point woody plants begin to supersede.



Remains of trees blasted in the eruption now surrounded by wildflowers – Red Paintbrush - *Castilleja miniata* & Pearly Everlasting - *Anaphalis margaritacea*.

Some areas of Mount St Helen did receive human revegetation, particularly in the form of aerial seeding. Problems occurred relating to the use of non-native species. Invasive grasses used in seed mixes were observed to prevent native species from establishing. This highlighted the need to use native species in restoration projects. The seeding was initiated due to erosion concerns in some areas; however, it was largely unsuccessful as the substrate was still so unstable that many of the seeds were eroded away too quickly to establish. Policies of land management were subsequently changed to ensure substrates were properly assessed to have enough stability before using seeding to help with further stabilisation.



Dramatic landscapes created by lahars (volcanic mudflows) – young conifers growing upon volcanic rock

Gardens

I visited many gardens of varying styles. One thing that unites them is their aim to connect people with nature and work harmoniously with their environment. This can manifest in many forms through thoughtful design, from the spiritual Japanese gardens which evoke or recreate natural landscapes, or the more categorised collections of botanic gardens, which if displayed creatively can be thought-provoking and inspiring. The most loved gardens are those that make a lasting impact. The translation of the awe, splendour and sublimity of nature can not only make you think but also feel a closeness and affinity with it. I wanted to explore a range of gardens to learn about their effect on people, the environment and how they can benefit both.

Washington Park Arboretum - University of Washington Botanic Garden - SEATTLE

The Washington Park Arboretum is a 230-acre site run by the University of Washington. The arboretum has roughly 1 million visitors a year and is free to enter. Accessibility is hugely appreciated by the local community in Seattle and enables the arboretum's message to reach more people. It was a great place to visit to familiarise myself with the native plants with the help of labelled specimens before venturing to the natural areas. The arboretum truly excelled in using horticulture to inspire people and protect nature.

I met with David Zuckerman – Manager of Horticulture who took me on a tour through the expansive arboretum. The collections mainly focus on trees and shrubs but there are also many display gardens with herbaceous interest interspersed throughout. David explained that the garden contains different types of collections such as - historic, including their Azalea and Cherry collections; taxonomic, such as their *Quercus* and *Acer* collections and horticultural displays like the Winter Garden.

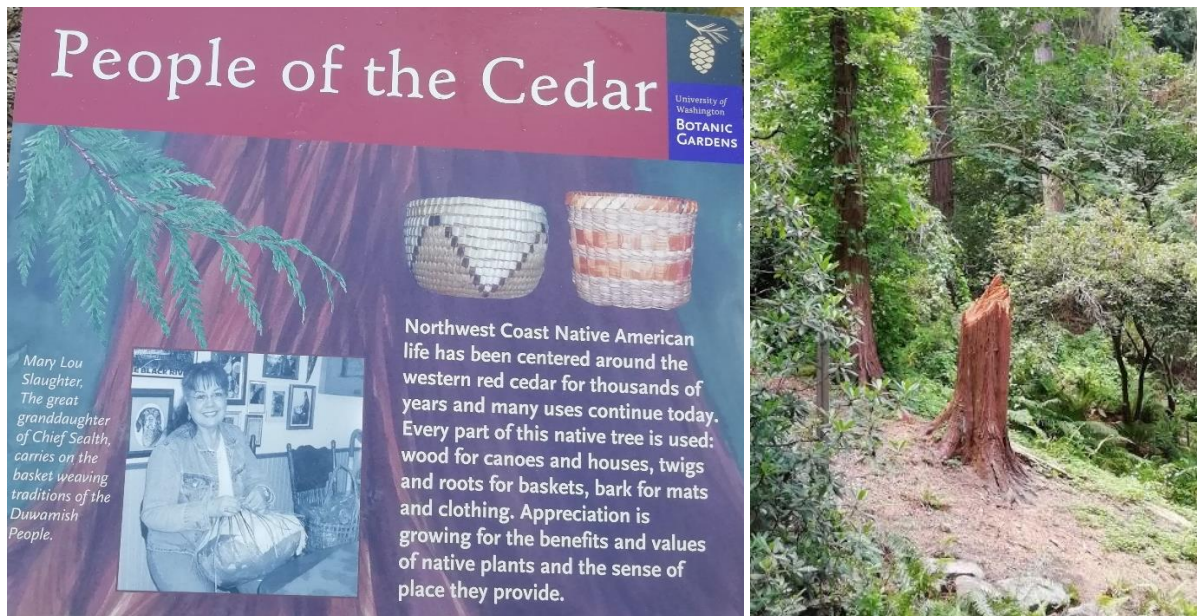
The newest developments in the garden are the Ecogeographic Collections, which have been designed to display the story of geographic and ecological evolution. This includes the Pacific Connections Garden which displays plants from five regions, all connected by the Pacific Ocean - Cascadia, Australia, China, Chile and New Zealand. The garden is a beautiful place for relaxation and learning, aiming to teach visitors about ecogeographic evolution and flora adaptations, the need for conservation, and the cultural connections people have with plants. These regions were chosen as they have similar climates to Seattle (which is within Cascadia), making the plants from these regions easier and more sustainable to grow within the arboretum. Plants which can tolerate the dry summers and mild wet winters require less water and energy, and are generally more likely to thrive, therefore resulting in less deaths. Planting geographic rather than taxonomic collections can ease the horticultural team's pressures, as maintenance tasks will generally be more efficient, requiring less altering for specific plants.



Interpretive shelter with green roof in the centre of the Pacific Connections Garden

The Pacific Connections Garden is designed with a central meadow from which the five different gardens have trails branching off. At the beginning of each geographic section a 'Preview Garden' is planted to demonstrate key plants which visitors might be able to grow in their own gardens, giving an idea for planting designs and easy to source plants. Within the main gardens the plantings aim to be a representative forest from each of the different regions. The gardens work with the existing gradient and topography of the landscape, making for interesting winding pathways down the hills. They are designed to imitate nature by having higher elevation plants at the top of the hills and lower elevation plants at the bottom.

Throughout the gardens, educational interpretation encourages comparison of the similarities and differences of plants across the regions. Within the central meadow sits an interpretive shelter which was designed with sustainability in mind. It was built using Western Redcedar wood – *Thuja plicata* (naturally resistant to decay and pests) salvaged from the arboretum. The wood was engraved by local artists and volunteers with artwork inspired by the five different regions. Interpretation within the shelter explains the connections between these regions, and the plants and people who live there. From each region 'Iconic Plants' have been picked out which have significance to the different cultures because of their traditional uses, roles in the ecosystem, and beauty. These include Western Redcedar - *Thuja plicata* from Cascadia, Monkey Puzzle Tree - *Araucaria araucana* from Chile, New Zealand Flax - *Phormium tenax* from New Zealand, Ginkgo - *Ginkgo biloba* from China, and Snow Gum - *Eucalyptus pauciflora* from Australia.



Interpretation signage about the importance of Western Redcedar - *Thuja plicata* & Standing snag left to create habitat

David explained how the teams work to manage the arboretum whilst considering the health of the ecosystem. When areas such as the Rhododendron Glen become too shaded, arborists will selectively remove trees whilst leaving a standing snag. This is then skilfully cut to provide a habitat for wildlife and epiphytes. Alternatively, they leave logs on the ground to mimic the natural succession in forests.

University of Washington Medicinal Herb Garden - SEATTLE

The Medicinal Herb Garden is set in the campus grounds of the University of Washington and is a long and narrow garden, mostly consisting of rectangular beds. I met with Keith Posse who has been the sole gardener since the 90s. It is a peaceful and private space, competing for light with maturing trees and the university buildings that surround. This poses a challenge for Keith, who groups plants together with similar shade and water tolerance, and therefore often by country of origin.

The garden contains a huge variety of different medicinal plants from all over the world, including many native to the Pacific North West. The native Pacific Yew - *Taxus brevifolia*, is the source of Taxol, an important cancer treatment drug. Harvesting the bark kills the tree and the exploitation of the species for medicinal purposes formerly threatened it. The drug is now produced via precursors and biosynthesis. Many indigenous people utilised the Pacific Yew sustainably for its strong wood and its medicinal properties. The Quinault people chew the leaves and spit them on wounds to aid healing and use a decoction of the bark as lung medicine.

Exotic plants displayed include the Toothache Plant - *Spilanthes acmella*, native to Brazil. I was invited to chew on a flower which caused a numbing, tingling sensation making it immediately obvious how it had obtained its name. The plant has a long history of traditional use and is now being researched for its many beneficial properties: antimicrobial and antimalarial, pain relieving, immunomodulatory, antirheumatic and digestive.



Toothache Plant - Spilanthes acmella & Purple Devil - Solanum atropurpureum

Rabbits are a major pest in the garden, prevented by placing wire cages over their favoured plants or by planting unappetising plants such as the spikey Purple Devil - *Solanum atropurpureum*. This plant is highly toxic but interestingly contains alkaloids which are used in medicine and as an antidote to anticholinergic nerve gas poisons. Keith employs a naturalistic approach, allowing plants such as Yerba Mansa - *Anemopsis californica* which has a stoloniferous habit, to grow together and intertwine with its neighbours. This plant is found in southwest North America and northwest Mexico and has valuable antimicrobial, anti-inflammatory and diuretic properties. Although the garden is no longer utilised for research into medicinal uses, it is hugely appreciated by students, staff and visitors to the university, and its benefits to people's wellbeing are evident and strong. It was a beautiful, peaceful haven and a place clearly tended to with love and many years of wisdom. It was also fascinating to see such a huge variety of herbal plants from around the world, many of which were new to me.

Bastyr University Gardens – KENMORE

Bastyr University is a non-profit, private university specialising in science-based natural medicine that incorporates mind, body, spirit, and nature. The gardens are within the campus and are also open to the public. The holistic approach extends to the gardens which are very much integrated into the curriculum. The gardens are designed, cultivated and managed by students and volunteers under the guidance of gardeners. The medicinal plants are utilised for creating medicines, and edibles for nutrition classes. The university places much importance on using plants sustainably and the production of raw plant material helps to avoid over harvesting and habitat loss in the wild.

During my visit I met with Katie Vincent – Garden Supervisor, who guided me through the different sections of the gardens which include – Botanical Family Garden, East Asian Medicine Garden, Body Systems Garden, Production Garden, Four Element Garden, Sacred Seeds Ethnobotanical Trail, Nutrition Garden, Student Plots, a Shade House and a Teaching Glasshouse. All areas are designed to be resources for education and to be efficiently and easily accessed and used.

The Body Systems Garden displays plants which have properties relating to specific systems in the body such as the immune system or the digestive system. Within the reproductive system bed, Katie showed me Blackhaw – *Viburnum prunifolium*, which is used in the treatment of menstrual cramps, recovery after childbirth, and the effects of menopause. It also has a dark history of being used by slaveowners to stop slaves having abortions. In order to prevent their children from being born into slavery, women would attempt to use cotton seeds to cause a miscarriage. The slaveowners would force them to drink an infusion of Blackhaw to reverse the effects.



Beneficial immune system plants: Marigold- Calendula officinalis, Coneflower – Echinacea purpurea and Elder - Sambucus nigra & Black Cohosh – Actaea racemosa growing the plant sanctuary

The Shade House functions as a plant sanctuary where at-risk native species are conserved. This project is affiliated with the United Plant Savers, an organisation which ‘aims protect native medicinal plants and their native habitat while ensuring an abundant renewable supply of medicinal plants for generations to come.’ Black Cohosh – *Actaea racemosa* is used for a variety of purposes, particularly for inflammatory conditions and menstrual disorders. 97% of traded Black Cohosh is sourced from

wild habitat. Since the roots and rhizomes are the parts harvested, Black Cohosh will usually not regenerate after heavy harvesting. Development and logging also threaten Black Cohosh habitat, weakening or removing entire populations and reducing genetic diversity within populations and the species as a whole.

The Nutrition Garden and Student Plots showcase and produce organic edible plants. Sustainable growing methods are used such as crop rotation, cover cropping and intercropping. Indigenous people have used companion planting schemes such as ‘Three Sisters’ for centuries. The three crops combined are corn, beans and squash. All of which provide food but also benefit each other whilst growing together. Corn provides support for the climbing plants, beans will fix nitrogen to enrich the soil and the squash will work as a living mulch, preventing weeds and keeping the soil moist. There is significant overlap between medicinal and edible plants and the idea ‘let food be thy medicine’ is encouraged at Bastyr. The gardens provide and promote a varied diet of fresh, non-processed food. Edible landscaping is even integrated around the student dorms, benefitting their health and wellbeing.

The Sacred Seeds Ethnobotanical Trail is a project devised to address rapid biodiversity loss and the loss of the relationships and uses of plants which accompany it. Bastyr works with an advisory committee of native tribes’ people who consult on the project and educational material for students and visiting school groups. The trail consists of 3 biomes – meadow, forest and wetland, and aims to conserve useful native plants, preserve ethnobotanical knowledge and allow communities to stay connected to native plants.

In the meadow area I saw Showy Milkweed - *Asclepias speciosa*, which is used for fibre, food, and medicine. It is used to heal wounds, warts, ringworm and to draw the venom from rattlesnake bites. Existing woodland is used to form the forest section of the trail, which is undergoing active restoration. This includes the removal of invasive species, pruning out of fungal diseases and understory planting of important native edible and medicinal plants: Oregon Grape - *Berberis aquifolium* and Salal - *Gaultheria shallon*. The moist conditions in the wetland support the growth of the medicinal fungus Turkey Tail – *Trametes versicolor*, which has immunomodulatory and anticarcinogenic properties.



Showy Milkweed - Asclepias speciosa & Turkey Tail fungus – Trametes versicolor

Beacon Food Forest - SEATTLE

Beacon Food Forest is a community permaculture project in Seattle. It provides a space for the community to grow healthy fresh food and learn about permaculture. Their goal is to grow food for the benefit of all species and to develop positive interactions with nature. It aims to inspire the community to develop connections to each other and their food sources, whilst also rehabilitating the local ecosystem, improving public health and food security. The site aims to be accessible to everyone and is centrally located and visible in the community. Beacon Food Forest started in 2009 and due to its success is planning to expand.

During my visit I joined in with a foraging tour led by Cheryl Wheeler. This tour helps members of the community to identify and learn about plants in the food forest which are available to anyone to forage. Cheryl explained that the garden design considered accessibility and aims to conserve energy at every stage, including ease of harvesting and tending to the plants. Walking us through the site, she pointed out various plants of interest during the summer season. Within the food forest there were many edible shrubs and trees which are important in permaculture design as they provide necessary layers to mimic a forest ecosystem. Natives such as Chokeberry - *Aronia melanocarpa* and Thimbleberry - *Rubus parviflorus* were fruiting and we were invited to taste the berries. Chokeberry tasted extremely sharp but is very nutritious and has beneficial gastroprotective and anti-inflammatory properties. Thimbleberry tasted similar to raspberries but are softer, making them less suitable for packing and shipping and therefore rarely grown commercially. It was interesting to think of how much food we might never eat simply because it is not profitable or easy to mass produce. A move towards more localised food production would not only be more sustainable and improve food security but could also increase the variety of our diets. Another shrub Cheryl pointed out was Goumi Berry - *Elaeagnus multiflora*. I was familiar with *Elaeagnus* as ornamental plants but had no idea you could eat the fruit. I also discovered that the genus grows symbiotically with nitrogen fixing bacteria, improving soil and benefitting the other plants within the forest. The Himalayan Honeysuckle - *Leycesteria formosa* berries were almost chocolate-like when very ripe. It was also a stunning plant with bracteate flowers produced on pendulous racemes.



Himalayan Honeysuckle - Leycesteria Formosa & Goumi Berry - Elaeagnus multiflora, almost fruiting

Visiting was a great opportunity to see a food forest beginning to come into its 'Forest' stage. The different layers were starting to mature, supporting a rich and diverse ecosystem. It was inspiring to learn about their community engagement and the impact it has on people. Community volunteers run regular work parties and frequent events which are productive in terms of growing and harvesting, and have great social, educational and wellbeing benefits. It enables sharing knowledge, skills and delicious homegrown food from many different members of the community.

Portland Japanese Garden - PORTLAND

Portland Japanese Garden has been described as the most authentic and beautiful Japanese style garden outside of Japan. It's 12 acres sit within Washington Park in the west of the city. Central to the garden's vision is the belief that there is power in cultural exchange, and that experiencing peace contributes to long-lasting and far-reaching peace across society.

During my visit I met with gardener Caleb Hendrickson who walked me through the 8 separate garden styles and explained the philosophy and design intentions behind them. I was also able to observe some of his duties and learn about the maintenance techniques required to achieve the stunning garden. It is a serene, urban oasis which draws on the traditional Japanese ideas of expressing the beauty and fragility of existence through a garden. The garden can be viewed as a microcosm, however the intention is not to be miniaturised but instead expanded to almost cosmic proportions. The garden is not isolated from the world but a condensation of all nature.



View from the bridge over the pond – Japanese style architecture of the Cultural Village in the background works harmoniously with landscape

Caleb explained that the sky is just as much a part of the garden as the plants. Gardeners carefully consider the treeline, and place, prune or remove trees selectively to maintain a balance. Balance is important and implicit throughout the garden, in terms of scale, colour, form and contrast. This in turn can create a feeling of equilibrium for the visitor. This idea of balance is also prevalent through the seasons of the garden, where cherries are displayed during spring and maples in autumn, so that visitors feel in tune with the natural systems of the world around them. The Sand and Stone garden is an example of a 'karesansui' garden which literally translates to 'dry landscape'. This garden plays with the balance of simplicity and complexity, with the underlying Japanese aesthetic principle of 'yohaku-no-bi' meaning 'the beauty of blank space'. Caleb described the importance of empty space and removing elements. Making space in the garden is likened to making space in the mind. This type of garden is designed to be viewed from a seated perspective. The idea of designated views, vistas and pathways are common in Japanese gardens, where there is a sense of careful control. This is not forced on the visitor in a restrictive or stifling way, instead the effect is comforting and a feeling of being gently guided.

Caleb emphasised the theme of exploration on many occasions, believing it to be a fundamental part of human nature. The meandering pathways and streams of the Strolling Pond Garden evoke a sense of intrigue. Before entering, the sounds of the trickling stream and waterfall are within earshot but out of view, encouraging people to venture further, using their senses to guide them. This design technique is called 'hide and reveal'.

There is a spectacular view of Mount Hood from the vantage point of the garden. A common Japanese garden theme is 'borrowed scenery', integrating the natural landscape of the surrounding area to the garden. Mountains are important to Japanese gardens, and many throughout history were designed to incorporate a view of a mountain or sit upon one. They are thought to have a divine wisdom and are a universal symbol of closeness to God. The Natural Garden was inspired by the landscapes of Mount Hood and designed to encourage visitors to rest and reflect on the essence and brevity of life. It includes many plants not traditionally used in Japanese gardens, featuring Pacific Northwest natives such as the delicate Vine Maple - *Acer circinatum*.



Heavenly Falls within the Strolling Pond Garden

Authenticity is important in all areas of the Portland Japanese Garden. Their attention to detail and commitment to working carefully and conscientiously was evident throughout the garden. Authentic materials and techniques are always used, even if initially more expensive or time consuming, as long-lasting quality results are prioritised. Every aspect is thoroughly thought out including the placement of stones in the Heavenly Falls waterfall. The stones were carefully arranged to create pleasing sounds, an example of how the garden aims to immerse all your senses.

A new addition to the garden is the Cultural Village which further promotes the connection between art, culture and nature by exhibiting daily demonstrations, facilitating music and craft workshops, and showcasing Japanese art. I observed a maple pruning workshop, where garden members were instructed on different style of pruning by the expert gardeners.

This garden embodied the idea of gardens connecting people with nature. It was inspiring to see the craftsmanship and thought that is applied to the garden, and the Japanese ethos and techniques which have been honed for centuries. The sensory and tranquil landscape is an idealisation of nature and provokes contemplation of being a small but integral part of the universe.

Bloedel Reserve – BAINBRIDGE ISLAND

Bloedel Reserve is a 150-acre site on Bainbridge Island in the Puget Sound. It is a harmonious collection of refined gardens, natural landscapes, and preserved forests. Once the private estate of the Bloedel family who were made wealthy by their logging business, the reserve was made public in the 80s and considered as their gift back to nature. The reserve works with the rugged landscape to celebrate the wonder of nature and to protect the environment and ecosystems within it. There is a focus on healing, and this permeates through all aspects of the reserve.

I was led on a tour by horticulturist Sean, who explained that there is a set 2-mile trail through the reserve. Visitors are encouraged to walk in the specified direction to observe the curated perspective. The reserve consists of interconnected spaces, carefully thought out to inspire a feeling of oneness and peace. From the carpark, visitors transition through a wildflower meadow, a large open space which is designed to be decompressing before entering the more enclosed woodland.

Sightlines are important and considered, particularly when transitioning from one area to the next. The aim is to make this transition intriguing and inviting, rather than jarring or abrupt. Plants are managed carefully where the different sections meet to soften the changes. The meandering trails can also lead visitors to unexpected places such as breath-taking viewpoints of the Puget Sound. In the naturalistic woodland areas, maintenance involves removing English Ivy - *Hedera helix*, and Elderberry – *Sambucus racemosa var. racemosa* to preserve the dappled canopy and sightlines. This also allows native understory plants to thrive, such as Vanilla Leaf - *Achlys triphylla* and Bleeding Heart - *Dicentra Formosa*. Shrubs included many native edibles such as Salomon berry - *Rubus spectabilis*, Red Huckleberry – *Vaccinium parvifolium*, Salal - *Gaultheria shallon* and Oregon Grape – *Berberis aquifolium*.

Big Leaf Maple – *Acer macrophyllum* is a common species within the woodland, with conifers dominating in shadier sections. Western Hemlock – *Tsuga heterophylla* are commonly found growing on nurse-logs, providing them with nutrients, moisture, and raising the seedlings above the woodland floor to increase access to light. It is one of the most shade-tolerant conifers due to its dense canopy and large needle surface area. Young Western Hemlock trees are successful in gradually growing beneath the canopy of other conifers such as Sitka Spruce – *Picea sitchensis* or Douglas Fir –

Pseudotsuga menziesii. Eventually the Western Hemlock can exploit a gap in the canopy and replace these other less shade-tolerant species. It is therefore referred to as a climax species. Ferns thrive in the shadier conifer dominated areas, and their texture, shape and movement is enchanting.



Native ferns from top clockwise: Sword Fern – *Polystichum munitum*, Lady Fern – *Athyrium filix-femina*, Maidenhair Fern – *Adiantum pedatum* and Deer Fern – *Blechnum spicant*

Sean explained that their main work in these areas is to prevent monocultures establishing and to encourage pollinators and wildlife. Snags are cut with a south-facing slit which allows sunlight to warm them up, creating an inviting shelter for birds. The team planned to remove part of the trail and set it back further away from a pond so that waterfowl may be more inclined to visit and less disturbed by visitors. Plants growing around the pond included Western Spirea - *Spiraea douglassi* and Red Alder – *Alnus rubra*. Nearby, they had recently established a new meadow area using native wildflowers. Sean explained how the meadow was designed to work within the ecosystem, benefitting pollinators and animals alike.

Bloedel Reserve is committed to sustainability and the team work as environmental stewards. They also care deeply about sharing the beauty and restorative message of Bloedel. Despite being in a remote area on an island, they have highlighted public transport routes for visitors to use and aim to become more accessible and reach more people. Visitor numbers have been increasing and they have taken steps to enhance the visitor experience by improving the entrance. They also run a very successful free program called 'Strolls for Wellbeing'. These are therapeutic guided walks, assisted through workbooks and group discussions, encouraging reflection and awareness. Everyone can benefit from the restorative impact of being immersed in nature. This scheme exemplifies Bloedel's role of being more than simply decorative and their dedication to improving mental, physical and social wellbeing.

Throughout Bloedel I saw many techniques and ideas which resonated with Japanese garden philosophy. From the management of the natural areas to the refined gardens, their careful curation honours nature in a similar way. Japanese gardens were a big inspiration for the Bloedel family, who wished to 'capture the essence of the Japanese garden - the qualities of naturalness, subtlety, reverence, tranquillity - and construct a Western expression of it'. Part of the reserve features a faithful interpretation of a Japanese garden, complete with a Sand and Stone Garden and a traditional Japanese guest house, where the horticulture team hold their staff meetings.



Dappled light in the moss garden

Another area directly inspired by Japanese gardens is the Moss Garden. This two-acre area is the largest public moss garden in the US. It is particularly captivating; the velvet carpet of moss softens and envelopes its surroundings. Originally planted with 27,500 plugs, it is now colonised by over 40 species of mosses and lichens. Complete with decaying tree stumps, the landscape feels ancient, evoking the Japanese theme of the passing of time.

Bloedel truly embraced environmental stewardship and the wellbeing benefits of nature. It was a lovely example of how to unite these ideas with the help of horticulture.

Problems Encountered

There were a few sites in my original proposal that I did not get to visit due to cancellations or incompatible timings. Sadly, this included Michael Pilarski's Medicinal Agroforestry Farm and meeting with bryophyte expert Dr Judith Harpel. This did not cause major problems for my trip as I still visited a wide variety of places relevant to my proposal. This also meant I had more time to spend in the places I visited. I also managed to visit an additional site, Mount St Helens, which was a valuable opportunity to compare natural regeneration to restoration aided by humans.

Some aspects were more expensive than I had estimated and the exchange rate at the time of traveling was low. However, I tried to save money in other areas and overall my trip was within budget. As I did more research into car hire, I discovered that most companies included hidden 'young driver fees' of up to \$30 a day, which would have made the trip exceed my budget. I avoided this fee by purchasing a membership to AAA, which offers benefits to members hiring from Hertz.

Conclusion

This trip was an incredible experience. I achieved each of my aims and objectives and consider it to be a huge success. The places I visited exceeded my high expectations and I feel extremely lucky to have had the opportunity to visit this amazing part of the world.

I learnt so much about the impact of horticulture on plants and people and how this can be beneficial. I feel inspired by the thoughtful design I have observed and the sustainable methods of growing which strive to work with nature. My understanding of ecosystems and plant communities has greatly increased. I feel more confident identifying plants in the field, have learnt about many new plants, and also gained new insights about plants I was aware of previously. The knowledge and techniques I have learnt will be indispensable to my career in horticulture. The restoration projects I visited highlight how the goal of improving the environment is intertwined with improving people's health and wellbeing. Visiting them gave me a sense of hope for the future. Having access to nature and all its benefits and being part of a thriving ecosystem is essential for a healthy and happy society.

The experts I met with imparted me with invaluable information and encouragement. I hope to maintain the connections I made and explore the ideas and techniques we discussed further. It was encouraging to discover an overlap between the organisations I visited, and that many were affiliated or in contact with each other. This solidified the idea that a culture of communication, connection and sharing is necessary and thriving in the world of horticulture.

In addition to the horticultural lessons learnt, I feel I have gained a lot from planning and organising this trip. The process of applying for funding, coordinating with professionals and organisations, and writing this report was hugely beneficial to me. I have not undertaken a project like this before so it is great to have developed skills which will enable me to create more opportunities like this in the future.

Future Plans

I was extremely inspired by the places I visited and the people I met and would love for my future career to align with what I have seen and learnt on this trip. I would like to seek out similar organisations within the UK to see if I can visit or become involved with work going on here.

Expenditure

Air Fare	£745
Ferry	£15
Car hire – 10 days	£406
AAA Membership (breakdown cover and young driver fee waived for members)	£45
Fuel	£110
Accommodation	£1395
Food	£500
Visa Waiver	£11
Permits (National Park/ National Forest Entrance Fees)	£70
Insurance- Last week First two weeks covered by Kew	£10 £0
TOTAL COSTS	£3307

Bursaries

RHS Coke Trust Bursary Fund	£2000
Hardy Plant Society Kenneth Black Bursary	£500
Great Dixter Christopher Lloyd Bursary	£500
Personal Contribution	£307

Acknowledgments

I would like to thank the following organisations: RHS Coke Trust Bursary Fund, Hardy Plant Society Kenneth Black Bursary and Great Dixter Christopher Lloyd Bursary. Without their generous funding I would not have been able to undertake this trip.

I would like to thank all the kind and passionate people who I met throughout my trip, helped me along the way and were so hospitable and welcoming. They so generously shared their time and knowledge with me, and I am extremely grateful to have had the opportunity to meet them and see the amazing work they do.

Finally, I would like to thank Martin Staniforth, Tony Kirkham and Olivia Steed-Mundin of the Royal Botanic Gardens, Kew for authorising and advising me on this trip.

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Route

