

# WESTERN AUSTRALIA COMES TO THE EDEN PROJECT



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## Personal Introduction

Born and raised in Surrey to an Australian Mother and English Father, I've always felt a strong connection to both countries. Although until recently my love of Australia has always been tied to the Eastern states as that is where my family are from. For the last seven years, Perth, Western Australia has been my home and Kings Park and the Western Australian Botanic Garden have very much played a part in my becoming settled and happy in Perth.

My Horticultural career began in my late 20's, when, after a year of international travel, on return to the U.K, I decided it was about time I sought out a job doing something that I loved and was continually interested in. In 2004 I took on a temporary role working on the RHS Plantfinder, assisting in the collation of the vast data therein. During this time I studied the RHS General Certificate. Upon completion of my time working on the Plantfinder, I went on to work in the RHS Wisley Herbarium, helping to database the pressed collection. During this time a permanent position became available in the RHS Trials Department at Wisley. This was such a wonderful job, working with many different genera and so many knowledgeable and generous members of the horticultural community.

After five wonderful years at RHS Wisley, I set off for Australia. I spent a wonderful month working in the three Adelaide Botanical Gardens and felt a particular affiliation for the Mt Lofty Botanic Garden, with its ridges of native bushland and gulleys of exotic plant collections, including one of the most beautiful fern collections I've seen. Here I was introduced to the flora of Western Australia by the Nursery Curator. Inspired and subsequently remotely introduced to the Nursery Curator at Kings Park, I made my way from South Australia to Western Australia and after two weeks of work experience at Kings Park, was fortunate to be offered a casual contract. Now seven years on, having experienced working in many areas of the Western Australian Botanic Garden, from the high profile entry beds to genera specific beds such as the Hakea & Grevillea bed (a real favourite!) and with a year as Assistant Curator. Now 3 years on from a year of maternity leave, I now work part time. Two days a week I care for the Mound, a raised gravel bed situated nearby the official entry to the Botanic Garden. The Mound is a show stopper, created to give the public a quick snapshot of just some of the incredible flora found in Western Australia. I also manage the beds leading on from the Mound down to the Floral Clock, so I can be found manicuring numerals from time to time. I enjoy being a part of the weekend roster in our amazing plant nursery (to play a small part in helping the next generation of beautiful plants become garden ready is a joy). When I look back over the last seven years, I realise just how much I have learnt about the diverse range of flora to be found in Western Australia, along with the vast range in environments and accompanying fauna. Looking forward, I feel excited. This is just a scratch in the surface on what I hope will be an ongoing, never ending journey.



## Project Overview

Located in a transformed china clay quarry pit in Bodelva, near St Austell, Cornwall, the Eden Project is home to two giant Biomes, one containing Rainforest flora and the other Mediterranean species. The Mediterranean Biome at the Eden Project has previously displayed Californian, South African and Mediterranean region flora. Following considerable planning and consultation with Kings Park, over the last four years, The Eden Project team sought to further expand the display and exhibit a range Western Australian species that also occur within a Mediterranean climate zone. In consultation with Kings Park, they elected to display representative flora from



the Banksia and Jarrah Forest and Kwongan ecosystems and to interpret them. Thought was given to the different growing conditions, including less sunlight and shorter daylight hours and advice was provided on where to source WA plants from and their cultural requirements, such as irrigation, soil and fertiliser requirements.

The purpose of my visit was to assist with the layout and installation of the permanent Western Australian exhibit, and in conjunction with Grady Brand (Senior Curator, Western Australian Botanic Garden) provide support to the Eden Horticultural team, providing suggestions and assistance in the planning for the exhibit's long-term management. The trialling of suitable Western Australian species within the external Mediterranean garden at the Eden Project was also discussed with the relevant staff. Consultative meetings were held with the Eden educational team to assist them with story development and interpretative signage outcomes.

## About Kings Park & the Western Australian Botanic Garden

At the heart of Perth, one of the earth's richest capital cities for plant life, sits a beautiful green heart. At 406 hectares Kings Park and the Western Australian Botanic Garden is one of the world's largest inner city parks. Approximately two thirds of the park remain natural bushland, within the remainder sits our unique and beautiful Western Australian Botanic Garden. Opened in 1965, and now in its 52<sup>nd</sup> year, at 17 hectares the garden is home to some 3,000 or so of the almost 12,000 plant species found in Western Australia. Over the past 50 years, the garden has moved away from the display of allied flora from South Africa, California and the Mediterranean, to focus primarily on the rich and bio-diverse flora of Western Australia. Plantings are grouped by regions of the state or notable taxonomic groups, and some are purely for spectacular display. A key feature is the Conservation Garden, which displays the state's most critically endangered and rare species.



Regional displays include flora from the Wheatbelt, Goldfields, Stirling Ranges, Rottnest and Garden islands, the Kimberley, Mulga, Southern Coastal and many more, with other beds dedicated to key native genera such as *Banksia*, *Verticordia*, *Boronia*, *Grevillea* and *Hakea*, *Chamelaucium*, *Anigozanthos* and *Eucalyptus*.

Whilst creating an ongoing garden of beauty, we have the opportunity to aid in the education about and conservation of, our unique and bio-diverse flora. Through signage, online literature, guided walks with our amazing volunteer guides and horticulturalists, quarterly plant sales we hope to inspire some of our 6 million annual visitors to join us in understanding and embracing the incredible flora we have in Western Australia. With ongoing change in our environment and the impact that can have on our unique, bio-diverse state, to have gardeners choose to grow natives can only be a positive venture in aiding to safeguard our flora and allied fauna for future generations.

Kings Park is also nationally and internationally renowned for its plant research and development work.

The Plant development team is currently focused on breeding activities including the development of new hybrid forms of *Anigozanthos*, *Boronia*, *Chamelaucium*, *Corymbia*, *Grevillea*, *Leptospermum* and *Scaevola*. This is with a view to increasing the range and form of Western Australian plants available for use in general horticulture in the botanic garden, home gardens and public landscapes. A major focus is providing environmental benefits, including reduced water and fertiliser use in the new cultivars, and desirable characteristics including compact form, attractive colouring, and an extended flowering season that will no doubt appeal. These plants are adaptable to differing sites and climates, and use limited water and nutrients, fulfil the demand for sustainable and low maintenance gardens, as well as to provide urban habitat for birds, insects, reptiles and small mammals.

Research into plant propagation techniques has been a long-term activity at Kings Park and Botanic Garden. This research enables the production of clonal material through cuttings, grafting and tissue culture to deliver the best outcome for display and conservation. This research can then be translated into techniques for commercial production. Through this research, the number of Western Australian species effectively propagated through cuttings has increased dramatically over the past ten years.

The development of grafting techniques and combinations for Western Australian species has also identified suitable rootstocks and scion combinations; this has enabled a wider range of plants to be displayed in the Western Australian Botanic Garden, and used in general horticulture. Grafting is particularly useful for the cultivation of many desirable forms of plants that have weak root systems, are susceptible to soil-borne diseases (such as *Phytophthora*), are intolerant of different soil pH, or are very difficult to produce through cuttings or tissue culture.

Kings Park and Botanic Garden is now able to display an amazing array of species from such genera as *Eremophila*, *Boronia*, *Verticordia*, *Prostanthera*, *Grevillea*, *Hemiandra*, *Pimelea* and *Diplolaena*, which could not be cultivated previously.

The Seed Conservation team collaborates with national and international partners, including other state botanic gardens and the Millennium Seedbank, Royal Botanic Gardens, Kew, UK, and works closely with Western Australian universities, the mining, agricultural industries and land care organisations. Research undertaken by the Seed Conservation team aims to advance the underlying principles of seed biology and translate these into technologies for plant propagation, conservation, and landscape restoration and aims to understand the role of seeds in shaping the establishment, reproduction, and persistence of plant species and communities. Seed Conservation research focuses on seed collection, quality assessment and control, seed banking, seed germination and dormancy, and techniques for improving seed delivery and seedling establishment at restoration sites and plays a vital role in conserving WA's biodiversity through the long-term storage of seeds.

Through annual seed collecting trips and trialling by the skilled in house nursery at Kings Park, new species continue to be introduced to cultivation within the Western Australian Botanic Garden.



*Pimelea physodes* (Qalup Bell) grafted on to *Pimelea ferruginea* rootstock, grown. Successfully in the Western Australian Botanic Garden.



*Polycarpea longiflora*, grown from seed collected in the Pilbara & Kimberley region, by the Curator of the Western Australian Seed Technology Centre of Kings Park. Recently introduced in cultivation in the Western Australian Botanic Garden. Grown as a summer annual.

## Western Australian Flora and its Biodiversity

Of the seven states and territories of Australia, Western Australia occupies approximately one-third of the country's total landmass. Occupying an area of more than 2.5 million square kilometres, it is about the size of Western Europe. Travelling the 2400km, from the tropical Kimberley region in the north, through deserts, along 2500km of stunning coastline, to the temperate forested south; Western Australia experiences a vast range of climatic and geographical conditions.

The focus of the Eden Project, Western Australian exhibit, is primarily the bio-diverse South west of the state, as illustrated by the red line on the map below, stretching from Shark Bay in the north, to Cape Arid National Park, just beyond Esperance, in the south. With particular focus on two key eco-regions found within the south-west; The Kwongan and the Banksia Jarrah woodland.

Covering an area of over 300,000 square kilometres, South Western Australia is one of 34 global biodiversity hotspots recognised by Conservation International. It is recognised worldwide for its wealth of natural diversity, particularly in plants - there are almost 12,000 plant species native to Western Australia (there are approximately 25,000 Australia wide). More than 7,000 of these are found in the southwest alone. There is a high degree of threat to this important natural resource, include clearing, *Phytophthora dieback* (*Phytophthora cinnamomi*), Salinity, Weeds, Feral animals, Fire and Climate change.



## Itinerary

From Monday 13 to Friday 28 March I was based at the Eden Project, Bodelva, Cornwall. For a large amount of this time, I was based on site, assisting with the preparation, placing and planting of the Western Australian Exhibit. This included site meetings to discuss nursery requirements for ongoing propagation, interpretation information, signage and storytelling and plans going forward for the exhibit. During my 3 weeks at the Eden project, I was also able to spend one day in the rainforest biome, a completely new horticultural experience for me and to visit a number of other gardens in the area; of which I will focus in particular on Tresco Abbey Garden. Here inclusion of further Western Australian species in the collection was discussed. Rather than listing a day by day account, I have input information herein in what I hope is a logical format, to give a comprehensive overview of the work carried out as well as further information about the plants, their environment and ecological associations.

## Site preparation

Preparation for the installation of the Western Australian exhibit entailed the removal of approximately two thirds of the Californian display, which was subsequently rationalised to a smaller collection. During Winter 2016/17, using diggers, forklifts and hand tools, around 100 cubic tonnes of soil was removed to a depth of 60cm and replaced with a sterile, pH neutral, low-phosphorous, free draining media, comprising of 50% composted bark and 50% Cornish grit. Whilst this was a huge undertaking, it was considered necessary to ensure the plants going in had the best start possible. As is the sustainable and environmentally mindful nature of the Eden Project, the Soil removed for the creation of the W.A beds was



relocated on site, for use in a proposed hotel building project elsewhere on the Eden site.

## Adding structure and authenticity to the exhibit

The first couple of days in the Mediterranean Biome were all about getting to know the site, each other and getting the structural elements of the display in place. The site comprises of a fairly steeply sloped bed, the largest of the three beds, home to the Banksia Jarrah Woodland display, a small central bed to be used as a highly decorative display bed and a long flat bed, running along the edge of the biome for the display of Kwongan flora.



Safety cones were used to mark out where the *Xanthorrhoea johnsonii* were to be planted. Seven of the eleven Grasstrees purchased were placed in the Banksia Jarrah bed, in keeping with where they would be found in the wild, with two in the central display bed and two in the Kwongan bed, adjacent to the story telling circle.

Myself on site, placing cones, where *Xanthorrhoea johnsonii* were to be planted

In the Banksia Jarrah woodland, charred branches from two dead Oak trees were included to give height & structure and to detract from unsightly beams high up in biome. The inclusion of these charred branches also to help convey the message of fire and its importance in this environment.

These branches were tested for *Phytophthora ramorum* (Sudden Oak Death) by the Eden Plant Pathologist. The results were negative, but the burning of branches served as additional piece of mind, as this is known to assist in the elimination of the pathogen.



The resourceful and knowledgeable Garden Development Team was on hand with the right tools to assist with the installation of the charred oak. Using bunny spaces and spoons, they dug down through 60cm of new topsoil, then through the original Eden soil, right down into the china clay from the original quarry, creating two holes, to a depth of 4 to 5 foot. Installing the branches at this depth and back filling with rubble & china clay from the holes will ensure long lasting stability. The remainder of the holes were backfilled with the new top soil.



In addition to the charred oak, the real show stopping structural element to the Western Australian exhibit was the inclusion of the 11 *Xanthorrhoea johnsonii*, an Eastern Australian species of Grasstree.

During the advice stage, in the four years preceeding, it was considered that the integrity of the display could be flexible in the use of non-Western Australian species. Creating the imagery of the Western Australian landscape was the important factor, whilst accurate botanical provenance was desirable, due to availability, transportation and quarantine restrictions, in some instances allowance for the inclusion of Eastern Australian species and hybrids with Western Australian parentage relating to the habitat on display, would be necessary.

Unfortunately it was not possible to export grass trees native to WA, in particular *Xanthorrhoea preisii*, to the UK within the time frame. However the mature and commanding specimens of the *Xanthorrhoea johnsonii* were available in Europe and were utilised in the display.

As well as international quarantine, Eden itself has strict quarantine requirements, up on receipt of plants into the off-site nursery, depending upon the type of plant material quarantine protocol must be observed prior to plants being allowed in to the Biome. The 11 *X. johnsonii* were held in the nursery for 1 year prior to planting.



Thankfully a digger and seven metre telescopic handler were on site to prepare the planting holes and lift in the huge grasstrees for planting. Symbio Mycoforce Tranplanter, a Mycorrhizal product containing endo and ecto mycorrhizae, beneficial soil microbes, minerals, trace elements and humates was broadcast in the planting hole, around the root ball and into the soil for backfill. The use of this product was suggested by a member of the Garden Development Team and whilst it's not something currently used by Kings Park, Grady Brand, Senior Curator, agreed it would not be harmful. Benefits of use are listed to include: improved transplant survival and growth acceleration, reduced need for fertiliser, fungi and water, increased natural vigour.



The one grasstree that had senesced did not go to waste. It was planted close to the path, with the top knocked off, so that visitors could see the fibrous material inside the trunk and how the trunk is composed of a mass of old leaf bases, held together with a natural resin.



## A bit about Grasstrees – *Xanthorrhoea sp.*

Grass trees epitomize the Australian bush: they're unmistakably beautiful, hardy, have the ability to thrive in nutrient-poor soils and are responsive to wildfire by flowering profusely. They are iconic.

- The trunk is composed of a mass of old leaf bases held together by natural resin, which upon melting in the extreme heat of a bush fire, oozes out and solidifies when cool.
- The centre of the trunk is filled with a fibrous material
- The growth rate is very slow, at approximately 2.5cm / year
- Leaves are narrow, grass like and stiff, extending to 1m or more, the needle like foliage reduces moisture loss during hot weather. Old leaves often hang down as a 'skirt' around the trunk, the longer the skirt, the longer the time without fire.
- Many species have the incredible ability to survive fire. Their leaves may be burnt and trunks blackened, but the tree usually survives: the living growth-point is buried underground, protected by tightly packed leaf bases.
- Some grass trees are stimulated by fire – in the spring following a summer bushfire, large numbers of plants can flower.
- Flowers spiral up a spear-like spike which can be up to 4m long, producing a good deal of nectar, beneficial to many native insects, birds and mammals. Once pollinated, each spike can produce thousands of seeds.
- The grasstree is important to indigenous people across Australia. For example, the resin found in the trunk is used as a glue. Flower spikes make tools such as a fishing spear, the tough seed pods are used as a cutting tool.



*Xanthorrhoea preissii* with flower Spike

## Eden Nursery & Propagation.

The Eden Project Nursery is located 5 miles away from the main Eden site, in Watering Lane, St Austell. Managed by just a handful of staff, the nursery has been owned by the Eden Project since preconstruction of the main site, initially, primarily to house large specimens from Europe, for the rainforest biome.

Myself and Grady Brand (Senior Curator Kings Park), were joined by Dina Gallick (Manager, Enclosed Biomes, Eden Project) and Catherine Cutler (Supervisor of Mediterranean Biome, Eden Project) and Marilla Burgess and James Kettle (Great Glasshouse, Botanic Garden of Wales) and met with Sally Brigden. Sally is responsible for the propagation, growing on and ongoing care in quarantine for all plant material sourced for the Western Australian Exhibit.



An afternoon early in our first week was spent looking at the West Australian stock. It was considered more productive to view the stock in the nursery, before making the decision as to what should be delivered to the Biome for planting and what should remain. Once out of the nursery, were plants to be returned, they would need to be quarantined for another 3 months. This was our first real glimpse of the plants that were to comprise the exhibit. It was exciting to see a good range of so many quality plants. Having had very little prior experience with Western Australian natives, it was agreed that Sally had done exceptionally well in propagating and caring for the plants.

### Recommendations

- Hold back some plants for propagation and in case a replacement is needed for the display in the Biome.
- Consideration needs to be given how best to ensure the continuation of stock, with what frequency, from seed, cuttings and division (if permitted) in house and also continued sourcing from other nurseries and horticultural organisations. Quarantine time frames need to be born in mind.
- Trial using smoke infused vermiculite, instead of smoke disks, to aid germination of species requiring smoke treatment, this is considered more effective, as each time it is watered it releases smoke (can be sourced along with seeds, from Nindethana, in Western Australia).
- The possibility for supplying domesticated seed collected from within the Western Australian Botanic Garden was discussed. It was agreed that with the correct funding and trialling to ensure material proves true to type this could be possible.
- Consideration should be given to the implementation of in house grafting, especially when, after time, certain species prove particularly successful in the biome environment, even if these are intergeneric grafts.
- Continue to use 6 month slow release fertiliser with the same ratio NPK (21.8/0/8.7 as our slow release fertiliser, 6 month, better for the season in biome rather than our 9 month. Also safe to use chelated iron.



## Kwongan Bed

Of the three beds within the Western Australian exhibit, the Kwongan bed is a long bed reaching from the border with the South African display, running along the edge of the biome, with one end encompassing the meeting place and story-telling circle.

Consideration was given to keeping lower growing more typical Kwongan species within this bed. Some larger specimens were dotted throughout and in particular towards the back of the bed, to form a back drop and help screen off the edge of the biome. Particularly decorative and showy species such as some of the *Pimelea*, *Anigozanthos* and *Scaevola* were placed closer to the edge, to give continuity crossing over in to the decorative bed, where they were also planted. A number of more mature specimens, grown on in large air pots, particularly those with interesting stories were planted around the meeting place. These would be useful for the Eden storytellers to refer to, for example: *Acacia cyclops* has a red aril around the seed, which attracts ants in search of food, the ants, then transfer the seed underground, where it germinates. Seed pods were visible on the plants at the time of planting.



### What is the Kwongan?

The Kwongan is a sandplain environment that has remained geologically unchallenged for millions of years, allowing species to evolve without major extinction as can be found in other parts of the world. Due to this undisturbed, ancient geology, the soils of the Kwongan are typically impoverished with low nutrients. In appearance the Kwongan environment is sandy and open with generally scrubby vegetation, it is considered the Australian equivalent to South Africa's Fynbos, California's Chaparral, examples of which are also on display in Eden's Mediterranean Biome. Occupying about a quarter of the South West Australian Floristic Region, the Kwongan occupies a large area.



As mentioned previously, there are almost 12,000 plant species native to Western Australia. Over 7,000 of these are found in the global biodiversity hotspot that is Southwest Australia, with the Kwongan containing around 70% of these species!

A list of species in the initial planting of the Kwongan Bed can be found to follow.

Reference to Florabase , the web database of Western Australian flora is recommended for further information on each species, such as: native distribution, botanical description, location map, images.  
<https://florabase.dpaw.wa.gov.au/>

N.B the source of the material has been listed where available.

## Planting List – Kwongan

Botanical Name	Common Name / Indigenous Name	Source
<i>Acacia drummondii</i> ssp. <i>candolleana</i>		Nindethana (seed)
<i>Acacia drummondii</i> ssp. <i>drummondii</i>		Nindethana (seed)
<i>Acacia glaucoptera</i>	Flat Wattle	Nindethana (seed) / Old Walled Garden
<i>Acacia guinetii</i>	Guinet's Wattle	
<i>Alyogyne huegelii</i>	Lilac Hibiscus	Old Walled Garden
<i>Banksia attenuata</i>	Slender Banksia / Piara	Nindethana (seed)
<i>Banksia blechnifolia</i>		Nindethana (seed)
<i>Banksia burdetti</i>	Burdett's Banksia	
<i>Banksia coccinea</i>	Scarlet Banksia	Nindethana (seed)
<i>Banksia hookeriana</i>	Hooker's Bankisa	
<i>Banksia media</i>	Southern Plains Banksia	
<i>Banksia menziesii</i>	Firewood Banksia	Nindethana (seed)
<i>Banksia occidentalis</i>	Red Swamp Banksia	
<i>Banksia praemorsa</i> (Red)	Cut-leaf Banksia	Nindethana (seed)
<i>Banksia praemorsa</i> (Yellow)	Cut-leaf Banksia	Nindethana (seed)
<i>Banksia repens</i>	Creeping Banksia	Nindethana (seed)
<i>Banksia violacea</i>	Violet Banksia	
<i>Callistemon glaucus</i>		Nindethana (seed)
<i>Callistemon</i> 'Kings Park Special'		Old Walled Garden Nursery
<i>Callistemon phoeniceus</i>	Lesser Bottlebrush / Dubarda	
<i>Calothamnus validus</i>	Barrens Clawflower	
<i>Chamelaucium uncinatum</i>	Geraldton Wax	Nindethana (seed)
<i>Conostylis aculeata</i>	Prickly Conostylis	Nindethana (seed)
<i>Eucalyptus erythrocorys</i>	Illyarrie	
<i>Eucalyptus forrestiana</i>	Fuchsia Gum	
<i>Eucalyptus macrocarpa</i>	Mottlecah / Mudelka	
<i>Gompholobium scabrum</i>	Painted Lady	
<i>Grevillea leucopteris</i>	White Plume Grevillea	
<i>Grevillea</i> 'Sea Spray'		
<i>Hakea drupacea</i>	Sweet-scented Hakea	
<i>Hakea elliptica</i>	Oval-leaf Hakea	
<i>Hakea laurina</i>	Pincushion Hakea / Kodjet	
<i>Hakea platysperma</i>	Cricket Ball Hakea	
<i>Hakea victoria</i>	Royal Hakea / Dalyongurd	Nindethana (seed)
<i>Kennedia prostrata</i>	Scarlet Runner	Nindethana (seed)
<i>Kunzea baxteri</i>		Old Walled Garden
<i>Kunzea ericifolia</i>	Spearwood / Pondil	Plantbase
<i>Melaleuca elliptica</i>	Granite Bottlebrush / Ngow	Old Walled Garden
<i>Melaleuca fulgens</i>	Scarlet Honeymyrtle	Old Walled Garden / Welsh Botanic Garden
<i>Melaleuca suberosa</i>	Corky Honeymyrtle	
<i>Melaleuca trichophylla</i>		
<i>Myoporum insulare</i>	Blueberry Tree / Boobialla	Welsh Botanic Garden
<i>Paraserianthes lophantha</i>	Albizia	
<i>Patersonia occidentalis</i>	Purple Flag / Koma	
<i>Pimelea ferruginea</i>		Nindethana (seed)
<i>Regelia velutina</i>	Barrens Regelia	Nindethana (seed)
<i>Thomasia quercifolia</i>	Oak Leaved Thomasia	
<b>Annuals:</b>		
<i>Rhodanthe chlorocephala</i> ssp. <i>rosea</i>	Common Everlasting	Nindethana (seed)

(White)		
<i>Rhodanthe chlorocephala</i> ssp. <i>rosea</i> (White, Black Centre)		Nindethana (seed)
<i>Schoenia filifolia</i> subsp. <i>subulifolia</i>	Mingenew Everlasting	Nindethana (seed)

### Recommendation for future inclusion

On return to Kings Park, further consideration was given to those species that should further included within the display.

Botanical Name	Common Name / Indigenous Name	Source
<i>Banksia petiolaris</i>	Prostrate Banksia	Nindethana (seed)
<i>Chorizema varium</i> (T)	Bush Flame Pea	Nindethana (seed)
<i>Banksia pteridifolia</i>	Tangled Honeypot	Nindethana (seed)
<i>Hovea trisperma</i>	Common Hovea	Nindethana (seed)
<i>Nuytsia floribunda</i>	Christmas Tree / Mudja	Nindethana (seed)
<i>Patersonia occidentalis</i>	Purple Flag / Koma	Nindethana (seed)
<i>Patersonia umbrosa</i>	Yellow Flags	Nindethana (seed)
<i>Santalum spicatum</i>	Sandalwood / Wilarak	Nindethana (seed)

Below are examples of some of the species included in the Kwongan bed.



*Hakea laurina*



*Schoenia filifolia* subsp. *subulifolia*



*Banksia coccinea*

## Banksia Jarrah Woodland

The Banksia Jarrah woodland bed has been created on the relatively steep, sloped bed, leading down from the remaining Californian bed. This area of the exhibit has been created to showcase the critical role of fire in maintaining habitats, as well as plant adaptations due to fire and other environmental stress, such as drought, as well as highlighting some of the key plants found in this eco-region.

It will also highlight how under threat this beautiful environment is from logging, agriculture, mining, disease and excessive controlled fire events. The safeguarding of such an environment will be imperative to maintaining this ecosystem that is vital to the survival to a number of native flora and fauna.



Placing and planting the Banksia Jarrah woodland required some strength and skill in balance! It was not the easiest site to work with. Working with the guidance of Grady, our collective team came together to create the display. Seven different Banksia species were used with a view to creating a Banksia prominent layer within the display. The relatively quick growing *Paraserianthes lophantha* – *Albizia* – were placed at the top of the slope, ideally to screen the remaining Californian display. *Corymbia ficifolia* were used to similar effect along the border with the Mediterranean Cork display. As mentioned previously, the *Xanthorrhoea johnsonii* and two burnt Oak branches, provided structure and added integrity to the message regarding fire.

The one Grasstree that did not make it to the end of the journey to the biome, had the top of its trunk knocked off. This was to show the inside of the structure and just how they would deteriorate in nature, this was placed close to the path and adjacent to one of the burnt oak branches, to further symbolise the message of fire and give visitors the opportunity to view with ease.

A number of plants provided a good initial impact, such as the *Hardenbergia comptoniana* – native *Hardenbergia*, which was planted up one of the charred oak branches. A good number of *Anigozanthos* – Kangaroo Paws, *Scaevola*, *Boronia* and some *Acacia* were joined by annuals shortly after the initial planting to ensure a good show of colour, while the display began to establish.

Whilst not planted initially, there were a few *Eucalyptus marginata* seedlings growing on in the nursery, with a little more growth they will be added to the display. They are not expected to reach their full potential but it is hoped that they will give a credible display in time. It is expected that in due course, a number of plants may be thinned, remove, replaced, it will be trial and error to see what is a success, with a view to keeping ongoing propagation for renewed planting or replacement with new species.



## A bit about Jarrah – *Eucalyptus marginata*

*Eucalyptus marginata* – Jarrah a straight magnificent hardwood tree is found only in south west Western Australia, once known as Swan River Mahogany.

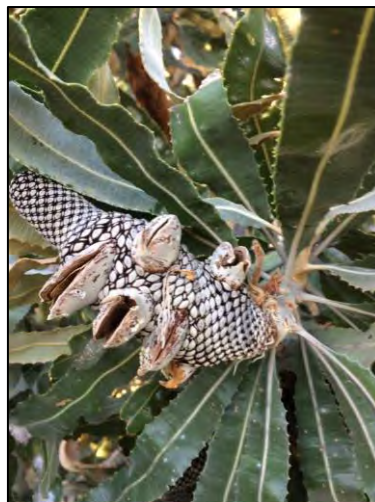
- Flowering from September to February they provide a rich source of nectar for bees, birds and possums.
- Slow growing, in optimum conditions, at maturity a Jarrah can reach 40 metres in height, with a diameter of around 2 metres. In less than ideal conditions it has a tendency to grow in a multi-stemmed mallee habit.
- The Jarrah is able to regenerate following a fire. The buds and food reserves stored in its lignotuber – the swollen, woody growth found below ground at the base of the Jarrah - enable it to reshoot after a fire.
- The long roots of the Jarrah tree enable it to source underground water during periods of drought.
- Jarrah is a vital habitat for animal life, particularly a good number of native mammals, birds, reptile species and bees, who seek the nectar from its flowers and homes in the hollows that form as the heartwood decays. When fallen, it provides shelter to native ground dwelling marsupials.
- Jarrah is one of the most harvested hardwoods for joinery, furniture and flooring. It is also under threat from clearing for mining and agricultural ventures.
- Jarrah, just like the Banksia's described below, is another Western Australian species vulnerable to dieback – *Phytophthora cinnamomi*, which causes root-rot. The unique habitat of the Jarrah Banksia woodland can be greatly altered if not destroyed by the presence of *Phytophthora*. Infestation can kill both the Jarrah over story and Banksia understory.
- The Nyoongar people strung fruits together as necklaces and hair ornaments; the wood was made into spear throwers to increase the distance a spear could be thrown.





## A bit about Western Australian Banksias

- There are over 200 Banksia taxa native to Western Australia (including those previously classified as Dryandra), a number of which are found only in a tiny pocket of the state, 93 of these taxa can be found on the Department of Biodiversity, Conservation and Attractions, Threatened and Priority Flora list, at March 2017.
- Banksias range in size from prostrate, woody shrubs, such as *Banksia blechnifolia* to trees up to several metres in height, such as *Banksia grandis*. With a wide range of striking, often cylindrical flowers, ranging from, yellow, through orange, pink and red, followed over time by iconic “woody cones”, they are a beautiful and remarkable addition to a garden.
- Banksias have a distinguishing proteoid root system comprising of groups of numerous small “rootlets”. These roots enable plants to be more resourceful in the up-take of nutrients from the impoverished soils where many Banksia species are found. Due to their adaptation to nutrient poor soils over many years, in cultivation, they can be adversely affected by over use of fertiliser, in particular phosphorus. As such, the general recommendation is that Banksias and other Proteaceae genera (e.g *Adenanthos*, *Grevillea*, *Hakea*) are fertilised only with low-phosphorus, slow release fertilisers, specially formulated for Australian natives. The fertiliser used by the Eden Project contains 0% Phosphorous.
- Banksias are vital in the food chain of the Australian bush. Rich in nectar, they are a valuable source of food for a variety of nectarivorous animals, including, birds, bats, possums and bees. It is not hard to understand how the survival of the native Western Australian flora and fauna is intrinsically linked.
- Banksias have adapted naturally to the occurrence of bushfires that take place in the Australian landscape. Whilst a number of species are killed by bushfire, these tend to regenerate quickly from seed. Fire stimulates the opening of the woody, seed bearing follicles and also instigates the germination of seed in the ground. A number of other species tend to survive bushfire, usually by re-shooting from the woody lignotuber at the base of the trunk. Careful management of the frequency of bush fires is imperative to the survival of Banksia populations. Arson and the over frequent occurrence of controlled burns to reduce the ferocity of wild fires near human inhabitation, can prevent Banksias from reaching fruiting age and subsequently compromise the regeneration of such areas.
- Dieback of *Phytophthora cinnamomi* is a particular threat to Banksias. This disease attacks plant roots, essentially rotting the root and preventing the absorption of water and nutrients. The fine, numerous, proteoid roots of Banksias make them particularly susceptible. Dieback thrives in moist soil conditions and can be a severe problem for Banksias that are watered, such as in a garden setting. Great attention to hygiene should be paid when working or visiting areas known to be infected, with frequent sterilising of boots, tools, machinery and vehicles.



***Banksia menziesii* flower head and open seed bearing follicle – this species is planted in the Eden display**

Recently released by the Kings Park Botanic Garden & Parks Authority, this infographic outlines some pertinent facts about the Banksia Woodlands surrounding Perth.

# BANKSIA WOODLANDS

## of the Swan Coastal Plain

Banksia woodlands form the dominant plant life and ecosystem of the Swan Coastal Plain, including the Perth metropolitan area. Once estimated to cover 6,229km<sup>2</sup> of Western Australia's south west, only one third of the woodlands remain intact in isolated fragments across the region.



**65%** OF BANKSIA WOODLANDS HAVE BEEN LOST

**VITAL HABITAT FOR 29 THREATENED SPECIES**

Since 2006, Hanson (formerly Rocla Quarry Products) and Kings Park Science have been working continuously to develop practical, successful restoration techniques for Banksia woodlands. During this 20 year partnership, 286 hectares of cleared land have been revegetated across seven sites.

### Total plant species and numbers of threatened plant species

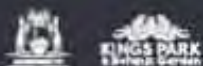


- COOLING REGIONAL TEMPERATURES
- STORE CARBON, REDUCE EFFECTS OF POLLUTION
- FILTER DRINKING WATER, STORED IN AQUIFERS
- SUPPORT SOIL HEALTH AND POLLINATION OF CROPS
- NATURAL PEST MANAGEMENT

VITAL ECO-SERVICES FOR THE PEOPLE OF PERTH

**KINGS PARK AND BOLD PARK ARE TWO OF THE MOST IMPORTANT BANKSIA WOODLAND REMNANTS IN PERTH**

Banksia Woodlands of the Swan Coastal Plain  
**Endangered Ecological Community**  
 Listed 16 September 2016  
 Australian Government



## Planting List – Banksia Jarrah Woodland

Botanical Name	Common Name / Indigenous Name	Source
<i>Acacia alata</i>	Winged Wattle	Nindethana (seed)
<i>Acacia cyclops</i>	Coastal Wattle	
<i>Acacia lasiocalyx</i>	Silver Wattle / Wilyurwur	
<i>Acacia saligna</i>	Orange Wattle / Kudjong	
<i>Allocasuarina fraseriana</i>	Sheoak / Kondil	Nindethana (seed)
<i>Anigozanthos flavidus</i> (Green)	Kangaroo Paw	Nindethana (seed)
<i>Anigozanthos flavidus</i> (Red)	Kangaroo Paw	Nindethana (seed)
<i>Anigozanthos</i> 'Big Red'	Kangaroo Paw	
<i>Anigozanthos</i> 'Revolution'	Kangaroo Paw	
<i>Anigozanthos</i> 'Yellow Gem'	Kangaroo Paw	
<i>Astartea fascicularis</i>	Recherche Astartea	
<i>Banksia brownii</i>	Feather-leaved Banksia	Nindethana (seed)
<i>Banksia formosa</i> ( <i>Dryandra formosa</i> )	Showy Dryandra	Nindethana (seed)
<i>Banksia grandis</i>	Bull Banksia / Pulgarla	Nindethana (seed)
<i>Banksia ilicifolia</i>	Holly-leaved Banksia	Nindethana (seed)
<i>Banksia littoralis</i>	Swamp Banksia / Pungara	
<i>Banksia menziesii</i>	Firewood Banksia	Nindethana (seed)
<i>Banksia undata</i> ( <i>Dryandra praemorsa</i> )	Urchin Dryandra	Nindethana (seed)
<i>Boronia heterophylla</i>	Kalgan Boronia	
<i>Calothamnus graniticus</i> ssp. <i>graniticus</i>		Nindethana (seed)
<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush / Kwowdjard	Nindethana (seed)
<i>Calothamnus quadrifidus</i> yellow		Nindethana (seed)
<i>Calothamnus rupestris</i>	Mouse Ears	Nindethana (seed)
<i>Calothamnus sanguineus</i>	Silky-leaved Blood Flower / Pindak	Nindethana (seed)
<i>Chorizema cordatum</i>	Hart-leaf Flame Pea	Nindethana (seed)
<i>Chorizema dicksonii</i>	Yellow-eyed Flame Pea	
<i>Corymbia ficifolia</i>	Red-flowering Gum	Nindethana (seed)
<i>Daviesia cordata</i>	Bookleaf	
<i>Dianella revoluta</i>	Blueberry Lily	
<i>Eucalyptus lane-poolei</i>	Salmon White Gum	Nindethana (seed)
<i>Gastrolobium celsianum</i>		Nindethana (seed)
<i>Grevillea</i> 'Little Robyn'		
<i>Grevillea</i> 'Ned Kelly'		
<i>Grevillea</i> 'Robyn Gordon'		
<i>Grevillea</i> 'Superb'		
<i>Guichenotia ledifolia</i>		
<i>Guichenotia macrantha</i>	Large-flowered Guichenotia	
<i>Hardenbergia comptoniana</i>	Native Wisteria	
<i>Hardenbergia</i> 'Purple Spray'		
<i>Hardenbergia</i> 'Sea of Purple'		
<i>Hardenbergia violacea</i>		
<i>Hovea elliptica</i>	Tree Hovea	
<i>Hypocalymma robustum</i>	Swan River Myrtle	
<i>Kennedia coccinea</i>	Coral Vine	Nindethana (seed)
<i>Kennedia prostrata</i>	Scarlet Runner	Nindethana (seed)
<i>Melaleuca laterita</i>	Robin Redbreast Bush	Nindethana (seed)
<i>Melaleuca radula</i>	Graceful Honey myrtle	Nindethana (seed)
<i>Melaleuca tricophylla</i>		
<i>Orthrosanthus multiflorus</i>	Morning Iris	
<i>Orthrosanthus polystachys</i>	Many Spike Orthrosanthus	Nindethana (seed)

<i>Paraserianthes lophantha</i>	Albizia	
<i>Pattersonia occidentalis</i>	Purple Flag / Koma	Nindethana (seed)
<i>Templetonia retusa</i>	Cockies Tongues	
<i>Thryptomene saxicola</i>	Rock Thryptomene	
<i>Xanthorrhoea johnsonii</i>	Grass Tree	
<b>Annuals:</b>		
<i>Rhodanthe manglesii</i>	Mangles Everlasting	Nindethana (seed)
<i>Xerochrysum bracteatum</i>	Golden Everlasting	Nindethana (seed)

### Recommendation for future / further inclusion

Botanical Name	Common Name / Indigenous Name	Source
<i>Acacia aphylla</i>	Leafless Rock Wattle	Nindethana (seed)
<i>Acacia drummondii</i> (any form, all are good)	Drummond's Wattle	Nindethana (seed)
<i>Chorizema cordatum</i>	Hart-leaf Flame Pea	Nindethana (seed)
<i>Chorizema dicksonii</i>	Yellow-eyed Flame Pea	Nindethana (seed)
<i>Clematis linearifolia</i>	Slender Clematis	Nindethana (seed)
<i>Clematis pubescens</i>	Common Clematis	Nindethana (seed)
<i>Hovea elliptica</i>	Tree Hovea	Nindethana (seed)
<i>Hovea chorizemifolia</i>	Holly-leaved Hovea	Nindethana (seed)
<i>Kennedia coccinea</i>	Coral Vine	Nindethana (seed)
<i>Kennedia nigricans</i>	Black Kennedia	Nindethana (seed)
<i>Orthrosanthus laxus</i>	Morning Iris	Nindethana (seed)
<i>Orthrosanthus polystachyus</i>	Many Spike Orthrosanthus	Nindethana (seed)
<i>Pimelea spectabilis</i>	Bunjong	Nindethana (seed)
<i>Thysanotus multiflorus</i>	Many-flowered Fringe Lily	Nindethana (seed)

Below are examples of some of the species included in the Banksia Jarrah bed.



*Xerochrysum bracteatum*



*Pattersonia occidentalis*



*Corymbia ficifolia*

## Central Decorative Bed

The smallest of the three beds within the West Australian exhibit at Eden. This bed is intended to provide a highly decorative display, throughout the year, perhaps with a higher turnover of shorter lived plants. Initially planted with the structure of two grasstrees, two *Eucalyptus caesia* and two *Banksia coccinea* specimens were also planted, both very showy in their own right. It is hoped that these three elements will, in time, provide the taller, more structural, permanent element of this display.

A good number of *Anigozanthos* hybrids, in many contrasting colours were included, along with two *Pimlea ferruginea* cultivars and a number of *Scaevola* cultivars. These provided instant colour to the display and attracted much comment from visitors and staff alike.

I would hope that going forward, this bed may be considered for species that fall outside the geographical catchment of the Banksia Jarrah woodland and Kwongan beds, but would still be considered a worthy inclusion, of high ornamental value and likely to succeed in the biome setting, for example, *Goodenia varia*.



Planting List – Decorative Bed

Botanical Name	Common Name / Indigenous Name	Source
<i>Anigozanthos</i> 'Big Red'	Kangaroo Paw	Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Dance'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Endeavour'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Fling'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Flirtation'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Fury'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Inferno'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Kings Park Federation Flame'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Midnight'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Pearl'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Pioneer'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Pizzazz'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Revolution'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Tenacity'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Bush Volcano'		Ramm Botanical (Tissue Culture)
<i>Anigozanthos</i> 'Yellow Gem'		Ramm Botanical (Tissue Culture)
<i>Banksia blechnifolia</i>		Nindethana (seed)
<i>Banksia coccinea</i>		Nindethana (seed)
<i>Chrysocephalum apiculatum</i> 'Silver and Gold'		Ramm Botanical (Tissue Culture)

<i>Eucalyptus caesia</i>	Caesia	
<i>Grevillea</i> 'Bon Accord'		
<i>Grevillea</i> 'Coconut Ice'		
<i>Grevillea preissii</i>	Spider Net Grevillea	
<i>Grevillea thelemanniana</i> 'Baby'		
<i>Kennedia prostrata</i>	Scarlet Runner	Nindethana (seed)
<i>Macropidia fuliginosa</i> 'Midnight'	Black Kangaroo Paw	
<i>Pimelea ferruginea</i> 'Blush Solitaire'		Ramm Botanical (Tissue Culture)
<i>Pimelea ferruginea</i> 'White Solitaire'		Ramm Botanical (Tissue Culture)
<i>Scaevola</i> 'Mauve Carpet'	Fairy Fan-Flower	Ramm Botanical (Tissue Culture)
<i>Scaevola</i> 'Aussie Crawl'		Ramm Botanical (Tissue Culture)
<i>Scaevola</i> 'Aussie Salute'		Ramm Botanical (Tissue Culture)
<i>Scaevola</i> 'Sitting Pretty'		Ramm Botanical (Tissue Culture)
<i>Scaevola</i> 'White Carpet'		Ramm Botanical (Tissue Culture)
<b>Annuals:</b>		
<i>Rhodanthe chlorocephala</i> subsp. <i>rosea</i>	Pink Paper-daisy	Nindethana (seed)
<i>Brachyscome iberidifolia</i>	Swan River Daisy	Nindethana (seed)

### Recommendation for future / further inclusion

Botanical Name	Common Name / Indigenous Name	Source
<i>Banksia blechnifolia</i>		Nindethana (seed)
<i>Banksia petiolaris</i>	Prostrate Banksia	Nindethana (seed)
<i>Gompholobium scabrum</i>	Painted Lady	Nindethana (seed)
<i>Hovea trisperma</i>	Common Hovea	Nindethana (seed)
<i>Patersonia occidentalis</i>	Purple Flag / Koma	Nindethana (seed)
<i>Patersonia umbrosa</i>	Yellow Flags	Nindethana (seed)
<i>Pimelea spectabilis</i>	Bunjong	Nindethana (seed)
<i>Swainsona formosa</i>	Sturt's Desert Pea	Nindethana (seed)
<i>Thysanotus multiflorus</i>	Many-flowered Fringe Lily	Nindethana (seed)

Below is an example of some of the species included in the Decorative bed



*Kennedia prostrata*



*Eucalyptus caesia*



*Anigozanthos* 'kings Park Federation Flame'

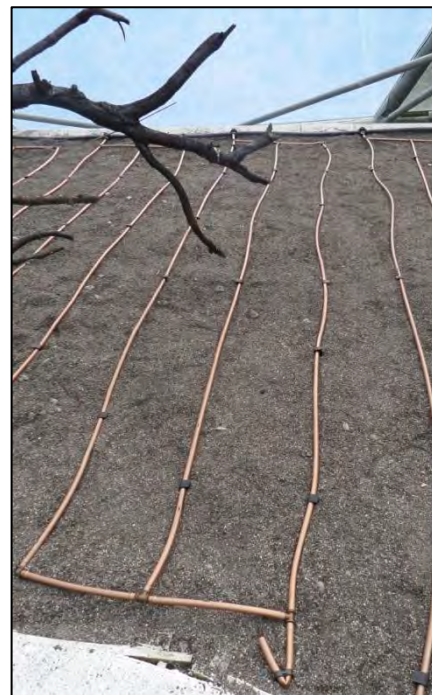
## Site Infrastructure & Interpretation

### Reticulation

During my time at the Eden project, I was able to assist with the installation of the reticulation system within the Western Australian Display. On the recommendation of Kings Park, the three beds comprising the exhibit were laid with subsurface trickle pipe. Through experience within the Western Australian Botanic Garden, we have found this form of automated irrigation to be preferable to sprinkler systems. The water goes straight to the root system, does not reach the crown of the plant and additional adverse humidity can be avoided – with a view to preventing fungal issues such as Ink spot, mildew and crown rot in the likes of the grasstrees.

The level Kwongan and display beds were installed on one solenoid and the sloped Banksia / Jarrah bed on another, with pressure regulators to ensure even pressure of flow through trickle as such a steep bed.

It was interesting to compare the configuration of the trickle system to ours back in Kings Park. In Kings Park, each garden bed has a supply line with air release regulator on the highest point of the bed, with a muck line and flush valve at the lowest point of our bed, with trickle lines running between the two. This means on flushing our system, ideally, the flush valve at the lowest point needs to be removed momentarily and the system turned on.



The Eden trickle system was comprised of a series of 3 trickle lines grouped together, each joined to the supply line by a manifold – as pictured here. There was no muck line or flush valve. Each group of 3 trickle lines was bent over at the end and held in place with a figure of 8 clasp. Each clasp is released when the system is flushed.

We did discuss how our systems work and recommendations were made to the Technical Manager at the Eden Project.

### Interpretation

Informative signage and Botanical labelling has been installed in all three garden beds, as per the example to the right, placed in the central display bed.

The sign in the Kwongan bed reads:

“Kwongan is one of the toughest environments on Earth. It means ‘sandy plain’ in the language of the traditional owners the Noongar people.

What looks at first like plain bushland is in fact a botanical paradise thriving on some of the oldest and least hospitable soils on the planet.



Kwongan is the equivalent of South Africa's fynbos, or California's chaparral. Over half of its plants are unique, ranging from underground orchids to the world's largest parasitic tree. All of them have adapted to survive in this harsh but beautiful landscape and plant-animal relationships are also highly evolved. Unique to southwest Australia, the honey possum is one of the world's smallest marsupials. It lives of pollen and nectar. "

And the sign in the Banksia Jarrah woodland focuses on the plants adaption to fire in the landscape, reading: "Shaped by fire. Hot summers, lightning and plants rich in volatile oils mean that bushfires occur regularly in southwest Australia.

The plants here have evolved to cope. Jarrah trees can resprout from deep underground, banksia need fire to release their seeds.

The Noongar people have used fire to manage the land for thousands of years. Fire stimulates prolific flowering in grass trees. To the Noongar these trees are sacred symbols of resurgence.

Understanding what, when and how to burn is essential. Controlled burning can renew a landscape by clearing tracks and promoting new growth, but wildfires destroy everything in their path".

This signage will further enhance the plant display, giving people a succinct insite into the complex world of Western Australian plants and their relationship with and adaptations to the landscape and associated fauna.



Botanical black labels, providing, family, genus and species name, along with common name where applicable, have been installed throughout the exhibit. A number of key species have a more comprehensive label, with artist impression of the flower, common and botanical name and species information. As per the example of the *Banksia coccinea* – Scarlet Banksia, shown here.

In consultation with Dr Richard Walley, a Nyoongar, statesmen from Perth, who frequently collaborates with Kings Park, artwork has been incorporated into the exhibit. The Nyoongar people are traditional custodians of a large part of the south west of Western Australia. The artwork tells the stories of the traditional six seasons of Nyoongar culture, their strong connections to country and ancient knowledge of native flora, fauna and environment. The creation of the Beedawong – Meeting Place, will allow for traditional land custodian messages to be retold through storytelling and this artwork.





## Storytelling at Eden

Storytelling is fun, informative and accessible to all as part of the Eden experience, with two dedicated sessions, lasting 15-30 minutes in the Mediterranean Biome each day. The Western Australian Exhibit will include a new spot for story telling within the biome, in the Beedawong meeting place at the entrance to the exhibit. Stories told within the biome range from local tales, to tales of far flung continents, plants and history.

Whilst at Eden a meeting with four story tellers took place, all keen to learn more about Western Australia and glean some ideas for bringing the exhibit to life for the Eden visitors.



### Topics discussed:

Topic	Key points
Combination of plants surrounding the meeting place	Providing a good initial snapshot of Western Australian flora – <i>Acacia</i> , <i>Anigozanthos</i> , <i>Banksia</i> , <i>Chamelaucium</i> , <i>Grevillea</i> , Annuals
Select some key plants to discuss	<ul style="list-style-type: none"> <li>• <i>Anigozanthos</i> ‘Kings Park Federation Flame’ – selected from a wild naturally occurring <i>Anigozanthos</i> in Bremer Bay (south coast W.A) and subsequently trialled in the nursery environment. Planted in Kings Park. Vibrant orange flowers, contrast with beautiful glaucous bloom on stems. Adaptation story – grey, hairy plants deter glare from the sun and trap moisture in the hairs, this is a heat adaptation. Also the name ‘Federation’ refers to all states in Australia coming together.</li> <li>• <i>Macropidia fuliginosa</i> - Black Kangaroo Paw. The single species of the genus <i>Macropidia</i>, found nowhere else on earth. 60% of South western Australian plants occur nowhere else on earth</li> </ul>
Relationship between Flora and Fauna	<ul style="list-style-type: none"> <li>• <i>Acacia cyclops</i> – Ants like to eat the red aril surrounding the seed. They remove it with the seed attached to their nest, underground, for storage. The seed may germinate following a fire. The bright colour of the aril is also attractive to native bird species, i.e Wattlebirds, Honeyeaters, Ringneck Parrots. The seeds pass through the birds in their droppings and are often dispersed some distance away.</li> <li>• A lot of shrubs are dense and prickly, i.e <i>Acacia</i>, <i>Hakea</i>, <i>Grevillea</i>, <i>Banksia</i> species, not only does this stop larger mammals from eating the plant itself, it also provides protective habitat for a number of smaller birds and mammals.</li> <li>• A lot of species of <i>Eucalyptus</i>, <i>Grevilleas</i>, <i>Hakeas</i>, <i>Banksia</i> and other Western Australian genera have red, orange,</li> </ul>

	pink flowers, which attract birds and honey possums, this symbiotic relationship provides food for birds and small mammals and subsequently ensures pollination.
Indigenous Culture	<p>Liaise with Dr Richard Walley for ideas and permission to use Nyoongar cultural information. (Dr Walley has spent over forty years educating Australia and the world on Nyoongar culture and identity through the arts and continues to work closely with Kings Park)</p> <ul style="list-style-type: none"> <li>• Suggested referral to the Aboriginal History and brochure sections of the Kings Park website for publications and information that has already been authorised (i.e Firesticks to Fireworks, Aboriginal Life, indigenous culture &amp; indigenous self guided walk brochure). <a href="http://www.bgpa.wa.gov.au/kings-park/visit/history/aboriginal-history">http://www.bgpa.wa.gov.au/kings-park/visit/history/aboriginal-history</a></li> <li>• Use stories to celebrate indigenous culture, totems, marriage, territories, boundaries, structure of healthy society over long period of time. Wagul – serpent carved out the Swan River.</li> <li>• Six seasons, gathering, dancing, ceremonial, winter wrapping up stories, interpreted by plants flowering and animal activity, 60000 years of successful living off the land.</li> </ul>
Public access to Western Australian Flora	It was considered that the public would be keen to ascertain whether some of the Western Australian flora might be grown at home. It was decided that it was worthwhile mentioning <i>Anigozanthos</i> , for pot cultivation, most likely treated as an annual, or perhaps overwintered frost free. Millenium Plants in Truro were to make <i>Anigozanthos</i> available and it was suggested they might be sold in the Eden plant centre.

## The Future

Towards the end of our time at the Eden Project, myself, Grady and the Eden team came together to discuss the future management of the display. It was agreed that to a great extent initially this was consist of trialling plants and cultural practices within the biome setting, recommendations and knowledge would be built on experience.

Working with the nursery will be the fundamental link in ensuring continuity of display. It will likely be necessary to create a rolling stock order. It will be necessary to implement a replacement policy. Consider 3-4 sowings of annuals each year, with a short term replacement strategy for the herbaceous plants, with larger more woody plants 5-10 years.

### Infrastructure

Mulch	Course sand for the Kwongan and Central Display bed Wood mulch for the Banksia Jarrah Woodland In keeping with the look of the respective eco-regions, this will add integrity to the display, finish off the beds nicely and display the plants well.
Pathways	Consider sealing the pathways with a different colour to the meeting place, to differentiate between the two areas.
Signage	Draft maps were reviewed and the Kwongan and Banksia / Jarrah woodland areas were revised and marked for inclusion

## Cultural

Watering	<ul style="list-style-type: none"> <li>- Grasstrees - Plug up reticulation around grasstrees, so in control of water application, deeper water less often is preferential to transplanted grasstrees. This was actioned whilst I was there. Avoid water in the crown of the grasstrees</li> <li>- Invest in a moisture metre for the grass trees, to record moisture levels at 10,20,30,40,50, &amp; 60cm, informing how much water is administered, to what level, over what time frame.</li> <li>- Keep water off all foliage as much as possible, be careful of collar rot, do not plant too deep</li> <li>- <i>Anigozanthos</i> &amp; <i>Macropidia</i> can be used as indicator plant as they wilt when dry</li> </ul>
Fertilising	<ul style="list-style-type: none"> <li>- Use 6 month granular native fertiliser for annuals as well as all other plants, as it is likely they will keep going longer than they do in Kings Park</li> <li>- After initial fertilising on any planting – 5mg of slow release –(N 21.8 / P 0 / K 8.7), it will be necessary to ascertain the best way to fertilise thereafter. Consider an annual fertilise or possibly feed certain things as they appear to require it, document what works</li> <li>-</li> </ul>
Pruning	<ul style="list-style-type: none"> <li>- <i>Anigozanthos</i> – trial pruning of Kangaroo Paws, ascertain when is the best time to encourage summer flowering?</li> <li>- <i>Banksia</i> – adapt pruning dependent on species, e.g <i>B. burdettii</i> successional pruning, <i>B. coccinea</i> only remove flowering stem</li> <li>- Melaleucas – prune in an almost bonsai like fashion to allow paperbark trunk to be visible</li> <li>- Ensure live foliage is left on stems when pruning</li> </ul>
Pests	<ul style="list-style-type: none"> <li>- Scale, Two-spotted Mite – particularly on softer foliage of plants like Boronia, Melaleuca. Eden use bio control, only spray if out of hand</li> <li>- Monitor grasstrees for scale in the crown, if found use a pest oil</li> </ul>
Disease	<ul style="list-style-type: none"> <li>- Watch for ink spot on the <i>Anigozanthos</i> and <i>Macropidia</i> foliage, try to avoid getting foliage too wet</li> </ul>

## Plants

Annuals	Recommend 2-3 successional sowings of annuals, don't allow to self-seed. Thicker everlastings by path, thin out through centre & and dense again towards back
Removal	<ul style="list-style-type: none"> <li>- <i>Kunzea ericifolia</i> at the back of the Kwongan could be removed once the Banksias mature. Don't let them steal the light, consider base cutting and allowing to reshoot</li> <li>- In time, consider removal of <i>Calothamnus</i> which could be a bit weedy, primarily used as initial filler.</li> <li>- Consider the removal of some <i>Grevillea</i> cultivars within about 12 months</li> <li>- <i>Anigozanthos flavidus</i> in Jarrah bed, some could be removed in time, for inclusion of further <i>Chorizema</i></li> </ul>
Additional plants of	<ul style="list-style-type: none"> <li>- <i>Anigozanthos</i> – additional cultivars / species to add to the exhibit</li> <li>- <i>Patersonia occidentalis</i> or <i>P. lanata</i></li> <li>- <i>Acacia glaucoptera</i> around back of sign in Kwongan, replace Goodias which are quick fillers.</li> <li>- <i>Xanthorrhoea preisii</i> – Once Grasstrees Australia (in Perth) have trialled different, coir based growing media, for international shipment, consider</li> </ul>

sourcing.

- *Banksia blechnifolia* & *Banksia petiolaris* in the Kwongan
- *Gompholobium scabrum* – plant remainder soon in Banksia Jarrah bed
- More *Chorizema* through Jarrah and central bed.
- Plant 2-3 *Eucalyptus marginata* & 1 *Eucalyptus lane-poolei* around each charred oak stump to provide representation and imagery of the Jarrah forrest.
- Add more Hoveas



The Decorative and Kwongan Bed – July 2017

## Tresco Abbey Gardens

Part way through my time at the Eden Project, I was incredibly fortunate to visit the Scilly Isles and in particular, Tresco Abbey Garden. To say I was excited was an understatement. The Scilly Isles is one of those places that I think you hope to visit one day, but don't always have the opportunity. It was a dream come true to visit and to be fortunate enough to spend considerable time with Curator, Mike Nelhams and Head Gardener, Andrew Lawson, both of whom were incredibly generous with time and knowledge and whose infectious enthusiasm was undoubtedly inspiring.

Tresco Abbey Garden, with its 20,000 plus plants from South Africa, South America, Australia, the Mediterranean, California and New Zealand has a unique and thus far to me incomparable beauty.



Views from the top terrace



*Kunzea baxteri*

There were some mature Grevilleas from the Eastern states of Australia in the garden, whilst a number of cultivars, grown from tissue culture, used in the Eden Project WA exhibit, were growing on in the Tresco nursery. A number of additional Banksia species had recently been planted on the top terrace, including, *Banksia menziesii* and *Banksia coccinea*.

Amongst the pure, rugged natural beauty of the Scilly Isles sits an exotic gem. I was struck by the different layers in the garden and so much texture everywhere I looked, my eye always being led on to another part of the garden or out to the borrowed landscape beyond. I don't think I'll ever be able to do it justice in my description!

Whilst all of the garden was of great interest, for us on this occasion, it was the light and sunny top terrace, with its coastal breezes, that captured our attention in particular, not only for the Western Australian plants that were already thriving here, but with a view to what might be a worthy inclusion going forward.

Western Australian beauties that we found flourishing on the top terrace and in a few other areas of the garden, were as follows:

*Banksia baxteri*, *Banksia formosa*, *Banksia grandis*, *Banksia integrifolia*, *Banksia praemorsa*, *Billardiera heterophylla* (Sollya), *Boronia alata*, *Corymbia ficifolia*, *Hakea sauveolens* (so happy here it sets seed!), *Hardenbergia comptonia*, *Kunzea baxterii*, *Kenedia nigricans*.



*Banksia formosa* (formerly *Dryandra*)



During our visit Andrew discussed a recent visit to the Banksia Farm in Mt Barker, Western Australia. He had a list of recommended Banksias for inclusion in the Tresco collection, from Kevin Collins the owner and would be sourcing seed directly.

On return to Kings Park, consideration was given to those species that are ornamental, from the southwest of Western Australia and loving of coastal conditions.

All species listed below are available as seed from Nindethana.

*Kennedia nigricans*

Botanical Name	Common Name / Indigenous Name	Source
<i>Beaufortia aestiva</i>	Kalbarri Beaufortia	Nindethana (seed)
<i>Beaufortia sparsa</i>	Swamp Bottlebrush	Nindethana (seed)
<i>Chorizema varium</i>	Bush Flame Pea	Nindethana (seed)
<i>Eucalyptus preissiana</i>	Bell-fruited Mallee	Nindethana (seed)
<i>Eucalyptus sepulcralis</i>	Weeping Gum	Nindethana (seed)
<i>Eucalyptus tetraptera</i>	Four-winged Mallee	Nindethana (seed)
<i>Eucalyptus xtetragona</i> (silver) = <i>pleurocarpa</i> #4055 & #4056		Nindethana (seed)
<i>Hakea cinerea</i>	Ashy Hakea	Nindethana (seed)
<i>Hakea laurina</i>	Pincushion Hakea	Nindethana (seed)
<i>Hakea victoria</i>	Royal Hakea	Nindethana (seed)
<i>Kennedia beckxiana</i> (red)	Cape Arid Kennedia	Nindethana (seed)
<i>Regelia velutina</i>	Barrens Regelia	Nindethana (seed)
<i>Xerochrysum bracteatum</i> (cultivated, dwarf mixed colours)	Golden Everlasting	Nindethana (seed)



Exploring the garden with Mike Nelhams



Andrew Lawson, Dina Gallick, Grady Brand and myself

## Conclusion and Key Outcomes

This is the first time a significant, permanent display of Western Australian flora of this kind has been established in the UK. Whilst there are other displays becoming established and growing – National Botanic Garden of Wales and Tresco Abbey Garden to name two; the Eden display also offers strong educational messages about the global significance of the biodiversity of WA's South West and the critical need for its ongoing conservation. The unity of a display of unusual flora, rarely seen outside of its native location, combined with the environmental messages and plan for ongoing development of such a display, are I believe a major achievement for all involved.

For me personally, to be involved in such an exciting, innovative, at times challenging project, with such ongoing scope for continued alliance with another like-minded organisation, whose focus is also the delivery of key environmental messages and the continued education of the public; was incredibly rewarding.

From the moment I first heard about this project from Grady Brand, I felt strongly that I had to be involved. I love England and I love our strong tradition of excellent horticulture as a nation. I am also totally enamoured with the Western Australian Native Flora and to be able to introduce the wonders to a wider audience, in such an incredible setting was a no brainer to me. I feel proud of myself for taking the opportunity to join this project. Being a mother to a three year old, at the time of the project, added another level to the experience. There was always someone else to consider and this made for longer, more tiring days, but I would not change this for the world. This was also an invaluable experience for my son too and it was a joy to show him the display we created and a surprise for him to see Kangaroo Paws and Grasstrees growing in a "giant bubble"!

I also learnt a lot from Grady about the plants involved, the environments they grow in and how to represent your organisation whilst being involved in a large project such as this. In researching and reading more, I have learnt more about the flora, the regions within the Western Australia, the environmental adaptations and challenges of our flora. The level of information available is almost overwhelming and there is still so much being discovered and to learn, this is both exciting and daunting! I think this project has helped me to focus on the future and reminded me just how lucky I am to have ended up in Western Australia working with this incredible and diverse flora.

Seeing the enthusiasm and joy from my fellow horticulturists and the visitors to the Eden Project, when seeing, questioning and learning about the completed Western Australian Display made me feel so proud of our beautiful flora and fall in love with it even more. It is my hope that we can continue to develop the relationship with the Eden Project and other international horticultural organisations, sharing ideas and information. To a large extent this is still an experiment, a trial to see what works and what doesn't, to try something different, how exciting!

### Some key outcomes

- Establishing three new permanent garden displays in the Mediterranean Biome at the Eden Project, featuring WA flora from the Jarrah/Banksia forest, Kwongan and a general display bed and enabling the creation of a strong collaboration between international horticultural organisations. Sharing of common objectives, knowledge and skill to ensure a high standard display.
- Additional collaborative relationships with other Horticultural and Botanical organisations were also instigated.
  - Staff from the National Botanic Garden of Wales, visited the Eden Project, during the installation of the Western Australian display beds in order to discuss WA flora with Kings Park Staff and share plant material with the Eden Project.
  - Additionally, a trip to the Tresco Abbey Garden on the Scilly Isles took place. Kings Park staff spent time exploring the garden with the Curator and Head Gardener, in order to appreciate WA flora already growing successfully on this site. Advice was given on suitable WA flora and where it might be sourced for incorporation in future displays.
  - On return to Perth, recommendations have been made to the curator of RHS Wisley for possible addition to the collection there
  - Also since our return, germinated *Grevillea* and *Hakea* material from the Millennium Seed Bank, has been donated to National Botanic Garden of Wales and Cambridge University Botanic Garden, this is with the permission of the Curator of the Western Australian Seed Technology Centre of Kings Park
- Promotion of the important work carried out by Kings Park Botanic Garden & Parks Authority, in the conservation, display of and education in the biodiverse flora and landscape of Western Australia.

- Traditional land custodian messages of the Nyoongar people will be retold through the use of art work and storytelling alongside the display
- Species selection was made using plants currently available within the horticultural trade or through commercial seed merchants in WA, so as to ensure the display could be maintained ongoing. Promoting plants that are commercially available, as the main function of the exhibition was for display and education.
  - Having been on site further consideration and advice has been given for additional species for inclusion in the display going forward. Utilising seed and plant material available from current sources – lists of additional species can be seen following each plant list.
- A future consideration for Kings Park is the potential for the supply of domesticated seed collected from within the Western Australian Botanic Garden.
  - Testing by the authority prior to supply would ensure seed collected remained true to its species, to ensure botanical integrity and uphold the high standard and reputation of the BGPA.
  - Should this be viable, the sharing of this seed could be considered with other Eden Partners that also grow WA plants in the UK. In particular Tresco Abbey Garden on the Scilly Isles and the National Botanic Garden of Wales. All organisations mentioned, have expressed an interest in exploring this opportunity.
- The opportunity for exchange visits between Kings Park and the Eden Project, to share horticultural and botanical knowledge and the development of skills would be beneficial to all parties, funding permitted.
- The new display generated significant media coverage in the UK press, including Tourism WA UK branch, the Telegraph UK Gardening Section, Horticulture Week and a segment on BBC Gardeners World in June 2017. In Western Australia, Grady Brand, Senior Curator gave a radio interview with the ABC and the Government of Western Australia, European Office. There has been web coverage from both Kings Park and the Eden Project. The above all with a very positive angle for both Kings Park and the Eden project.



**The Decorative and Banksia Jarrah Bed – July 2017**



## Budget

I was awarded £800 by the John Coke Trust. Below is a breakdown of how I used this funding to assist me during my time in Cornwall and the Scilly Isles.

RHS BURSARY RECONCILIATION						
Supplier	Description	Date	Receipt Total	Own Cost	Bursary Total	Supporting Document
Isles of Scilly Travel	Return flight Newquay - St Mary's	20/3/2017	£210	£0.00	£210.00	Booking Ref: 114850
Enterprise	Car Hire 3 weeks	4/3/2017	£565.00	£0.00	£565.00	Invoice: 3065795
Fleet Service Station	Petrol	11/3/2017	£30.02	£5.02	£25.00	
			£805.02	£5.02	£800.00	

In addition to my funding by the Royal Horticultural Society, I was fortunate to receive financial assistance from the Friends of Kings Park, under their Vic Galea Scholarship. This money was used to book International flights and accommodation for the duration of my scholarship trip, below is the funding utilised during my time in Cornwall.

FRIENDS OF KINGS PARK , VIC GALEA SCHOLARSHIP FUNDING						
Supplier	Description	Date	Receipt Total	GBP Rate	Bursary Total	Supporting Document
Singapore Airlines	Flights		\$1488.46		\$1488.46	
Cornwall Accommodation	3 weeks		£1000	0.5531	\$1807.99	

All other expenses, including additional fuel and food were covered at my own cost.

## Acknowledgements

A very heartfelt thank you to:

- The RHS Coke Trust Bursary Fund for assisting me with this scholarship project
- The Friends of Kings Park for their support in awarding me the Vic Galea scholarship 2016
- Grady Brand, Senior Curator, Kings Park
- Dina Gallick, Manager Enclosed Biomes, the Eden Project
- Catherine Cutler, Rob Elley, Doris Mckellar, Riyah Snow, Sally Brigden – Mediterranean Biome & Nursery, the Eden Project
- All the lovely staff I met during my time at the Eden Project
- Mike Nelhams & Andrew Lawson, Tresco Abbey Garden
- My colleagues in Kings Park & the Western Australian Botanic Garden
- My partner Michael Grennell & my mother Elaine Smith, without their support, my involvement in this project would not have been possible.

## References and bibliography (further reading)

### Books:

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- The Southwest Australia Ecoregion Jewel of the Australian Continent, Copyright text 2006 Southwest Australia Ecoregion Initiative. All rights reserved. Author: Cheryl Gole, WWF-Australia

## Sourcing plant material

<p>Nindethana Seed Service (ABN 69 138 511 690)          Western Australia          Phone: +61 8 9844 3533          Fax: + 61 8 9844 3573          Email: <a href="mailto:seed@nindethana.net.au">seed@nindethana.net.au</a>  <a href="http://www.nindethana.net.au">www.nindethana.net.au</a></p>	<p>Ramm Botanicals          New South Wales          Australia          Phone: +61 2 4351 2099  <a href="http://www.rammbotanicals.com.au">www.rammbotanicals.com.au</a></p>
<p>Plantbase          East Sussex, U.K          Phone: 01892 785599          Email: <a href="mailto:plantbaseuk@gmail.com">plantbaseuk@gmail.com</a>  <a href="http://www.plantbase.co.uk">www.plantbase.co.uk</a></p>	<p>Millenium Plants Cornwall Ltd          Newquay Road          Goonhaven          Nr Truro          Cornwall          TR4 9QQ          Phone: 01872 572310  <a href="http://www.millenniumplants.co.uk">http://www.millenniumplants.co.uk</a></p>
<p>The Old Walled Garden          Oxonhoath          Hadlow          Kent          TN11 9SS          Phone: 01732 810012</p>	



Eden Project Staff and Volunteers, with myself and Grady Brand in the centre