



**K.KUMARASIVAM YOUNG ENVIRONMENTALIST
INTERNSHIP AWARD
2018**

**Report on:
Internship Program at Kings Park & Botanic Garden,
Perth, Australia
(4th March 2019 – 18th March 2019)**

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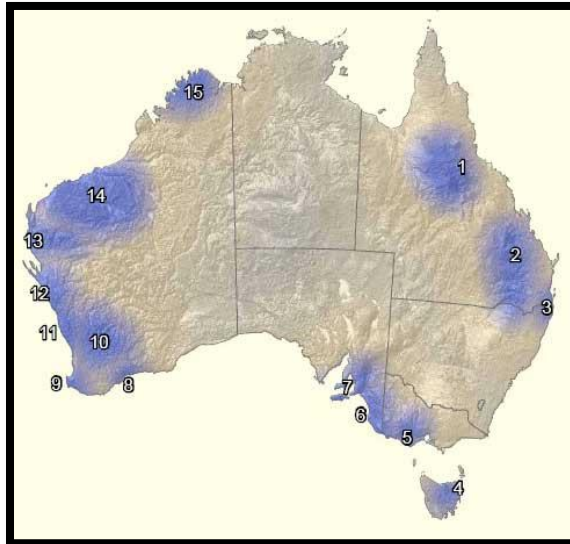


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1.0 INTRODUCTION

1.1 WESTERN AUSTRALIA BIODIVERSITY



15 Biodiversity hotspot of Australia

(Source: <https://www.environment.gov.au/biodiversity/conservation/hotspots/national-biodiversity-hotspots>)

Western Australia (WA) is the biggest state in Australia occupying one third of the country with a total land area of 2,529,875 km². Perth is the capital of WA located at the southwest corner which holds 79% of the population. While Kimberley region is located at the north of WA, which is the home to ancient Aboriginal rock art, the Bungle Bungle sandstone domes and Broome, with Cable Beach camels and a pearling industry.



Anigozanthos manglesii (Kangaroo paw), Emblems of WA

8 out of 15 biodiversity hotspot of the country are located at WA with the significant regional endemism. It is estimated that there are more than 12,000 species of plant, 207 species of mammal, 439 species of reptile, 540 species of birds and 1,600 species of fish found at WA. Around 70% of the plant species are endemic to WA which does not occur naturally anywhere else on earth.

1.2 KINGS PARK & BOTANIC GARDEN



Kings Park & Botanic Garden (KPBG) is one of the world's largest and most beautiful inner city parks with total area of 400.6 hectare. KPBG is located at Mount Eliza with a beautiful panoramic view of Swan and Canning Rivers, the city skyline and the Darling Ranges to the east. It is rich in historical and natural elements, aboriginal and contemporary culture and offers innovative design, displays and services.



View of Swan River from KPBG

KPBG is not an ordinary public park but it is home to the spectacular Western Australian Botanic Garden, which holds over 3,000 species of the WA unique flora. Two thirds of the park is covered and protected as bushland which are rich in native biodiversity.

It is also one of the leading institutes in scientific research, horticulture, conservation and public education which successfully undertaking researches in native plant biology and supports conservation of biodiversity of WA with systematic approaches.

KPBG is under the management of the Botanic Gardens and Parks Authority (BGPA). The Authority is bound within the Western Australian State Government portfolio of the Minister for the Environment. BGPA receives significant funding from the WA state government. The total number of staff at KPBG is around 120 staff including the research, administration and ground staff.

1.2.1 Western Australia Botanic Garden



The entrance of Western Australia Botanic Garden

Western Australian Botanic Garden (WABG) is an important element of KPBG which has the largest display of WA flora in the world. It was first open on 4th October 1965 with the focus to cultivate and display WA's flora collections. Now it is successfully displaying around 3,000 species of WA's native flora. The total area of

17 hectares holds spectacular garden displays, featuring outstanding species from around the state.

At the entrance of the WABG, we are welcomed by the sculpture called 'Symbiotica' and group of beautiful Silver Princess trees (*Eucalyptus caesia*). It is then followed by the 750 years old Giant Boab (*Adansonia gregorii*) which was transplanted from the East Kimberley in 2008.



750 years old Giant Boab (*Adansonia gregorii*)

The floral collections in the garden are displayed according to several themes. The regional display beds is to present the flora diversity of various region in WA include the Wheatbelt, Goldfields, Stirling Ranges, Rottnest and Garden islands, the Kimberley, Mulga, Southern Coastal and Darling Range. While the other parts of the garden is displayed according to the notable taxonomic groups such as Banksia, Verticordia, Boronia, Grevillea and Hakea, Waxes and Kangaroo Paws and Eucalyptus. It is also consists of Conservation Garden, which displays the state's most critically endangered and rare species.

1.2.2 Bushland



View of KPBG Bushland

Around two thirds of Kings Park is covered by bushland with native biodiversity. It holds around 325 species of local native plants, which represents 15% of the native flora of the Perth Region. There are three major plant communities can be found at Kings Park Bushland; limestone heathland; Banksia woodland and low moist areas. The bushland is dominated by tall Tuart (*Eucalyptus gomphocephala*), Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia callophylla*) along with *Allocasuarina fraseriana* and *Banksia* species such as *Banksia attenuata*, *Banksia grandis*, *Banksia menziesii* and *Banksia prionotes*.

Kings Park Bushland is also habitat for various fauna species. There are more than 70 species of bird, 20 species of reptile and hundreds of different invertebrates found in Kings Park bushland. This bushland also supports native mammals such as Brushtail Possum (*Trichosurus vulpecula*), Quenda (*Isodon obesulus*) and a number of bat species along with a rare population of native snail, *Bothriembryon indutus* (Scarp Snail).

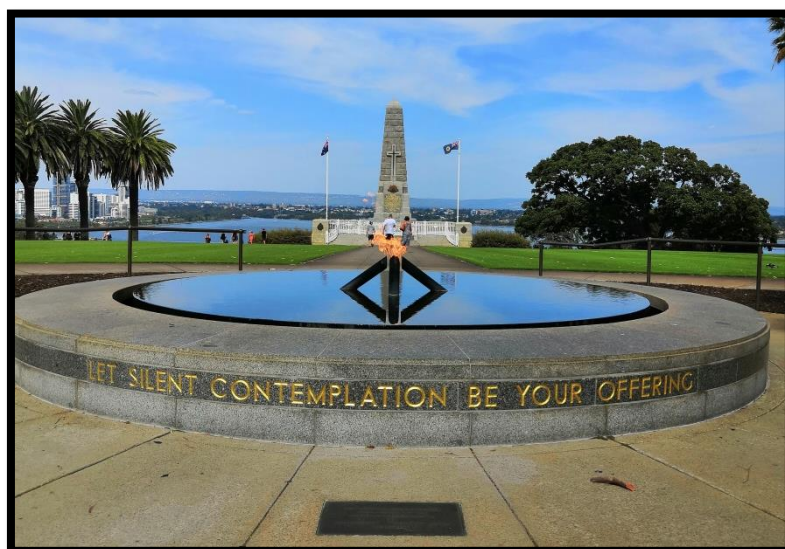
Kings Park's bushland is not only home for plants and animals, it also holds the population of more than 265 species of fungi. Fungi with different shapes, size and colours can be seen at the bushland, especially after the rains. It is anticipated that there are more fungi species are yet to be identified and could be native to the area.



Pedestrian walkway at bushland

There are numbers of pedestrian walkways and bicycle paths designated along the Kings Park bushland to allow public experience the unique biodiversity of bushland. However, during hot season especially on summer some of the bushland area is closed for public access as it is prone to bushland fire. The fire risk scale is monitored daily and the regular visit to the fire prone area is done during high fire risk days. KPBG also own fire engines to control the bushland fire. The biggest bushland fire happens at KPBG was 10 years before where it burns more than 40 hectare of bushland. The recent incident was in January 2018 where it burns more than 15 hectare of the land.

1.2.3 Memorials



State War Memorial

KPBG holds more memorials, statues and honour avenues than any other parks in entire Australia. Examples of memorials that can be found at KPBG are State War Memorial, Bali memorial, Battalion Memorial, South Africa War Memorial, Jewish War Memorial, statues of John Forrest and Queen Victoria and The Pioneer Women's Memorial.



Cenotaph at State War Memorial



Sandakan Death March Memorial



The Pioneer Women's Memorial

Every year in 25th April more than 40,000 people will gathered at the State War memorial in conjunction with ANZAC Day. ANZAC Day was originally devised to honour the members of the Australian and New Zealand Army Corps (ANZAC) who served in the Gallipoli Campaign in the First World War.

1.2.4 Rio Tinto Naturescape

Rio Tinto Naturescape is an excellent initiative of KPBG to connect the kids with nature and educate them to understand and appreciate the unique Western Australian environment. It covers six hectares and surrounded by natural bushland. As it is covered by bushland, Naturescape is closed for public access during hot weather.

Rio Tinto Naturescape is also the centre of Kings Park education. It gives opportunity to the city kids to interact with the natural environment. Kids get the hands-on experience with WA's natural environment that will inspire them to involve in environmental conservation in future. It has large aerial walkways called The Python and The Bungarra, a creek and waterhole for wading in, a cubby-building area, tunnels, rocks and a web of climbing ropes called The Tangle.



Left: The Phyton, large aerial walkway ; Right: Cubby building by using natural sources found at bushland

(Source: <https://www.bgpa.wa.gov.au>)

One third of the area is set as the committed education zone for schools and other pre-booked groups. The education zone is popular as outdoor 'living classrooms'. It is also includes innovative education about Western Australian biodiversity, local Aboriginal culture and the natural sciences. This outdoor education benefits the kids in improving their mental health, social and cognitive and problem solving skills, physical fitness and healthy development.

1.2.5 Other Public Space

There are many other public spaces found at KPBG. Some are designated with picnic facilities and children playground. There are also restaurants and café can be found in the park area. Aboriginal arts are also displayed and sold at the Aboriginal Art gallery. Besides that, botanic terraces and pavilions also can be found around the park area. Moreover, during summer The Pioneer Women's Memorial transforms to become a magical setting for live concerts.



Left: Water Garden Pavilion; Right: Lycopod Island, Children Playground

1.2.6 Public Engagement

KPBG has an outstanding public involvement and support. They have NGOs and volunteering groups engage with the park. At the entrance of KPBG a small building owned by Friends of Kings Park can be found. Currently, a small area is given to the volunteer group to build their own management building. However all the activities by the volunteers are completely monitor and control by KPBG management.

There are free guided tour programmes run by volunteer every day. All the volunteers are well trained and very knowledgeable about the park. I get a chance to follow a tour organised by volunteers on 18 May in conjunction with World Women's Day. The objective of this tour was to reveal the contribution of women in the history and development of KPBG.



Tour in conjunction with World Women's Day celebration

Besides free guided tour, volunteers are also involved in park maintenance activities. Every Tuesday and Wednesday a group of volunteers will be joining the Horticulture team for the maintenance activities. Example of tasks that will be done by the volunteers are manual weeding, simple plant pruning, plantings and rubbish picking.

Not only that, volunteer are also involve in plant propagation for the Kings Park Festival which celebrated on September each year. They are provided with own nursery to grow plant for selling during the flora festival. The income from the sales will be then used for their volunteering activities and to fund KPBG's development projects.

1.0 INTERNSHIP AT KINGS PARK & BOTANIC GARDEN

Throughout the two weeks internship program, I was placed under different departments and engaged with various garden management tasks. I also get a chance to join the Women's Day walk on 18 March along with Mr. Grady Brand, senior curator of KPBG.

2.1 Nursery Department

Nursery is a key factor of every botanic gardens and parks. It is where the plants are propagated and grown before planted at garden beds. KPBG's nursery department is lead by Ms Amanda Shade, curator of Nursery. KPBG nursery has the complete facilities such as glass house, cold house, seed treatment room and various plant nursing sites. I was placed under this department for three days. The activities I involved in were reporting, pruning, transplanting of seedlings and propagation by grafting and tip cutting techniques. The database system used at KPBG nursery is BG Base.

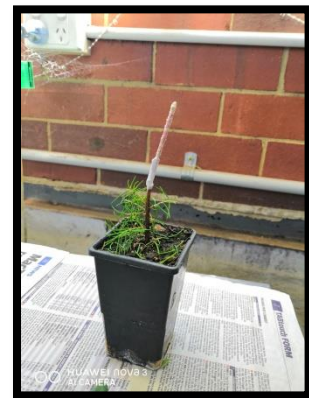
At KPBG nursery reusable planting container are used propagation and they avoid from using polybags which can end up with huge plastic waste. The containers will be decontaminated with heat before used for the next cycle to prevent diseases. 'Rocket' pot is an example of planting container used at KPBG. This pot was designed with many holes around to enhance the root growth and to prevent the root ball formation. It is also easily detached during reporting and transplanting.



Left: *Verticordia grandis* planted in 'Rocket' pot; Middle: Slow release fertilizer;
right: Horticulture mix

The planting medium used by this nursery is a standard horticulture mixture supplied by certified supplier. Slow releasing fertilizers are mixed with the medium with ratio medium to fertilizer of 1 m³ to 4.5 kg. Slow releasing fertiliser is used to ensure continuous nutrient supply for at least 6 months. Besides that, using slow release fertiliser also prevents nutrient leaching.

Grafting technique is used to propagate the plant species which difficult to grow in garden bed. The plant selected as rootstock is usually the plant which can tolerate the soil condition in garden bed. Both rootstock and scion need to be at least from the same family. During the internship I was taught to carryout cleft grafting. I have grafted *Geleznovia* sp. Red Bluff (scion) with *Correa reflexa* (rootstock) and *Verticordia grandis* (scion) with *Chamelaucium* sp Walpole (rootstock). Besides that tip cutting technique also was used to propagate *Verticordia grandis*.



Left: *Chamelaucium* sp Walpole (rootstock); Midle: *Verticordia grandis* (scion);
Right: Grafted plant



Left: Repoting; Midle: Weeding; Right: Glass house

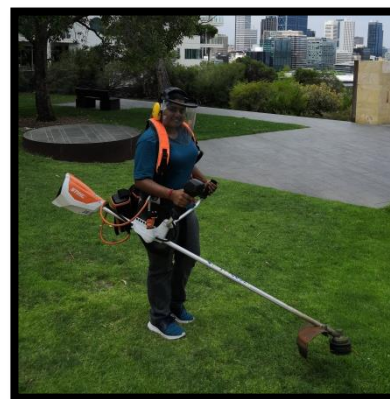
2.2 Bushland Department

As mention earlier two third of Kings Park is covered by bushland. The team of Bushland Department is responsible for bushland maintenance, fire management and restoration of plants. I have spent a day with bushland team to prune the overgrown plants and dead twigs along the walkways. Some unwanted plants have also removed to reduce the density of the plants. Many dead trees due to bushland fire and other factors are not removed as they are habitat for many flora and fauna. However, the dead trees which are hazardous to public are advised to be removed or will be under observation of arborist.

2.3 Horticulture Display Department

The department of horticulture display is headed by the curator, Mr Peter Nguyen. This department is responsible for the lawns and garden planting bed management including planting, clearance and maintenance. I had a great experience with horticulture display team for three days.

As ANZAC day will be celebrated at KPBG on 25 April 2019, Marigolds were planted at State War Memorial around the Court of Contemplation. I have also involved in shrub pruning at car park area and grass cutting at lawns.



Left: Marigolds planted around the Court of Contemplation; Right: Grass cutting at lawns

The toughest job that I have experience during this internship was the clearance of transition bed for two days. Transition beds are the planting beds in between bushland and the botanic garden beds. It is a buffer zone to prevent the bushland plants to enter the botanic garden area. The clearance task was involved by all the horticulture department staff including the curator. I was assigned to trim all the dry branches of the shrubs and dry leaves of the cycads. I have also help the team to load the green waste into the truck which later will be sent to the transfer area. Although it was very tiring, I get a great experience working with the whole team which majority are women.



Top Left: removing dry branches using saw; Top Right: Loading into the lorry;
Bottom: Horticulture display team during transition bed clearance

2.4 WA Seed Technology Centre

WA Seeds Technology Centre (WASTC) of King Park plays a major role in collection of seed and plant material from threatened habitats where the plants rare or under risk of extinction. The plants then will be displayed in the WA Botanic Gardens. The seed collection expedition is conducted by Luke Sweedman or better known as the seed man is one of the world's most prolific seed collector.



Image of *Lambertia multiflora* var *darlingensi*
(Source:<https://florabase.dpaw.wa.gov.au>)

I'm proud to say that I have joined him for a day for field collection. The species that we targeted was of *Lambertia multiflora* var *darlingensi* which the population recorded to be found at Darling Range. The spatial data of the population of *Lambertia multiflora* var *darlingensi* was downloaded from Florabase website and connected to the handy GPS navigation system. We went to few places; Serphinetine falls and some roadside bushes. Unfortunately, we couldn't find any of the plant population there. According to Luke, It could be due to the dry season which dries up most of the plants. Even though the plants are dry, seeds or other vegetative parts of the plants will be in dormant state and will sprout during spring. Even we failed to find the planting material that we were looking for, it was a great experience for me to work with such a professional seed collector.

2.5 Kings Park Science

Kings Park Science is part of the Department of Biodiversity, Conservation and Attractions, undertakes research in native plant biology, underpinning conservation and ecological restoration of Western Australia's unique biodiversity. The research programmes is focused on field such as restoration ecology, seed science, conservation genetics, conservation biotechnology, orchid conservation, and fire management. KPB has a strong research background with well experience researchers.

I was introduced to Dr Jason Steven, Program leader of Kings Park Science. He has explained to me about the on-going research programmes at KPBG. Then I also was introduced to five researches who involve in different research field in KPBG. They are Dr Eric Bunn (Senior Research Scientist in Conservation Biotechnology), Dr Belinda Davis (Research Scientist in Orchid Conservation), Dr Siegy Krauss (Senior Research Scientist in Conservation Genetics), Dr David Merritt (Research Scientist in Seed Science) and Dr Ben Miller (Research Scientist in Fire Ecology).

I was brought to various research laboratories such as tissue culture lab, cryopreservative lab, genetic science lab, orchid propagation lab, seed technology lab and also to seed storage cold room. They also briefly explained to me about the research activities carryout by each of them.



Left: Tissues culture lab; Right: seed germination in incubator



Left: Cryopreservation equipment; Middle: Collections of *Banksia* seeds; Right: Orchid seeds

2.5 Meeting With Senior Curator, Mr Grady Brand

I had a chance for short discussion with the senior curator, Mr Grady brand about the establishment of WA Botanic Garden. I did share my experience and some challenges facing by Penang Botanic Garden in developing as a world class botanic garden. Mr Grady has also shared his journeys in establishing the WA Botanic Garden; the challenges faced by him and how he overcomes it. It was a very informative and inspiring discussion for me.

2.6 Sustainable Approaches at KPBG

Throughout this internship period I have come across and observed few sustainable approaches practiced at the KPBG. As mention earlier reusable containers are used for plant propagation to reduce plastic waste.

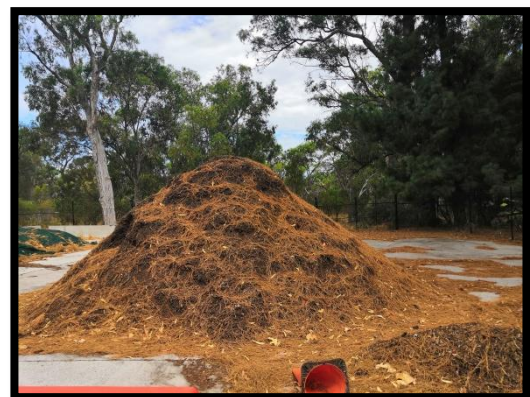
Besides that, as KPBG has limited staff the manpower were well utilized for the garden management activities. The garden area is divided according to the priority. Area with high public attention is considered as high priority area and regular maintenance will be carried out. While for the area with fewer visitors the maintenance will be done only when needed. This is due to the small number of ground staff involving in the maintenance task.

All the garden beds and other planting space including bushland area are covered with thick and neat mulch consist of wood chip and dry leaves. Mulching is an important sustainable garden maintenance practise as it has various functions. Mulch insulates the soil to provide a buffer from heat and cold temperatures. Mulch also holds water to keep the roots zone moist. It also prevents weed growth, soil compaction and mechanical injuries during lawn clearance.



Left: Mulching around the tree; Right: Sprinkler irrigation for the lawns

Green waste from the garden such as pruned tree branches, grass clippings and dried leaves are gathered at the transition area and later turned into compost or mulch to be used in the park. For the garden beds subsurface drip irrigation system is used to utilise the water source effectively. Sprinkler irrigation is used for the lawns and some parts of nursery which control by the timer.



Left: Green waste collected at transfer area; Right: Composting the green waste

Informative labels about the plant species, regional information, aboriginal value and IUCN status is put up garden beds. This helps the public to get know more about the plants. The labels are also designated with pictures and aboriginal arts to attract the public attention.

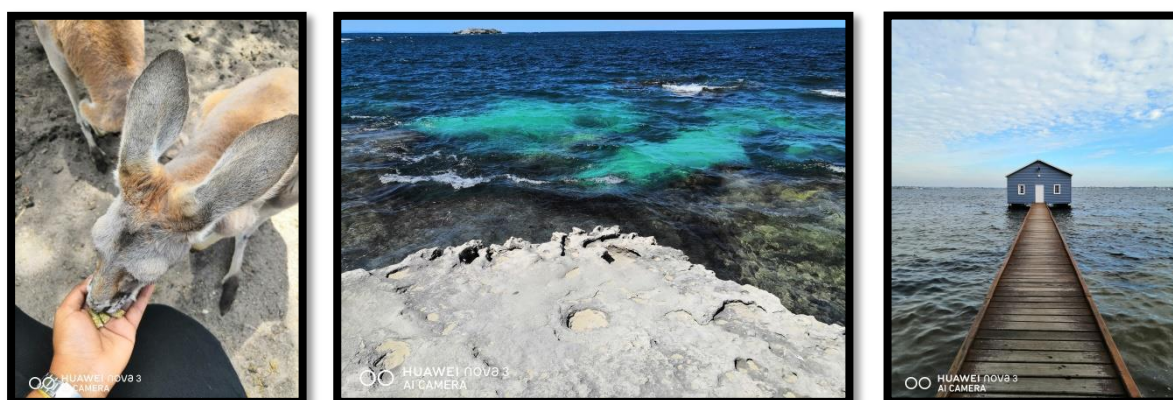


Example of labels

3.0 TRAVEL AROUND PERTH

3.1 Public Space

Along the 2 weeks stay at Perth, I got chances to visit some of the attractive tourist spot in Perth. The places that I have visited were Caversham Wildlife Park, Blue boat house, Perth Mint, Bell tower, Twilight Market, Fremantle and Rottnest Island. Perth city are very rich in culture, history and natural elements. At Caversham Wildlife Park native animals such as kangaroos, koala and wombat are can be seen and public area allowed to interact with them under the guidance of park management. Fremantle is a town rich in historical buildings. While Rottnest Island is an island rich in native biodiversity and beautiful beaches.



Left: Feeding kangaroo atr Caversham Wildlife Park ; Midle: Beautiful beach view at Rottnest Island; Right: Blue Boat House

Almost at all the public spaces at Perth, recycle bins are placed at every short distance. Very few or no rubbish can be found littered. Besides that, at restaurants the foods are packed by using papers or recyclable microwave containers. Water dispenser also can be found at most of the public space, where public can refill their water bottles. This reduces the plastic waste. At Rottnest island motor vehicles such as car and motorcycles are not allowed. The tourist only can travel by shuttle bus, train or bicycle. This ensures the rottenest island is free from pollution cause by vehicles.

3.2 Transportation

Perth City has an excellent public transport services with high bus frequency. The public transports that can be found are buses and trains under the management of Transperth. There are also area declared as Free Transport Zone which covers the Perth City and KPBG. Therefore, public prefer to use public bus services for travelling to work and school. This not only reduces the number of personal vehicles on road but also helps the public to travel without worrying about parking services.

4.0 CONCLUSION

Kings Park & Botanic Garden (KPBG) is one of the leading botanic garden in the world with largest native collection of Western Australia flora. The key factors for the success of KPBG are the strong management planning, research activities and staffs. Besides that, KPBG also has an excellent public and government support.

Throughout this 2 weeks internship period I have learned plenty about the botanic garden management. Firstly, it has made me understand more about the concept of botanic garden. I have also understood that to establish a proper botanic garden, a good management plan and collection goals are very important. Besides that, scientific researches, staff and expertise plays a major role in building up a world class botanic garden.

Currently, Penang Botanic Garden (PBG) is lack of some of these factors especially in research field. I strongly believe the knowledge and exposure that I gained through this internship definitely will guide me and my team to establish PBG as the world class botanic garden in future.

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