

## The Role of the Western Australian Botanic Garden Nursery – Collections, Conservation and Education

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### Summary

Nurseries attached to Botanic Gardens are uniquely placed within the industry – as the primary producers for organisations that hold “documented collections of living plants for the purposes of scientific research, conservation, display and education” (reference – BGCI website) they are often in the privileged position to become involved in a range of activities linked to these core functions of a Botanic Garden. Western Australia is home to over 13,000 highly diverse, unique and environmentally specialised taxa. At Kings Park in Perth, home of the Western Australian Botanic

Garden, the nursery has developed over time to become a specialised producer of a large range of this world-renowned flora, propagating plants that are variously utilised for collections, ornamental display, important conservation and restoration outcomes and educational and training purposes. All propagation activities, trials, experimentation and production are intertwined and underpinned by these driving influences, and over the past almost 60 years the Kings Park nursery team have refined their propagation techniques to ensure repeatability and reliability in allowing the

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## INTRODUCTION

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Western Australia is home to over 13,000 highly diverse, unique and environmentally specialised taxa. At Kings Park in Perth, home of the Western Australian Botanic Garden (WABG), the nursery has developed over time to become a specialised producer of a large range of this world-renowned flora, propagating plants that are variously utilised for collections, ornamental display, important conservation and restoration outcomes and educational and training purposes.

All propagation activities, trials, experimentation and production are intertwined and underpinned by these driving influences, and over the past almost 60 years the Kings Park nursery team have refined their propagation techniques to ensure repeatability and reliability in allowing the showcasing and conservation of a diverse range of species, many of which have not been previously introduced into cultivation or are not commercially available. This paper explores the themes of collections, conservation and education with a focus on the

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## Background

WABG is located within Kings Park, a large urban park that occupies an elevated 406 ha site overlooking the Perth Central Business District. Kings Park was established as a public park in the 1890’s and is managed by the Botanic Gardens and Parks Authority (BGPA), a State Government statutory authority. The key functions of BGPA are related to conservation; recreation and tourism; education and interpretation; cultural heritage; horticulture; and scientific research. The park attracts over 5 million visitors annually and is known for its significant cultural and natural history and sweeping views over the Swan and Canning rivers (**Fig. 1**).

About two thirds of the park today is remnant Swan Coastal Plain bushland; approximately 17 ha are dedicated to the Western Australian Botanic Garden, and the remaining area is landscaped parkland that incorporates playgrounds, a range of visitor facilities and numerous memorials including the State War Memorial. The idea of establishing a Botanic Garden in Perth began to gather momentum in the 1950’s, and Kings Park was chosen as the future home of the State Botanic Garden in 1959. From the very beginning there was interest in propagating and cultivating Western Australian flora for display, with collections of

seed from the wild being undertaken as early as 1963 to be grown on in the Kings Park nursery for research and display purposes. This journey from the field to display continues to this day with most taxa propagated from material collected from the wild under licence, with the nursery providing an essential link in that chain. The WABG was officially opened in 1965. At that time, the founding vision was that the Botanic Garden would be *‘designed to interest and educate the public in the conservation and*

*cultivation of the Western Australian flora’*. The celebration of endemic Western Australian genera continues to this day, but the extreme diversity in our flora can often present challenges for those of us attempting to propagate and bring them into cultivation. The WABG is supported by the Western Australian seedbank, the Kings Park Nursery, a comprehensive horticultural database that records all available details of each collection and a herbarium specimen of every collection.



**Figure 1.** Entrance to the Western Australian Botanic Garden located within Kings Park, a large urban park that occupies an elevated 406 ha site overlooking the Perth Central Business District on one side and Swan and Canning rivers on the other (Image credit Dave Blumer).

The Kings Park nursery was established in 1962, several years prior to the opening of the WABG. Roughly 50-60,000 plants are grown annually for display of the collections to the public within the WABG and

wider parkland areas; for restoration and rehabilitation programs in BGPA managed remnant bushland; for tree replacement programs; and for conservation programs man-

aged by other WA state government departments. The nursery is slightly different to commercial and other production nurseries in that it has only one ‘client’ – Kings Park. Although the nursery is still a primary producer, its programs are very much dictated by the requirements of the state botanic garden and the parkland displays and natural area revegetation/restoration programs – i.e., collections, conservation and education as the driving influences. Because of the nature of its activities, the nursery has a defined main propagation season of spring and summer, when the majority of production occurs. This is to allow for the ‘client’ requirements of stock size and age for winter planting. As a Botanic Garden nursery, at Kings Park we are uniquely placed to be able to see exactly where the nursery stock is planted – the location of the nursery within a Botanic Garden means the staff is also able to monitor the establishment and performance of the plants once they leave the nursery. This often provides real-time valuable data for the staff to enable constant improvements in propagation programs and methods. It is also a great stock garden for sourcing future material. We are also privileged to potentially have access to the flora from the entire state of WA, which at last count was close to 14,000 taxa.

Rather than focus on a smaller number of species and grow large numbers of these Kings Park nursery does the opposite – it regularly deals with a large number of species (around 3-4000) but tend to produce small quantities of each. While the nursery provides an integral link in the chain from field to garden, this paper covers three key roles– collections, conservation and education.

### **Collections**

A living plant collection is a managed group of plants grown for a defined purpose or demonstrating a particular theme. Botanic Garden collections are underpinned by science - they are formally identified or botanically verified, documented, labelled and actively curated to varying degrees based on their intent. Holding living plant collections are key roles of Botanic Gardens and are what distinguishes a Botanic Garden from a standard garden. They are often valuable scientific and cultural resources and support the typical function of a Botanic Garden – conservation, research, education and training, and public and social engagement (BGANZ, 2023).

Living plant collections may be themed based on aspects such as taxonomy, geography, ecology, conservation, display, culture or education (**Fig. 2**).



**Figure 2.** A living plant collection is a managed group of plants grown for a defined purpose or demonstrating a particular theme. Southwestern Australia is home to the greatest diversity of *Banksia* spp. (Proteaceae) with 60 species out of a total of 173 recorded, and Australia is home to all but one. This diversity is captured in the *Banksia* collection at Western Australia Botanic Gardens (Image credit Dave Blumer and Amanda Shade, BGPA).

The WABG holds collections of primarily WA flora from all over the state. These are collections that are in-ground and publicly accessible, but we also manage container collections in the nursery, a seed-bank, tissue culture collections, cryostorage collections and herbarium (**Fig. 3**). These collections are not publicly accessible but play an important role in supporting the function of the WABG. Our nursery collections at Kings Park are maintained as an insurance policy. We maintain and repropagate collections of plants within our nursery and glasshouses for a number of reasons, in particular as an insurance policy. It is unrealistic to expect that every species from a state as vast and environmentally diverse as WA will grow well in the Perth climate and soils. Also, we have some pathogen challenges in some of our soils, and general security challenges as we are not a fenced

park or Botanic Garden and are open and accessible 24/7. We need to secure against theft, damage and vandalism, so hold a range of species in a more secure nursery collection. These may be:

- Threatened flora or those with limited seed material available for future production. These are precious cargo, and we need to ensure we have backups in a secure environment.
- Certain genera that are notoriously difficult to establish or short-lived in-ground in our Perth conditions, or never meet their full potential (eg, *Boronia*, *Eremophila*, *Darwinia*)
- From remote or difficult to travel to regions or from plant groups that require significant manipulation of environment that is not possible in-ground. For example, some Kimberley species can

cope with cold and wet to a degree, but not at the same time. We have the benefit of glasshouses in the nursery to modify growing environment over our winters for this group of plants.

- Ephemerals (e.g. *Stylidium*) – often plants in this category can get lost in the wider landscape so it's more practical to

secure representation in a nursery container collection.

- For ongoing horticultural research – for example, species previously untried in cultivation or species that require bulking up to generate more material for trials.

Often some species fall into more than one of these categories.



**Figure 3.** In addition to publicly accessible in-ground collections, the Western Australia Botanic Garden (WABG) manages a seedbank (a), tissue culture collections (b) and a herbarium (c) that are not publicly accessible but play an important role in supporting the functions of the WABG (Image credit Dave Blumer and Amanda Shade, BGPA).

### Conservation

Conservation is a major influence on our activities within the botanic gardens, within nursery projects and within our scientific research branch. While it is a key function of a Botanic Garden conservation horticul-

ture is also gaining momentum as an important branch of horticulture. With increasing biosecurity threats, loss of habitat, climate change, and resource limitations, promotion of conservation is at the forefront of modern-day Botanic Garden functions worldwide.

The Botanic Garden nursery is perfectly placed to produce quality plants for ongoing promotion of conservation, and to support conservation projects. Plants produced within the Kings Park nursery:

- Help raise public awareness of threatened flora generally – we propagate and grow plants that are displayed within designated conservation areas in the Botanic Garden; we also pass on knowledge and skills to our volunteer groups who produce this flora for public sales, spreading important conservation messages to the wider community.
- Assist with the promotion of respect for our native flora – people don't tend to care about what they don't know about. Education is power, and the more stories we can tell about the importance of conservation, the better.
- Aid with our bushland restoration and conservation programs – our remnant swan coastal plain bushland is part of a Threatened Ecological Community (*Banksia* woodland), and our nursery contributes to these conservation efforts by producing plants using provenance material.
- Contribute to significant statewide conservation programs of critically endangered flora – through a long running collaboration with other government departments on translocations of critically endangered species, Kings Park nursery grows stock for translocation plantings, but also for projects involving threatened flora such as seed orchards. Many species of threatened flora can be difficult to propagate and require thorough trialling, detailed data recording on processes and success rates, and intensive focus.

We are currently seeing the major influence of climate change and biosecurity concerns on conservation. Kings Park nursery is working on developing and displaying more climate resilient and landscape suitable plants for the future, ensuring we have reliable data on how to propagate and grow these before recommending them for wider use within industry and the community. This emphasises the importance of ongoing trials and monitoring, and the importance of accurate records.

### **Education**

The nursery has an important role in both horticultural training and public education. Some of the ways we contribute include:

- \* Workshops – we run an autumn and a spring workshop series for the public on propagation, grafting and other horticultural elements of plant production.

- \* Tours for school, TAFE and university groups.

- \* Industry events and webinar presentations.

- \* Horticultural training via schools' work experience

- \* Professional development placements. Increasingly we are being approached by regional community groups, mining companies and other government departments to take on placements to value-add nursery skills to local indigenous people, students and employees engaged in existing or upcoming nursery-based enterprises. There is a huge appetite at the moment to learn about propagation and cultivation of WA flora, from both a conservation and restoration perspective, but also from a growing business angle, and a lot of it is being driven by regional groups.

Possibly our most important role in the education realm is our long-running horticultural trainee program. This program has been running since the 1960's as a means for developing highly skilled people with a passion for WA flora and horticulture in general. Our trainees are offered unique opportunities to work within a diversity of horticultural teams throughout the park, including three-month stints in the nursery, where they are exposed to everything involved with plant propagation; plant establishment, soils, pest and disease management, general nursery duties and maintenance.

Nurseries are perfect places to inspire students about horticulture. The unbridled joy on their faces when they see germination of seed they've personally sown, or cuttings that they've prepared strike for the first time— it unlocks something and builds a foundation for connection to plants and horticulture. Propagation and grass-roots horticultural activities involved in the production of plants is the perfect place to start if looking to inspire the next generation about the value of plants, and about important environmental and conservation messages (Fig.4).



**Figure 4.** Botanic Gardens and Park Authority trainees in the nursery (Image credit Amanda Shade)

These three responsibilities can't and don't exist in isolation – they are intertwined and underpin everything we do. In all of our

roles we propagate and cultivate a range of species each year - including annuals, herbaceous perennials, shrubs and trees from



just about every corner of Western Australia – for primarily collection, conservation or education purposes (and often a combination of all three). Alongside this production role, we regularly conduct propagation and growing trials of rare species, difficult species, or species with desirable display potential that have not previously been cultivated. No one year will be the same in terms of species propagated, number propagated, or methods employed.

It's our role with these trials to think outside the box, and perhaps most importantly, document our findings such that others can replicate what we may find is the best practice for the propagation and subsequent cultivation of often rare, temperamental, or new to cultivation WA species.

Following are some brief case studies that highlight our collections-conservation-education focus and also our significant propagation experimentation activities.

## Case studies

### 1. *Calytrix brownii*

In winter 2022, a team of six Kings Park staff travelled to the Kimberley region of WA on a field collecting expedition to collect primarily material of Myrtaceous species as a preparedness action against the potential of Myrtle Rust (*Austropuccinia psidii*) existing in other eastern states spreading into WA. We focussed on species we didn't already have seed or plants of in our collection – so were aiming to boost our collections and add to our conservation activities. We had a long target list of species that we were looking to collect, including the species *Calytrix brownii*. We collected both seed and vegetative material, with the latter being flown back to Perth for processing (**Fig. 5**).



**Figure 5.** Collection of material at Bell Gorge (Image credit Emma Dalziell)

There were some immediate challenges faced by the nursery team when the material arrived. Firstly, we had never propagated this species before, although we had experience with other Southwest *Calytrix* species. Secondly, the material was delivered mid-winter, having come from a much warmer and drier environment in the north, so some significant environmental manipulation was required. To address these challenges, we needed to do a bit of pre-planning and research beforehand. We looked at the natural habitat and environment this species grows in and modified the propagation media and glasshouse environment and performed a range of treatments based on what we thought would be most suitable, carefully recording every detail of all that was done, from media, containers, growth regulators, pre-treatments, glasshouse environment, frequency and method of irrigation, size of cuttings and temperatures (the latter being monitored via temperature data loggers). Recording of the best combination of variables means we will be able to repeat the same in the future.

This propagation resulted in production of a large number of plants from three different collection sites. Some have recently been planted for the first time in the WABG, adding to the diversity and increasing the value of our collection of Kimberley species, and contributing to public education by expanding the species on display. From an education perspective it also taught our trainees a valuable lesson in the importance of understanding the complexities in propagating species out of season and out of their natural range, and the research needed to make these undertakings a success. In terms of conservation, we will use this species as one of our sentinels in monitoring for possible Myrtle Rust outbreaks in the

Botanic Garden – a task that is even more important now, given this pathogen has recently been detected in the north of WA and has the potential to move south.

## 2. *Eucalyptus x impensa* (Eneabba Mallee)

This taxon is a critically endangered, naturally occurring hybrid from the northern sandplains of WA. Any seed stored has high conservation value and therefore has limited availability for use – and results in significant variation due to its hybrid status. Rooting of cuttings for Eucalypts can be quite challenging so we decided to try grafting. Not knowing the exact parentage, we had to make some considered decisions about potential rootstock from a compatibility perspective. We consulted with Eucalypts experts and looked carefully at species with similar characteristics that grew naturally within a similar range, and other species within that classification series. Using these tools, we decided on two different species for initial trials – *Eucalyptus macrocarpa* and *E. burracoppinensis*. We employed the mummy grafting technique for this species – it's our go-to method for a range of other *Eucalyptus*, *Corymbia* and genera from drier inland regions such as *Eremophila* and *Verticordia*, as we tend to focus on this technique primarily over our hot summer months. Mummy grafting uses essentially the same techniques as standard cleft or wedge grafting, with the added step of removing all foliage from the scion and wrapping the entire scion in grafting film. We place our mummy grafts in a very hot glasshouse (which can reach up to 50-60 degrees on very hot Perth summer days) and often see bud burst within a week. Since we've started using this technique for selected genera, we've seen significant increases in success rates. *Eucalyptus* and

*Corymbia* in particular produce very encouraging results consistently (**Fig. 6**).



**Figure 6.** An example of standard grafting of *Pimelea physodes* onto *Pimelea ferruginea* rootstock (Image credit Dave Blumer).

What this development has meant for our three themes is that it has enabled a greater range of species to be successfully produced in greater quantities, more diversity within our collections, more conservation messages getting out to the public, and has helped build on the horticultural knowledge that we can share with others. Production of more threatened species of plants vegetatively in this manner also means we are not impacting the natural populations.

We now have established this taxon in the collection in-ground. These specimens are continually monitored for their performance, and we've gathered some useful

data so far about how the two different rootstocks have differed in terms of longevity and long-term compatibility, not to mention overall condition. Feedback on longevity helps us fine-tune rootstock selections for long-term survival in-ground.

### 3. *Physopsis chrysophylla* (Golden Lambstails)

This species is a perfect resilient plant of the future – it grows naturally in a very restricted distribution in the Shark Bay region of WA, has very low water requirements, grows well in sandy soils and is highly ornamental. Traditional vegetative propagation methods proved largely unsuccessful, so we needed to start experimenting with the variables.

Several furry dry/arid region species we've propagated have shown encouraging success with the use of rockwool as a growing medium. *Physopsis* has a very tactile and furry stem and foliage so we naturally assumed this would perform. It didn't. But that's OK – as we teach our trainees, a zero result is still a result, and can help us understand what we may need to change in order to improve. We tried altering media by the addition of different products to aid drainage; different hormone treatments; anti-transpirants as a pre-treatment; tried different timing; different glasshouse environments; and finally landed on the right combination after several years of fine-tuning and tweaking the details.

A team member had a lightbulb moment – ordinarily we would remove the very soft small tips of species such as this one as they are very prone to wilting. Her suggestion was - what if we kept these, placed them in very shallow propagation trays to enable adequate heat transfer, use lower concentration hormone, and place them in an area of

slightly higher humidity with no overhead watering to combat any drying effects. Sometimes it's a small adjustment to your process, sometimes it's a combination – in this case it was a combination. By modifying the type of cutting, the depth of the container used, the glasshouse environment and the timing we can now successfully strike this species with consistently good success rates. We also found the best results were in a somewhat restricted timeframe over summer. Timing is a really important factor that sometimes gets overlooked, and this is a species that we have found has quite a specific 'window of opportunity' for successful propagation.

## CONCLUSION

Working within the nursery industry is such a rewarding experience, but to be able to also work for a Botanic Garden nursery is an absolute privilege. Having the opportunity to make a significant contribution towards conservation and education outcomes is both rewarding and humbling.

A colleague at another state Botanic Garden recently described nurseries as the engine room of a Botanic Garden. If that is true, then I think the staff of these nurseries are the fuel for that engine. I'd like to acknowledge my very dedicated and enthusiastic team at Kings Park nursery – not only are they skilled in nursery activities but they are also called upon at various times to be field operators, seed collectors, public relations specialists, tour guides, social media contributors, teachers, and scientists. The support of this dedicated nursery team significantly and consistently allows our Botanic Garden to achieve displays of quality collections, promotion of conservation, and a vitally important contribution to ongoing research and education.

## LITERATURE CITED

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