



TREE PLAN 2022–2042

Managing the Extraordinary Tree Collection at Royal Botanic Gardens Victoria

Royal Botanic Gardens Victoria



Title

Royal Botanic Gardens Victoria Tree Plan 2022–2042

Managing the extraordinary tree collection at Royal Botanic Gardens Victoria

Cover Image

Tree work at Cranbourne Gardens

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We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria’s land and waters, their unique ability to care for Country, and their deep spiritual connection to it. Royal Botanic Gardens Victoria’s sites are situated on the ancestral lands of the Bunurong and Wurundjeri Woi Wurrung Aboriginal peoples of the Kulin Nations. We pay our respects to Elders past and present and recognise that sovereignty has never been ceded. We honour all the Aboriginal and Torres Strait Islander peoples and their countries on which much of our conservation, research and education work takes place.

The *Royal Botanic Gardens Victoria Tree Plan 2022–2042* is the result of the work and support of many people. We thank the staff of both Melbourne and Cranbourne Gardens and all those across the organisation who enthusiastically contributed to the development of the plan. The technical input of the Arboriculture Team is particularly valuable. The project was led by **Chris Cole, Executive Director Melbourne Gardens** and **Charles Carroll, Manager Arboriculture**. Editorial assistance was provided by Andrea Proctor and Lisa Wedmore.



Aboriginal Heritage Guides, Melbourne Gardens

TERMINOLOGY AND NAMING

Accession: Plant material that is collected at the same time and location from a single species and which is typically propagated and given a unique accession number for identification and tracking purposes.

Age: The biological age of a tree in terms of its overall life cycle and role in the landscape and defined as follows:

- **Juvenile:** A young tree which is still establishing in the landscape and needs to be correctly nurtured to reach its full potential
- **Maturing:** A tree which has reached or is reaching a size where it makes some contribution to the amenity value of the landscape while still being considerably less than its potential mature size
- **Mature:** A tree which has reached a size where growth has slowed and dramatic increases in size would not be expected without changes to growing conditions (e.g. removal of competition)
- **Over-mature:** A mature tree with age related structural defects or health problems
- **Senescent:** A tree of any age which is still alive but is reaching the end of its life and is no longer growing or able to effectively repair itself through cell division.

Arboriculture: The cultivation, management, and study of individual trees, especially those that are in proximity to people.

BGANZ: Botanic Gardens Australia and New Zealand Incorporated, a not-for-profit peak industry body formed to build and maintain links with relevant national and international bodies.

BGCI: Botanic Gardens Conservation International, an umbrella organisation for botanic gardens and arboreta all over the world with an emphasis on the conservation of plants and plant communities.

Board: Royal Botanic Gardens Board Victoria, the body that has accountability under the *Botanic Gardens Act 1991*.

Cranbourne Gardens: Royal Botanic Gardens Cranbourne under the management of Royal Botanic Gardens Victoria. Comprises the horticultural landscapes (including the Australian Garden) and the surrounding Conservation Zone bushland.

DBH: A tree's trunk Diameter at Breast Height (1.4–1.5m above natural ground level). A standard measurement for tree size.

DELWP: Department of Environment, Land, Water and Planning, the State Government Department with responsibility for Royal Botanic Gardens Victoria.

Fail / Failure/ Failing: The uncontrolled collapse of part or all of a tree.

Hardware: Cables, slings, braces, props, and other artificial supports placed in, on, under, or around trees to mitigate risk.

Hazard: A tree, or part thereof, which poses an unacceptable risk to people or property. For a tree to be a hazard it must have a part at risk of failure which is large enough to cause damage to a known target. Hazard relates to the likelihood of damage not the risk of failure. A tree may be at risk of failure, but if in an isolated location without risk of damage, it is not a hazard.

IDx: *The identification status of a specimen in the living plant collection of RBGV.* ID3 Indicates botanical verification is completed by a plant scientist. ID2 generally means that plants have been partially verified but uncertainty persists, or identification is not yet fully possible. ID1 status indicates that plants have not been verified.

Living Collection: A categorised group of living plants curated for a defined purpose.

Melbourne Gardens: Royal Botanic Gardens Melbourne under management of Royal Botanic Gardens Victoria. Includes the National Herbarium of Victoria, the original Botanic Gardens, The Ian Potter Foundation Children's Garden, and the Melbourne Observatory site.

Provenance: The location from which a plant is sourced, and which is known and documented.

Risk: A calculated determination of the chance of a tree causing harm to people and/or property, and the extent of the damage if this was to occur. Risk calculations are based on a matrix assessing the likelihood of a tree failing, the likelihood of it causing damage if it were to fail and the likely extent of this damage. As living organisms all trees are inherently at risk of failure, even if an arborist cannot identify any factors

compromising the tree's structural integrity. Arborists cannot determine if a tree will or will not fail, they can only determine the likelihood of the tree failing based on the information available to them at the time. A tree is at 'risk' of failure or increased 'risk' of failure when it has an identifiable defect or other factor which may potentially compromise its structural integrity.

Royal Botanic Gardens Victoria or RBGV: The whole organisation including the sites at Melbourne and Cranbourne, the National Herbarium of Victoria and the State Botanical Collection.

Safe: The correct management of trees to mitigate the risk to people and property. It must be noted that trees are living organisms, and as such there is always a degree of inherent risk, and no tree can be considered completely 'safe'. The use of the term 'safe' in this document relates to the management of trees to reduce the risk posed by trees to the level expected in a well maintained, public landscape.

Target: People or property within the fall zone of the tree, and which therefore have the potential to be damaged, injured or killed if the tree were to fail.

Taxa: Plural for taxon. A taxonomic group of any rank, such as family, genus, or species. In this document, 'taxa' usually means the total of distinct plants at the lowest taxonomic rank – this can include varieties and cultivars.

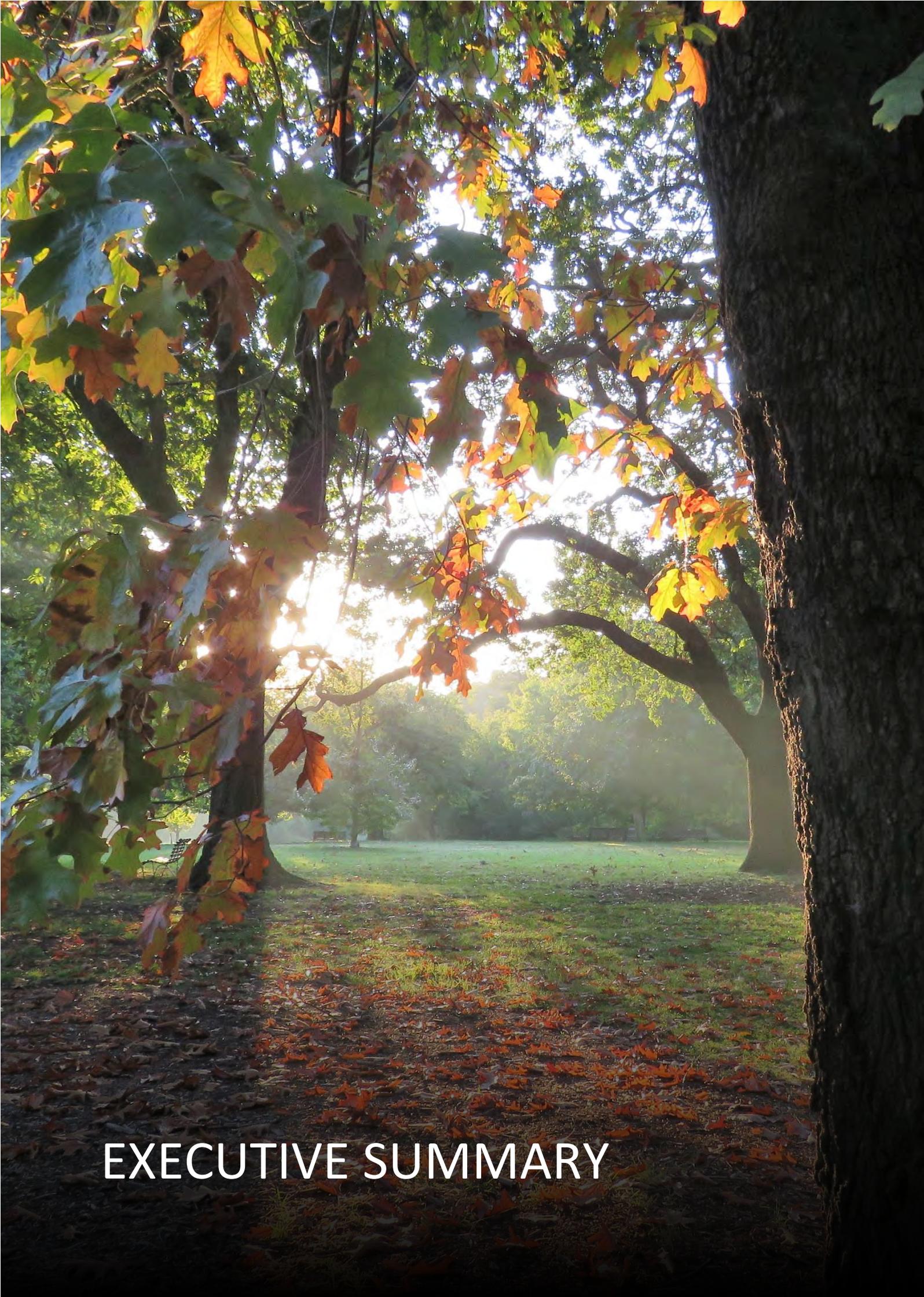
TPZ: Tree Protect Zone. The area around a tree which must be protected to prevent damage to the tree during any development works. Determined as per Australian Standard AS4970 (generally 12 times the DBH measured as a radius).

Traditional Owners: The Traditional Owner Registered Aboriginal Parties for the Melbourne site are the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation and Bunurong Land Council Aboriginal Corporation. The Traditional Owner Registered Aboriginal Parties for the Cranbourne site are the Bunurong Land Council Aboriginal Corporation. It also refers to Traditional Owners across Victoria and other regions of Australia that our sites' work extends to.

Tree: A large, woody perennial plant typically having a single stem or trunk and bearing lateral branches. Also includes any large, perennial plants managed as part of arboricultural regimes such as palms, and cordylines.

ULE: Useful Life Expectancy. A professional assessment which considers health, structural integrity, public safety, and climate suitability in order to determine the life expectancy of an individual tree in the landscape.

Wild Collected: Living plant material that is sourced directly from natural habitats.



EXECUTIVE SUMMARY

Established in 1846, Royal Botanic Gardens Victoria manages two outstanding botanic gardens, one in Melbourne and one in Cranbourne, spread across 400 hectares and with over 8,700 taxa from around the world. Melbourne Gardens, located on the banks of Birrarung (the Yarra River) is considered one of the most beautiful botanic gardens in the world. A green oasis in the midst of the city, the Gardens are home to over 7,500 taxa from across the globe. Cranbourne Gardens located around 60 kilometres south-east of Melbourne in the growing City of Casey, focuses on Australian flora, with approximately 2,000 different taxa of native plants. Centred around the award-winning Australian Garden, the site also contains high value conservation bushland. Together they support a collection of vast scientific and public significance and are treasured sites for both locals and visitors.

For both gardens the tree collection is of utmost importance. The landscape of Melbourne Gardens is defined by sweeping vistas framed and punctuated by mature trees, both exotic and native. Cranbourne Gardens, and in particular the Australian Garden, has a younger and still maturing collection supported by the surrounding Conservation Zone. For both sites trees are critical for shade, heat mitigation, carbon sequestration, habitat, plant science, collections management and public amenity.

The goal of the Tree Plan is to guide the management of the tree collections across both sites, safeguarding them for now and the future.

The plan highlights the need for proactive management and adaptation to a changing climate, and advocates strategically for the long-term health and resilience of RBGVs trees. Critical to this will be balancing the preservation of the collection with the proactive need for management and change. Trees are RBGVs longest lived botanical assets, with many over 100 years old, and are important markers of changes in climate, water use, and landscape management. But while important, trees are at times unpredictable and proactive tree management is critical for the provision of safe public landscapes, especially with increasingly volatile weather.

To achieve this goal the following strategies and targets have been developed:

Strategy 1: Base tree management decisions on current and accurate tree data

Target: All trees in publicly accessible areas are regularly assessed with data used to inform maintenance work and management practices

Strategy 2: Adopt an industry best practice approach to tree management, protection, conservation, and collections management

Target: All trees are proactively managed to increase their health and viability and reduce the risk of harm to people or property

Strategy 3: Actively transition to a diverse, mixed-age and future-climate resilient tree population at both Melbourne and Cranbourne Gardens

Target: Both Gardens have transitioned to a collection of trees which are viable, manageable within available resources and resilient to a 2090 projected climate

Strategy 4: Integrate the Tree Plan with RBGV strategic and planning documents

Target: Trees are recognised as significant landscape assets and essential in the planning and future development of both gardens

Strategy 5: Implement arboricultural practices within the Conservation Zone at Cranbourne Gardens

Target: Trees in the Conservation Zone are proactively managed to reduce risk while supporting ecological and conservation goals

Strategy 6: Improve public understanding of the role trees play both within the Gardens and in supporting life

Target: The importance of trees and the need for tree management is better understood by industry, institutions, and Gardens visitors.



1 INTRODUCTION

The *Royal Botanic Gardens Victoria Tree Plan 2022–2042* provides a twenty-year plan for the management of the organisation’s tree collection. Trees are RBGVs largest and longest-lived botanical assets, and as such require a strategic, long-term approach with care and management. As a scientific institution, they also require a different approach to traditional urban tree management, as the tree collection has a scientific value beyond the recognised environmental and public amenity role of municipal trees. While the Tree Plan needs to address common concerns such as climate change, risk mitigation and maintenance practices, it is also embedded in the management practices of a world leading botanic garden.

The Tree Plan covers both sites managed by Royal Botanic Gardens Victoria. The 38 hectare Melbourne Gardens, which is a heritage garden established in 1846 and showcasing plants from across the globe, and the 363 hectare Cranbourne Gardens, which focuses on Australian taxa and includes both designed landscapes and high-value conservation bushland.

The aim of the Tree Plan is to provide a consistent, long-term approach to the management of RBGVs trees in order to provide a safe, healthy and resilient tree population now and into the future. It addresses the Melbourne and Cranbourne Gardens in a unified way, while recognising the individuality of the two sites. In particular, the conservation areas of Cranbourne require a different strategic approach to the manicured landscapes of the Melbourne Gardens and Australian Garden.

The Tree Plan provides a framework for RBGV to actively manage its tree population. It serves to educate the public and industry on the importance of trees and urban forest management, while providing a best practice approach to tree management, conservation horticulture, indigenous vegetation management and landscape succession – especially in light of a changing climate. Trees have a finite life expectancy and are both static and often long-lived, making them susceptible to environmental change. This can range from global climate change to localised pressures such as new pathways, increased traffic, and the growth and removal of surrounding trees. It is therefore imperative that tree management is approached holistically – considering the long-term development of both gardens, environmental context, and individual site management requirements.

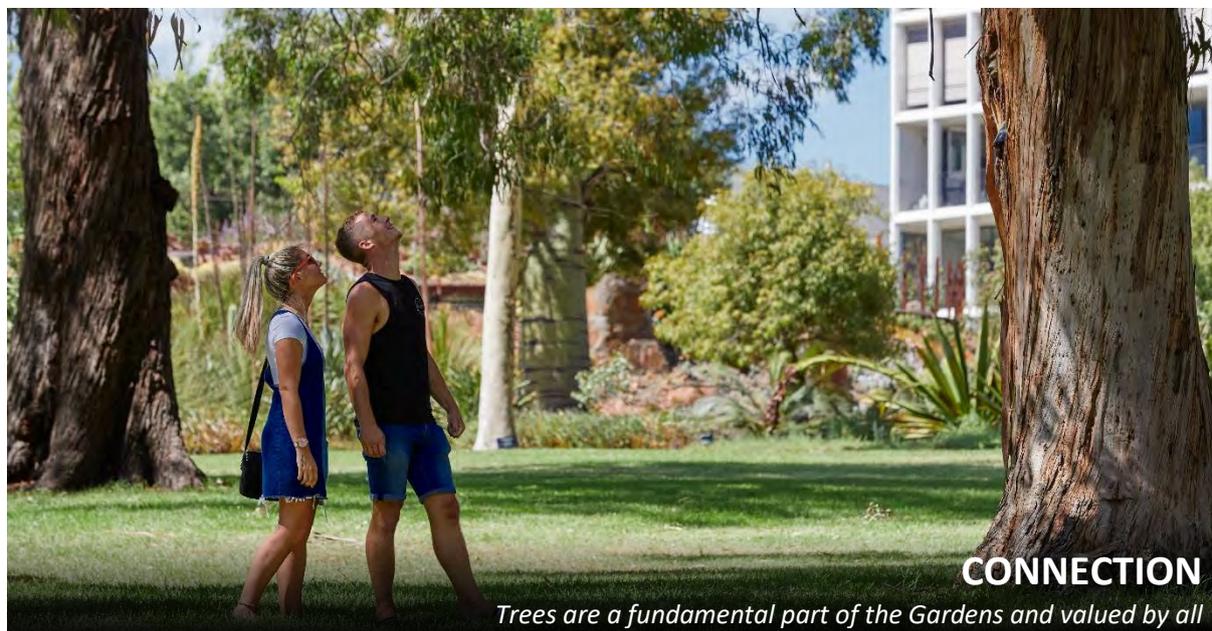


Moonrise through eucalypt canopy, Cranbourne Gardens Conservation Zone



2 GUIDING PRINCIPLES

In developing the Tree Plan, Royal Botanic Gardens Victoria seeks to be a proactive custodian of its trees. Trees are fundamental to Royal Botanic Gardens Victoria. They are core to the organisation’s vision and mission, playing a vital role as its largest and longest-lived plants and linking culture and history for past, present and future generations. To assist with tree management, the following guiding principles were developed. These identify the principles which are critical to the responsible management of the tree collection and align with the organisation’s mission to safeguard plants for the well-being of people and the planet.



In a complex and interconnected environment such as Royal Botanic Gardens Victoria, trees are an essential element and a key component in long-term decision making. Trees provide a long-lived connection to the history, culture, and landforms of the Gardens, from the Traditional Owners to the present day. In conservation areas they are keystone species for biodiversity. Trees are iconic and help create much-loved parts of the Gardens, inspiring wonder and awe, and an opportunity to engage both locals and visitors with the work of the organisation. To manage these important connections, we recognise the need to proactively engage the community and develop a shared understanding of the complex requirements of tree care from seed to senescence.



The tree collection is central to the fabric of both Gardens and must be protected. This includes prioritising the protection of trees during development works and functions and events. All parts of trees need protecting, both above and below ground components and including the soil around trees. We aim to protect the tree collection, and care for individual specimens while also acknowledging their broader role in the Gardens living collections.



Trees are living organisms which require management. Tree management and maintenance reduces risk, improves longevity, and showcases the splendour of our trees. We recognise the different management approaches required for gardens and conservation areas and the significant role trees play in integrated ecological management. The most effective approach to management is pre-emptive and based on sound investigation and research – implementing an informed preventative approach to tree management benefits all.



We manage our trees to the highest standards, caring for them throughout their life. Climate change already poses a threat to the Gardens' trees and that threat is expected to increase. Higher temperatures, lower rainfall, and increased climate volatility and storm events are predicted. To preserve both the tree collection and broader living collections, a proactive approach to landscape succession is required. This means retaining and managing important individual specimens while making strategic decisions to develop a more climate resilient collection.



We recognise the role trees play beyond amenity horticulture – being a rich scientific resource for horticultural and plant scientists around the world and contributing to local and global plant conservation efforts. We know that the public hold our tree collection in great affection and look to RBGV for advice and understanding on tree management. We have an important role to play within the scientific community, in public education and engagement, and as an industry leader in best practice tree management and education.



3 BACKGROUND AND CONTEXT

The Tree Plan builds on Royal Botanic Gardens Victoria’s long history of successful tree management, and the rich scientific work which governs the care, curation, and management of the living collections. The following chapter provides background information to the broader context in which the Tree Plan operates.

3.1. Current Collection

Royal Botanic Gardens Victoria’s tree collection is spread across two iconic sites in Melbourne and Cranbourne. Melbourne Gardens, which lies on the bank of the Yarra River only two kilometers from the city centre, is a heritage landscape with over 7,500 taxa from around the globe, while Cranbourne Gardens is dedicated to the conservation and display of Australian flora. While the two sites have much in common regarding response to climate change, tree care, and risk and collections management, they also have their own unique challenges and individual care requirements.

Melbourne Gardens, established in 1846, has a predominantly mature canopy and is designed in a globally important picturesque/gardenesque style in which trees play a crucial role. The Gardens support an impressive plant collection, including over 5,500 trees of approximately 1,300 different taxa. Heritage considerations, always complex regarding tree care, play an integral role in tree management beyond the requirements that come with managing a beloved public open space. An ageing tree population, limited opportunities for replanting, ageing infrastructure and high site use all impact tree management.



View across Melbourne Gardens to the Central Business District

Cranbourne Gardens located approximately 60 km to the south-east is a very different site with two distinct areas. The award-winning Australian Garden, stage one of which opened in 2006, contains an extensive collection of Australian plants and has a relatively young tree collection, the composition of which is actively changing. It is estimated that the 13 hectare Australian Garden contains nearly 2,800 trees, however as discussed below, arboricultural data is limited. This is surrounded by approximately 350 hectares of Conservation Zone, comprised of approximately 265 hectares of high quality, remnant indigenous vegetation and 86 hectares of former pastureland. This pastureland contains some pre-1835 remnant indigenous trees, augmented by a planted mix of indigenous and non-indigenous Australian trees.

The Cranbourne Gardens Conservation Zone is home to over 25 endangered or rare and threatened species and considered a Site of State Significance. This conservation area is precious, being in the centre of one of Melbourne’s major growth corridors and containing eight vegetation communities, seven of which are threatened. The two areas, the Conservation Zone and the horticulturally managed Australian Garden, and other planted collections (including the Eastern Entry Precinct and Southern Grasslands), have very

different requirements in terms of management and scientific purpose, especially in relation to tree management.

Tree data across the Cranbourne Gardens is currently limited. While some individual specimens are very well documented, many are not. This lack of data makes management complex and will need to be addressed for proactive, informed management practices to be implemented.

3.2. Royal Botanic Gardens Victoria Strategies and Plans

The Tree Plan sits within a broader suite of documents which guide the management of Royal Botanic Gardens Victoria, its landscapes, collections, and purpose. It is not the role of the Tree Plan to discuss all RBGV documents, but the following are of relevance in guiding its development and implementation.

Landscape Succession Strategy

The *Melbourne Gardens Landscape Succession Strategy 2016–2036* was developed to inform the adaptation and management of the Melbourne Gardens landscape to the challenges of future climate change, dwindling water supplies, ageing plant populations, and biosecurity. A key goal of the Landscape Succession Strategy is to retain heritage character and landscape qualities while transitioning from existing plantings to a composition more suited to the potential projected climate and environmental conditions of 2090.

As the Gardens' longest-lived assets, management of the tree collection is integral to the implementation of the Landscape Succession Strategy and a key driver for the development of the Tree Plan. While based around Melbourne Gardens, the Landscape Succession Strategy also contains principles of relevance to Cranbourne Gardens, with the Tree Plan being the first report to carry its application across both sites.



View across Cranbourne Gardens and the Weird and Wonderful Collection

Living Collections Plans

The *Melbourne Gardens Living Collections Plan 2022–2042* guides the management, curation and development of Melbourne Garden's living collections, including the tree collections. A similar plan *Royal Botanic Gardens Cranbourne Living Collections Plan 2022–2032 (draft)* is currently under development for Cranbourne Gardens. These documents set out the scientific and horticultural framework for the management of the two Gardens as a scientific and botanical resource, with a particular aim of contributing to local, national, and global plant conservation work. The Living Collections Plans for both sites provide a systematic, considered direction for the management of the tree collection and help direct tree selection and curation. Management of individual collections is guided by Precinct Curatorial Management Plans at Cranbourne Gardens and Collections Management Plans at Melbourne Gardens.

Master Plans

The *Melbourne Gardens Master Plan 2020–2040* and the *Cranbourne Gardens Master Plan 2016–2026* guide the design and development of the landscape, including the tree collection. The Melbourne Gardens Master Plan in particular provides detailed guidance on the management of the heritage landscape and the important aesthetic and environmental role trees play. This includes direction on the location and type of tree planting to preserve the much-loved heritage character of the place.

Melbourne Gardens Conservation Management Plan

The *Conservation Management Plan: Melbourne Gardens and Melbourne Observatory, Royal Botanic Gardens Victoria*, completed by Context Pty Ltd in 2018 identifies the heritage significance of the Gardens and provides conservation policies to protect this significance. As a botanic garden, trees are an essential part of the heritage landscape. The Conservation Management Plan includes an extensive list of significant trees and guidance on their management from a heritage perspective.

Royal Botanic Gardens Consolidated Engagement and Impact Strategy

The *Consolidated Engagement and Impact Strategy 2018–2021* sets growth and participation targets for the Gardens in alignment with various State and Local Government strategies and plans. The Strategy describes major actions for the organisation in fulfilling its vision and mission for increased and deepened engagement with individuals, families, international visitors, and local communities.

As related to the Tree Plan, the Engagement and Impact Strategy will first focus on creation of the whole-of-organisation Interpretation Framework, with establishment and rollout of key themes that align to the organisation’s mission, with these guiding the interpretation and education recommendations made in the Tree Plan.

Other Documents and Policies

The aforementioned strategies and plans relate directly to the implementation of the Tree Plan, though there are many other related documents that guide the management of RBGV. These include:

- *Royal Botanic Gardens Act 1991* (amended 2017)
- Royal Botanic Gardens Victoria Vision and Mission
- *Corporate Plan 2021–2024* (and subsequent versions)
- *Reflect Reconciliation Action Plan Royal Botanic Gardens Victoria November 2021 – November 2022* (and subsequent versions)
- Royal Botanic Gardens Victoria Risk Management Framework
- *Collections and Natural Assets Biosecurity Policy*, June 2020
- *Royal Botanic Gardens Victoria Aboriginal Heritage Values: Melbourne Gardens* (Context Pty Ltd 2017).



4 STRATEGIES AND TARGETS

The following strategies and targets will direct the management of Royal Botanic Gardens Victoria’s tree collection over the next 20 years. The aim is to provide a safe, resilient, and climate appropriate tree collection into the future – including managing the change that will inevitably be required to achieve this.

The Cranbourne and Melbourne sites share many similarities, especially in regard to visitor pressures and a changing climate, however, on a management level, the tree collections are very different. Cranbourne Gardens faces the challenge of a rapidly maturing tree population in and around the Australian Garden, coupled with the complex circumstances that arise when managing publicly accessible and ecologically sensitive conservation areas. Meanwhile, Melbourne Gardens needs to address an ageing and much-loved tree population, some of which lacks climate suitability into the future. The actions below, therefore, will be tailored specifically for each site and each situation.

Action	Timing (Years)		
	Short 0–5	Medium 6–10	Long 11–20
Strategy 1: Base tree management decisions on current and accurate tree data			
<i>Target: All trees in publicly accessible areas are regularly assessed with data used to inform maintenance work and management practices</i>			
Action 1: Complete a full assessment of all landscape and high-profile Conservation Zone trees on both sites to create a baseline dataset, ⁱ including an individual risk assessment as well as landscape values such as climate suitability, design intent, collections management and habitat value	✓		
Action 2: Develop specific targets for tree age and diversity for each site	✓		
Action 3: Transition tree data management to a mobile, GIS-enabled, and real time records management platform		✓	
Action 4: Use assessment data to prioritise arboricultural operations and works programming, including regular scheduled maintenance		ongoing	
Action 5: Document location, condition, and ongoing performance of newly planted trees to inform future plantings		ongoing	
Strategy 2: Adopt an industry best practice approach to tree management, protection, conservation, and collections management			
<i>Target: All trees are proactively managed to increase their health and viability and reduce the risk of harm to people or property</i>			
Action 6: Develop and implement a tree risk assessment, reporting and works program based on industry best practice	✓		
Action 7: Develop and implement an assessment schedule and maintenance plan for all arboricultural hardware (cabling, bracing, propping)	✓		
Action 8: Develop and implement tree protection specifications for construction and events	✓		
Action 9: Develop and implement specifications for tree planting, including procurement and establishment specifications	✓		
Action 10: Develop capacity within the Arboricultural Team to expand work at Cranbourne and deal with threats of climate change and emerging issues		ongoing	
Action 11: Proactively manage tree health through appropriate pest and disease control, irrigation, and soil management		ongoing	

ⁱ For Cranbourne Gardens this includes the Australian Garden, picnic areas, playgrounds and other high target areas.

Action	Timing (Years)		
	Short 0–5	Medium 6–10	Long 11–20
Action 12: Implement an integrated approach to risk management which includes remediation, signage, and exclusion options		ongoing	
Action 13: Review risk assessment, staff training, management, reporting, resourcing, and operational requirements in its entirety at least every five years		ongoing	
Strategy 3: Actively transition to a diverse, mixed-age and future-climate resilient tree population at both Melbourne and Cranbourne Gardens			
<i>Target: Both Gardens have transitioned to a collection of trees which are viable, manageable within available resources and resilient to a 2090 projected climate</i>			
Action 14: Identify and map areas for potential new tree planting considering all relevant information	✓		
Action 15: Develop and implement a tree succession plan to guide and actively plan for future removals and replacements	✓		
Action 16: Develop and implement a proactive arboricultural program for established trees		ongoing	
Strategy 4: Integrate the Tree Plan with RBGV strategic and planning documents			
<i>Target: Trees are recognised as significant landscape assets and essential in the planning and future development of both gardens</i>			
Action 17: Develop and implement a specific replacement policy for trees the Conservation Management Plan identifies as significant ⁱⁱ		✓	
Action 18: Support the implementation of the Landscape Succession Strategy and its extension to Cranbourne Gardens		ongoing	
Action 19: Prioritise tree retention in new development proposals and utilise the opportunities provided for succession planning		ongoing	
Action 20: Continue the 'Fallen Giants' program to repurpose timber as creative solutions to celebrate the lives of lost trees		ongoing	
Strategy 5: Implement arboricultural practices within the Conservation Zone at Cranbourne Gardens			
<i>Target: Trees in the Conservation Zone are proactively managed to reduce risk while supporting ecological and conservation goals</i>			
Action 21: Develop and implement appropriate tree protection and risk remediation processes for the Conservation Zone, including identifying high target areas (e.g. playgrounds, tracks, picnic areas) for proactive management	✓		
Action 22: Improve collaboration between arboriculture and ecology in the management of trees in conservation areas		ongoing	
Strategy 6: Improve public understanding of the role trees play both within the Gardens and in supporting life			
<i>Target: The importance of trees and the need for tree management is better understood by industry, institutions, and Gardens visitors</i>			
Action 23: Develop a program for arboricultural apprenticeships and internships	✓		
Action 24: Develop a strong online presence for RBGV arboriculture (e.g. consider linking to the City of Melbourne Open Tree database project which allows direct public engagement)		✓	
Action 25: Identify and nominate additional trees for inclusion on the National Trust Significant Tree Register, using the CMP as a guide		✓	

ⁱⁱ Includes Outstanding, Significant and Contributory trees and groups

Action	Timing (Years)		
	Short 0–5	Medium 6–10	Long 11–20
Action 26: Collaborate on tree-based research projects with industry and teaching institutions			✓
Action 27: Proactively communicate tree succession plans to build community support and understanding around tree removal and replacement		ongoing	
Action 28: Build community connection with trees and understanding and support of urban forest management		ongoing	
Action 29: Collaborate with industry and the botanic gardens network to participate in tree management forums and knowledge sharing opportunities		ongoing	
Action 30: Integrate the latest research into RBGV tree management		ongoing	



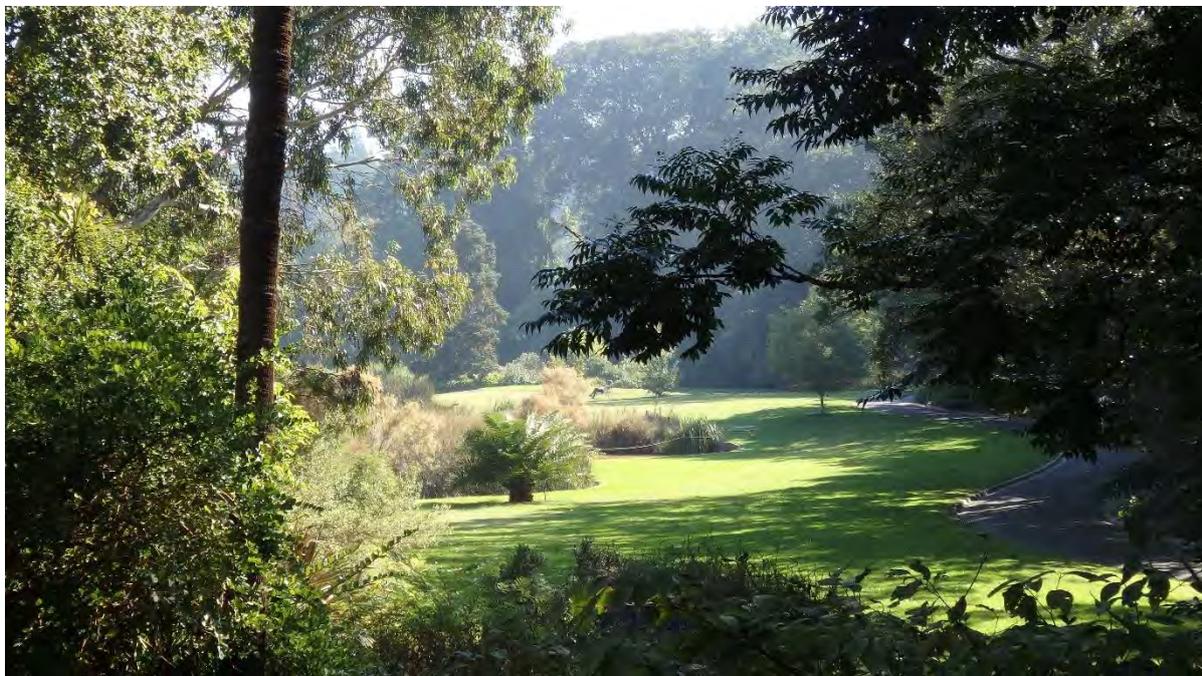
5 CONSIDERATIONS

Managing Royal Botanic Gardens Victoria's tree collection is a complex task – commensurate to the importance and complexity of the collection itself. The following chapter discusses the issues which have informed the development of the strategies listed above and factors which must be considered as they are implemented. These should be considered a starting point for tree management, and the latest research, emerging technology, and changes in industry best practice will all need to inform the daily management of RBGVs trees.

5.1. Benefits of Trees

It is widely recognised that trees provide social, environmental, and economic benefits. But to get the most out of these benefits they require investment. Trees provide benefits from the day they are planted and increase exponentially as they grow, however, to maximise these they must be cared for through regular inspection, care and maintenance.

Trees are highly valued in the landscape and promoting and enhancing the benefits provided by trees is fundamental to Royal Botanic Gardens Victoria and its Vision that '*life is sustained and enriched by plants*'. By valuing trees in the landscape their care will be promoted and the benefits they provide will only increase. RBGV has a leading role to play in sharing the benefits that trees and green space in general can provide and promoting this in the wider community.



Melbourne Gardens from near Bridge Gate

5.1.1. Social Benefits

Trees can change the way people feel and significantly lower stress and fatigue. They bring the natural environment into an urban setting, improving connection with nature and the quality of people's lives.¹ The presence of trees has been shown to increase people's mental and physical health, improve social interaction, reduce crime, and increase participation in recreational activities. In the past two years, people have flocked to public open spaces as the global pandemic has reduced access to shared indoor environments and given people a new appreciation for outdoor spaces and the trees they contain.

5.1.2. Economic Benefits

Trees have an individual monetary value, and as they grow are a constantly appreciating asset. They also provide wider economic benefits to the community. The presence of trees can reduce energy use in buildings by 5–10%.² Trees improve the character, amenity, and brand of a region, drawing people into an area and supporting the service economy.³ Trees provide an ecological contribution associated with

aesthetic, recreational, and educational uses which create further economic benefits.⁴ The social benefits described above also have an economic benefit through a reduction in health care costs.

5.1.3. Environmental Benefits

Trees provide an abundance of environmental benefits by moderating high temperatures, reducing noise and pollution, improving air quality, reducing stormwater runoff, and providing habitat for local fauna. Trees are one of the most effective mechanisms for reducing the Urban Heat Island Effect and have the ability to sequester carbon, and particulate matter and other air pollutants.⁵

5.2. From Seed to Senescence: Managing Trees Throughout Their Life

The Tree Plan addresses the management of the tree populations at both Melbourne and Cranbourne Gardens. The two sites share many similarities, however, on a management level they are very different. The sites are not only geographically separate, but fundamentally different in terms of collection composition, and there are individual challenges inherent in their management.

Irrespective of these differences – risk management, landscape requirements, whole of life maintenance, collections management, and succession planning are shared arboricultural requirements applicable to both sites. The behaviour and physical requirements of each individual tree, species, and the collection as a whole is complex and involves a strategic approach no matter its location. From this perspective the Gardens are intrinsically linked.

Melbourne and Cranbourne Gardens are to an extent polarised in terms of their arboricultural assets. Melbourne Gardens has an established collection of mature trees from around the globe, whereas the Australian Garden collection at Cranbourne Gardens is still in the development phase in contrast with the remnant vegetation of the Conservation Zone.



The White Oak Project, Melbourne's fallen giant viewed from neighbouring trees

Melbourne Gardens is considered to be at a canopy maximum, with potentially diminishing arboricultural assets and the increased risk of failures and losses associated with an over-mature tree population. Meanwhile, Cranbourne Gardens faces the challenges which come with endeavouring to successfully establish a mature tree population, and so requires investment to ensure its collection can reach a sound level of maturity and cover. The differences between these sites are further emphasised when considering the ecological needs of the Conservation Zone at Cranbourne Gardens, where arboriculture, bushland ecology, and fire management find themselves at a tangible confluence requiring a holistic approach to tree management.



The Arboricultural Team through the canopy of Fern Gully, Melbourne Gardens

While both sites require a considerable investment in proactive arboricultural maintenance, the works programs of the two sites are substantially different. The focus of Melbourne Gardens is on risk mitigation, caring for ageing but important trees, and gradual replacement replanting with more climate resilient taxa. For the landscaped areas of Cranbourne Gardens, the focus is on formative pruning, canopy establishment,

and judicious thinning and replanting. For Conservation Zone areas, the emphasis will be on ecologically sensitive risk mitigation.

Trees, irrespective of their species, require arboricultural investment throughout their life. Good species selection, high-quality stock, proper site preparation and planting, after-planting care, and formative pruning are crucial for young trees. As trees age so their maintenance requirements evolve, all the way through to their ultimate removal and replacement, when the cycle starts again.

As trees grow, so does their structural complexity and potential to cause harm, however, this is countered by their grandeur and valuable contribution to the environment, landscape, community, and the organisation. It is this concept that must be appreciated to understand the investment in trees and the need for tree assessment, management and protection.

A further complexity comes from the fact that not all trees are in optimum planting locations from a species, climate, and landscape perspective – although great care may have been taken in their original planting. There are many factors which need to inform the placement of future tree plantings as this impacts their long-term viability and management.

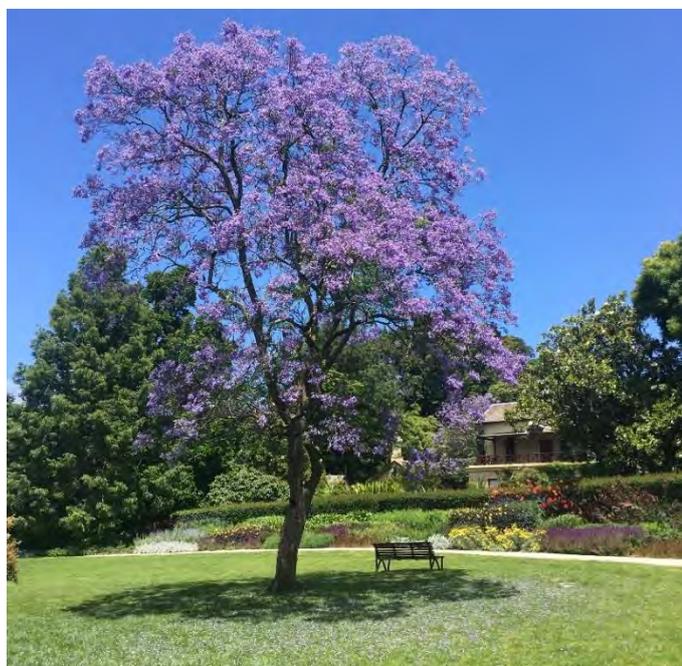
The challenges for RBGVs tree collection are viewed through a ‘seed to senescence’ approach, which actively manages trees from a whole of life perspective. The fundamentals of arboriculture apply with equal importance at both Gardens and provide a strong foundation for their management, irrespective of the structural and species composition of the site.

5.3. Responding to Climate Change

The need to adapt Royal Botanic Gardens Victoria’s tree collection to a changing climate is a key driver of the Tree Plan. The challenges and risks posed by climate change for Cranbourne Gardens are covered in the *Royal Botanic Gardens Cranbourne Living Collections Plan 2022–2032 (draft)*. For Melbourne Gardens, they are included in the *Melbourne Gardens Landscape Succession Strategy 2016–2036* and *Melbourne Gardens Living Collections Plan 2022–2042*. These documents inform the development and implementation of the Tree Plan across both sites.

RBGVs response to climate change is to begin to transition the species composition and structure of the landscape to a more climate appropriate palette of plants. For research purposes this includes testing taxa outside their natural climate range, and the aim is to do this while maintaining the character of the place and responding to visitor needs. The predicted effects of climate change will put pressure on the existing tree population, including on species that are currently well suited to our climate but may not tolerate the warmer and drier conditions predicted into the future. Significantly, this includes many indigenous species.

The predicted effects of climate change include a climate which is hotter, drier, and subject to more extreme weather events (storms and wind). The environmental stresses associated with a changing climate will have a direct



Jacaranda mimosifolia has good climate tolerance

arboricultural impact, exacerbating existing biotic and abiotic stresses on trees at both Gardens. These stresses are likely to result in diminished tree performance and ultimately reduced longevity in the landscape. They also increase the risk profile of the trees. Stressed trees are more likely to fail in any situation and extreme weather events can lead to large losses. An increase in active tree management, combined with the targeted selection of climate-suitable trees through implementation of the Landscape Succession Strategy, will be vital in adapting to climate change.

Trees at Royal Botanic Gardens Victoria, and throughout the world, are at risk from the impacts of climate change as they depend on suitable growing conditions to support their growth and survival in the landscape.⁶ To secure a viable future tree population at RBGV there is a need to understand how trees grow and adapt in their environments. Such understanding can inform the selection of resilient tree species and the management strategies needed to care for trees in the landscape.

5.4. Useful Life Expectancy

The Useful Life Expectancy (ULE) of a tree is an arboricultural estimation of how long a tree will remain in the landscape before it is no longer suitable for retention. This is a species-specific assessment that considers a tree's health, structure, age, and the suitability of its location. For RBGV this also includes an assessment of its climate suitability.

ULE data can be used as a tool to assist in tree and landscape succession planning and reduce the adverse effects of tree removal. An interventionist approach and careful management of arboricultural assets at both Gardens is required, allowing practices which can extend the ULE of climate suitable trees at both sites – helping to buffer against change in the landscape.



Preparing fallen timber for the White Oak Project, Melbourne Gardens

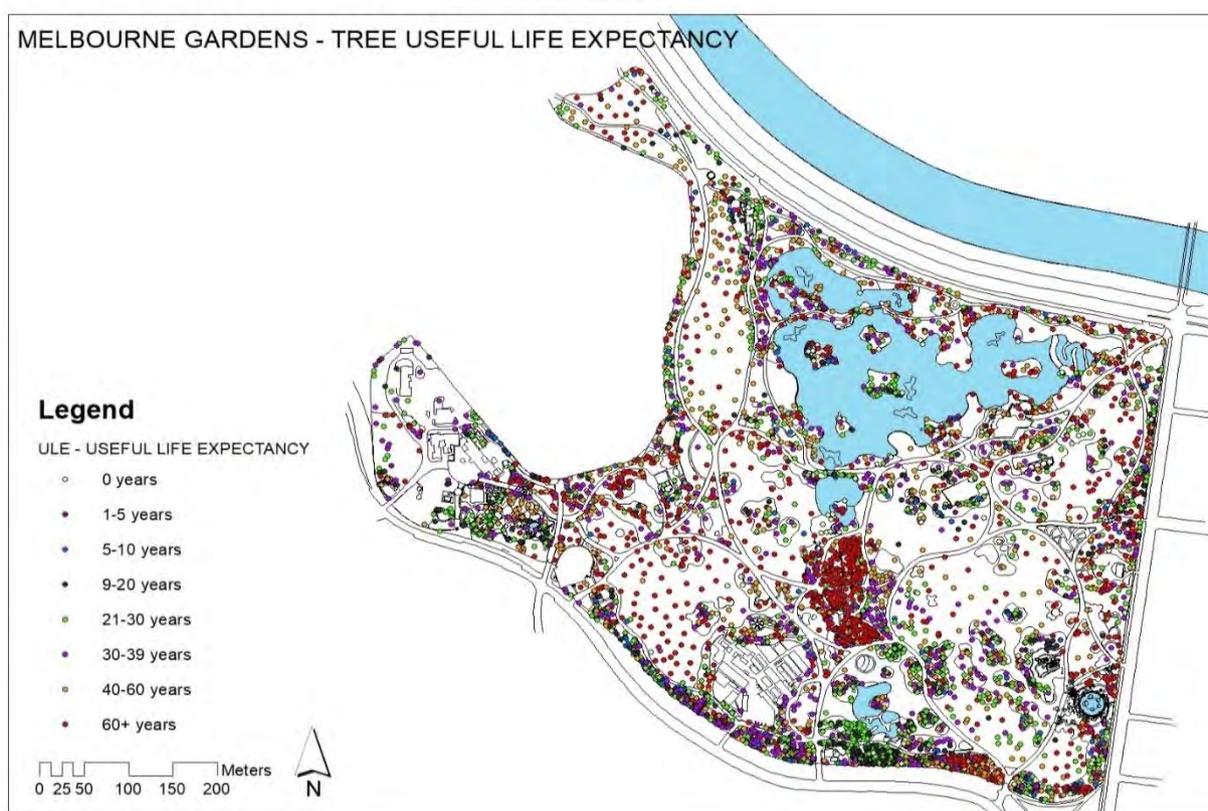
Leading urban tree management practice suggests that a tree population should have a broad range of ages.ⁱⁱⁱ An RBGV Useful Life Expectancy assessment of 1,195 trees with a DBH >30cm, completed as part of the Landscape Succession Strategy, rated 87% of the trees as either mature or over-mature. Approximately 13% of these trees are estimated to reach the end of their useful life within the next five years, and more

ⁱⁱⁱ Standard urban forest management aims for a mixed age population approximating 20% maturing, 60% mature and 20% over-mature. The Melbourne Gardens situation means a greater percentage of over-mature trees is acceptable.

than 25% in the decade following. As an industry standard, it is usual to strive for no more than 10% of a tree population reaching the end of its useful life within the coming decade.⁷

The complexity for RBGV is that these targets are based on urban forest strategies, which generally consider trees across a whole local government area and treats them as assets to be managed. The aim and purpose of trees in a botanic garden is very different, and a range of attributes need to be considered when making decisions in regard to the tree canopy, not just the ULE. In the Gardens, large old trees are a significant part of the landscape providing beauty, interest and gravitas and being highly valued by visitors. They also provide important scientific benefits and habitat value, and botanic gardens are generally well positioned to maintain a high percentage of over-mature trees and dedicate the additional resources required for their care.

As a botanic, conservation and heritage landscape, it is desirable to have a higher percentage of over-mature trees than would generally be acceptable in broader urban forest management, and while the Gardens are willing to support the increased maintenance old trees need, and nurture these venerable specimens, their eventual loss still needs to be expected and managed. Developing a strategic tree management approach aims to minimise the impacts of these losses and the subsequent reduction in canopy cover.



Useful Life Expectancy of trees at Melbourne Gardens, assessed 2018

The landscape at Cranbourne Gardens is very different, with the Australian Garden in particular being completed in 2012 and still establishing. For the 2,400 trees in the Australian Garden, there is currently no ULE data from which to extrapolate projections, but since its establishment it is estimated to have experienced approximately 50% tree losses. In part this is due to the experimental nature of the new plantings, but in the absence of detailed data it is fair to assume that Cranbourne Gardens have a high percentage of trees approaching the end of their useful life, partially due to deliberate over planting to establish the site. This has significant impacts for the young landscape.

5.5. Risk Management

Trees provide a range of benefits that continue to increase as they mature (see Section 5.1). As a tree gets older and larger it is also more likely to develop decay, cavities, or other conditions that can increase the likelihood of failure.⁸ However, the same features that compromise structural integrity provide valuable wildlife habitat and can result in higher aesthetic qualities (gnarled, twisted, and extended branches) and environmental and health benefits.⁹ These characteristics need to be managed.

At Melbourne Gardens, having a landscape heavily populated by mature trees brings challenges in terms of arboricultural risk management, particularly controlling the risk of trees causing harm to people. As discussed above, over-mature trees can be at increased risk of failure, but even if a tree does not have these defects, the consequence of failure in a large tree may be greater due to their size and structural complexity. Added to this, large and statuesque trees draw a greater number of visitors, increasing the likelihood of a failure impacting a person. Failures may occur for a whole variety of reasons and can even be for unknown causes. Known factors influencing failure rate include strong winds, environmental stress, and construction activities. Areas accessed by visitors and staff require rigorous inspection, assessment, and documentation of large trees, in combination with risk remediation works to allow trees to be safely retained for the benefit of all.



Large, old trees require additional care and resources, including this oak at Melbourne Gardens

It is important to recognise that it is impossible to remain completely free of risk when assessing and managing trees. Regular assessment and maintenance work can reduce the risk of unexpected tree failure, but trees are still living organisms with unique responses and growth patterns. While some defects can be predicted, it is impossible to completely read their physiological structure, or predict how this structure will respond under extreme conditions. This Tree Plan therefore strives to strike a balance between the inherent risk any individual tree poses and the wealth of benefits they provide.¹⁰

The following key principles provide the foundation for establishing this balance between tree risk and benefits:¹¹

- The risk to human safety is extremely low
- Trees provide a wide variety of benefits to society

- Trees are living organisms and naturally lose branches or may fall
- Tree owners have a legal duty of care
- Tree owners should take a balanced and proportionate approach to tree safety management.

RBGV monitors risk in various ways to reflect best practice and to promote a positive risk culture across the organisation. RBGV maintains a current Risk Management Framework, available to all staff, that is regularly audited for Audit and Risk Committee (ARC) endorsement and Board approval. Tree Risk is included in RBGVs Strategic Risk Register under *S02 – Risk of physical or mental harm to the general public due to our operating environment*. This register is overseen by the Executive Team and regularly reported to ARC. An Operational Risk Register is administered by the Senior Leadership Team and discussed at quarterly Risk Planning and Review Group meetings. Risk number *OR-08 Environmental – Risk to public safety such as uncontrolled wildlife and tree risk which may lead to injury, loss of life and/or reputational loss* captures tree risk for regular discussion at management level.

Further details on how the balance between tree risk and tree benefits is implemented at RBGV is provided below.



Arborist carrying out maintenance on a heritage tree in Melbourne Gardens

5.5.1. Risk Assessment

The standard practice for all types of risk assessment is to consider the likelihood of occurrence and consequent severity of the potentially harmful event. For trees, this includes an assessment of ‘target’ – or what would the tree hit if it were to fail. A tree overhanging a bench seat (where people may sit for an extended period) has a higher risk rating than the same tree in the middle of a garden bed (where people seldom venture).

Risk assessment for trees is based on arboricultural investigation of the health and structural integrity of the tree and its potential target (people and physical assets). Risk mitigation addresses either works to reduce the likelihood of failure, or options to reduce the target value. Examples of the former include pruning, weight reduction, and treatment of pests and disease. Examples of the latter include mulching or creation of garden beds under trees to reduce visitor access, or at Cranbourne the relocation of paths and

picnic areas. This later approach is especially relevant for high habitat value, indigenous trees and veteran trees.

5.5.2. Duty of Care

No matter the risk profile, there is a duty of care to manage the risks from trees under RBGV management, and there is a need to strive to do everything ‘reasonably practicable’ to separate visitors and staff from unreasonable levels of risk from the failure of trees. This is especially applicable for spaces designed for vulnerable visitors.¹²



Children playing in autumn leaves, Oak Lawn, Melbourne Gardens

5.5.3. Proactive Management and Mitigation

Undertaking tree assessments on a regular basis, including proactive inspection and maintenance, is the most important part of risk management. The aim is to improve the structural condition and overall viability of arboricultural assets and identify and address risks before they become hazards. This needs to be combined with a target-based assessment, both to improve the mechanical stability of the trees and allow for their preservation in the landscape.

5.5.4. Diagnostic Assessment

Advanced diagnostic equipment should be used to support tree risk assessment, allowing for the quantification of the likelihood of tree failure. Given the scientific, environmental and heritage value of RBGVs trees it is important that there is a high degree of confidence in inspection results, including advanced levels of inspection. Tree risk assessment processes should also follow the latest, and continually developing, industry best practice. For example, the use of tomograph machines has been hugely beneficial in understanding the internal structural integrity of large old specimens. The use of the latest technology can allow more informed decisions to be made, especially regarding the potential need for removals.¹³

5.5.5. Review and Feedback

Investment in tree risk assessment and process improvement, including regular review, is key to optimising risk management procedures. Linking operational priorities towards the prevention and remediation of tree risk and corrective arboricultural management is key to this plan. This prioritises safety in day-to-day arboricultural maintenance and the regular review of the effectiveness of the approaches used.

5.5.6. Communication and Outreach

Community engagement and education in communicating inherent tree risk and the necessary management is an essential component in how RBGV approaches the risk associated with its tree collection. Addressing people’s perceptions towards trees helps create an understanding and acceptance of inherent risk.

5.6. Veteran Tree Management

Veteran Tree Management is the care for very old and valuable trees. The practice is widely adopted in the United Kingdom when caring for trees that are several hundred to thousands of years old, but has a place in the Australian context, especially when dealing with ‘Ancient Sentinels’ – remnant indigenous trees with high cultural and ecological value. In such cases, trees are allowed to decline in the landscape, and proactive removal is not appropriate, even for old and failing trees. In such cases, removal of the target rather than the defect should be the first course of action. Veteran tree management is also open to alternative management techniques such as fracture pruning, habitat creation and cultural scaring.

Remnant indigenous trees that may be hundreds of years old should be proactively managed in the landscape with a ‘retention first’ policy. Some components of veteran tree management may also be applicable to older exotic trees, where controlled decline is encouraged to allow the tree to be retained for longer in the landscape.

5.7. Tree Retention and Removal

One of the most challenging notions in the management of trees at RBGV is the need to balance tree preservation with an inherent need for systematic removal and replacement in different settings. Melbourne and Cranbourne Gardens have three distinct arboricultural zones; Melbourne Gardens, Cranbourne Gardens horticultural areas (Australian Garden and Eastern Entrance Precinct), and Cranbourne Gardens Conservation Zone. While each of these sections can be broken into several subsections with more individualised management needs, in terms of tree preservation, the Cranbourne Gardens Conservation Zone has particularly complex requirements.



Remnant indigenous *Bursaria spinosa* at Melbourne Observatory, Melbourne Gardens

In principle, all trees at RBGV share a common purpose and pose the management challenge of balancing tree preservation with a requirement for tree removal and replacement. This balance may present in many ways, but generally it cannot be easily achieved by planting more trees, nor the stringent preservation and protection of mature trees in the landscape.

Tree removal is considered an essential element in successful tree management, as all trees will ultimately require removal and replacement. It is also likely that the need for strategic tree removal for climatic and succession considerations will be more pronounced in the coming years. Although tree removal is an essential tool, it must be done in a considered way and holistically in terms of its role in succession planning.

Trees proposed for removal must be considered unsuitable for on-going retention only where remedial arboricultural management cannot be reasonably applied to alleviate the situation. As a result, tree removal should generally only be considered where a tree poses an unjustifiable risk to people, is decidedly unsuited to its current location, is a biological hazard, or can be considered dead, dying, or diseased. An exception being the retention of dead and dying trees where they provide important habitat value, especially within the Cranbourne Gardens' Conservation Zone. In these cases, as long as the risk can be appropriately managed, dead and dying trees have a continuing value in the landscape and will require ongoing management.



Mueller's Pinetum looking south c1875

However, at RBGV, some important exceptions to tree retention apply. As a highly managed botanical landscape, it may be necessary to actively remove some trees with little landscape value in order to proactively manage the living collections and increase the climate resilience of the landscape as a whole. For example, removal of one relatively young tree with a poor projected future climate tolerance may allow for the establishment of a diverse understorey with high conservation value. The overall value of the collection, and the climate resilience of individual trees, needs to be considered as part of a holistic tree management response.

Given the diversity of sites at RBGV, the retention value of each tree must be individually assessed and include the consideration of all influencing factors. Tree removal, where not essential due to risk, should be part of strategically planned replacement. Removal will also be a staged approach in order to lessen the impact on the landscape and allow the successful performance of its replacement.

5.8. Tree Replacement and Planting

One of the most important elements in tree management is the need for suitable replacement planting. This includes species selection, location, propagation, procurement of stock, planting, establishment, and ultimately continued management within the landscape. This process is an important one, as the selection and placement of suitable trees in the landscape heavily influences the Useful Life Expectancy. For example, it has been shown that poorly planted and sited urban street trees have a life expectancy of only approximately 20 years,¹⁴ compared to the over 100-year life expectancy of a tree in public gardens such as Cranbourne and Melbourne Gardens.

Tree replacement planting is challenging – with both sites being highly designed and managed landscapes which cannot tolerate the indiscriminate placement of new trees. Finding suitable locations for replacement trees is the most difficult part of the process, and as discussed above can require judicious replacement of under-performing trees in order to establish a viable whole of site tree collection.

Tree longevity and future viability is heavily influenced by the selection of the correct species for a specific growing environment. This can be complex, but the ultimate aim must be to select the best tree for the location with consideration for the individual location, climate suitability, scientific purpose, collections management, species longevity, ecological requirements, landscape aesthetics, heritage value and biosecurity. This can be expanded with selection of a particular provenance within a species' range, allowing for the selection of populations with particular attributes or tolerances. This is especially relevant when working with Australian conservation collections. Selecting trees of a suitable species and provenance, both for now and the future, is fundamental to the health of the tree collection.



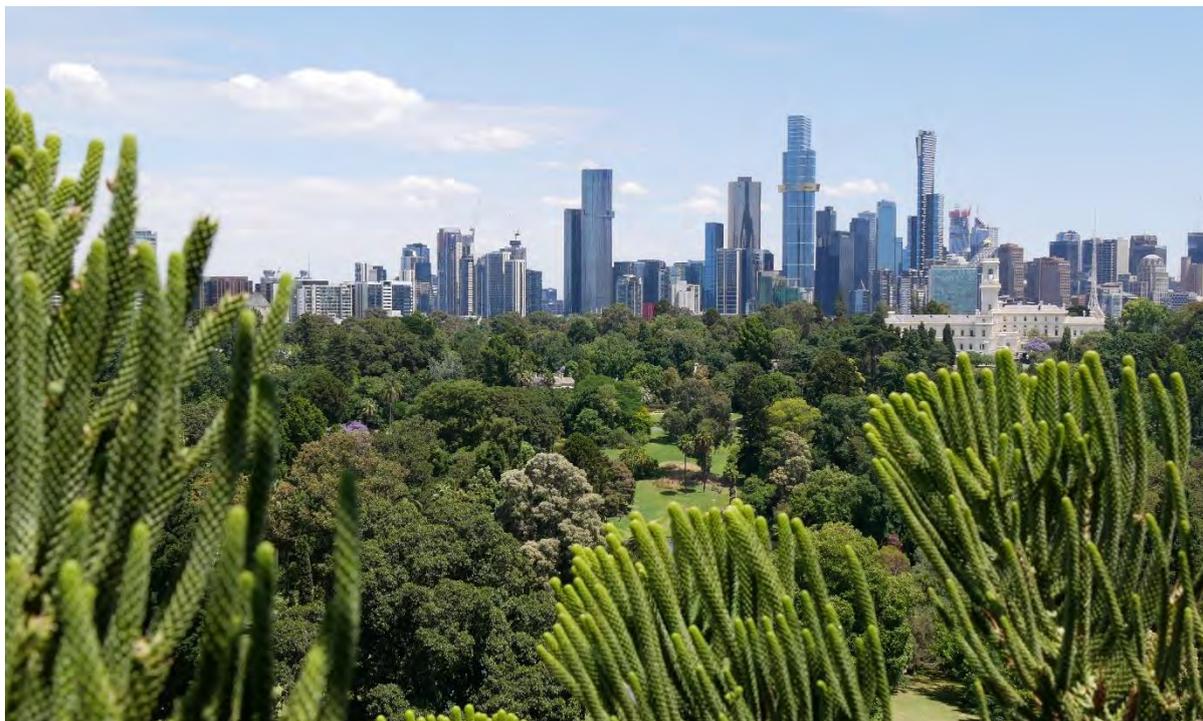
Former Curator Horticulture, Peter Symes planting a climate-suited *Eucalyptus grandis*

When replacing or planting a tree or group of trees at either site, consideration must be given to the following:

- Selection of appropriate taxa and provenance with good climate resilience, suitable to the location and supportive of the landscape/amenity requirements of the location
- Selection of appropriate taxa and provenance to support the living collections and conservation aims of the organisation, including wild collected and known provenance materials
- The current and future suitability of the proposed location, including the tree's impact on the surrounding environment in terms of vegetation layers
- Providing suitable lead times to allow the nursery to source, propagate and grow stock of an appropriate size and quality
- Soil and ground preparation
- Broader site management objectives e.g. Master Plans, ecology, design, heritage (Melbourne), collections management, research etc.

It is also important that planting and removals take place over a suitable time frame with enough forward planning to allow quality, appropriate nursery stock to be produced. The importance to a botanic garden of wild collected and known provenance plants cannot be underestimated and is integral to the organisation's conservation work, and to the implementation of the Landscape Succession Strategy and

Living Collections Plans. Sourcing, propagation and developing trees which meet these requirements takes time – up to five years for semi-advanced landscape trees. It is of utmost importance that potential tree planting locations, and the taxa and provenance suitable for the location, are identified well in advance of removals so that acquisitions are planned for. This will require the combined expertise of arboriculturists, plant scientists, horticulturists, and landscape architects across the organisation.



View across Melbourne Gardens from the canopy of a mature *Araucaria cunninghamii*

5.9. Trees and Development

Trees require protection from the potential impacts of site development and construction activities. This encompasses the above and below ground portions of the tree, including their surrounding environment. Changes to soil (e.g. compaction, trenching) or wind patterns (new buildings, vegetation removal) are examples of environmental changes that can have a significant impact on established trees. Construction and development works, including short-term events, can have a considerable impact on the vitality and longevity of trees in the landscape – especially where they impact a tree’s root system. The good news is that there is significant knowledge in the industry of how to prevent these impacts and a desire from RBGV to ensure these are appropriately implemented. For sites managed by RBGV, it is recommended that a ‘tree first’ approach be taken for all developments, except where removal aligns with broader Master Plan, landscape collection and succession aims.

In Australia, tree protection is managed through the Australian Standard, *Protection of Trees on Development Sites (AS4970)*. RBGV is continually looking to improve the landscape amenity and visitor services offered for both sites, with these improvements often requiring construction works. Early planning is the most effective way to minimise impact to the existing tree population as it allows tree preservation to become a critical factor when changes are planned. Tree preservation is always more successful when designs are developed around trees, rather than impacts managed as an afterthought during construction.

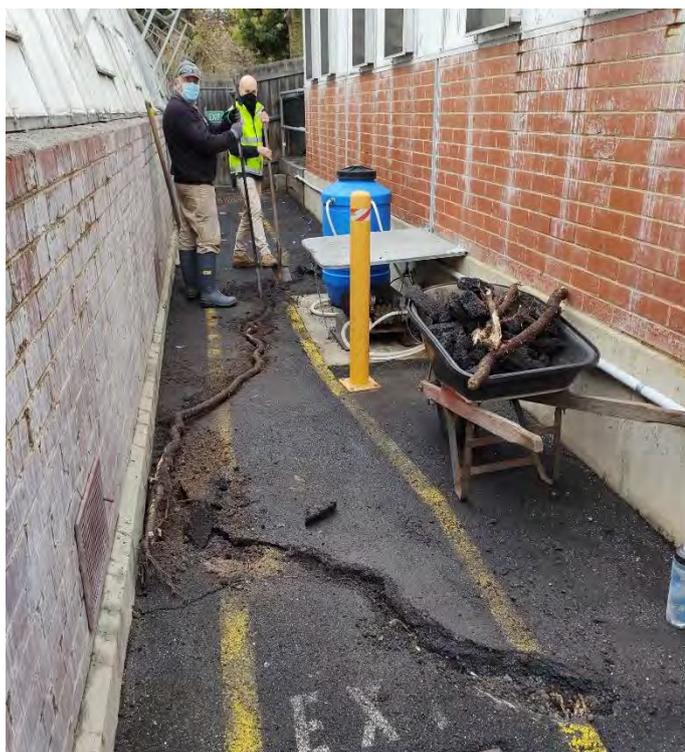
It is essential that tree protection is factored in at the early planning stages for any new construction projects or events, and that it is implemented in accordance with industry best practice and the relevant Australian Standards throughout the entire design, construction and post-construction periods. For the Melbourne Gardens, this also becomes a legal requirement through the Heritage Victoria permit process.

'Most trees will take many years and possibly decades to establish but can be injured or killed in a very short time as their vulnerability is commonly not understood.' (AS4970)

5.10. Trees and Infrastructure

Management of the built assets is complex for both Cranbourne and Melbourne Gardens. Melbourne has challenges with ageing infrastructure, including drainage systems and path networks, whereas Cranbourne has a newer asset profile; several are approaching the end of useful asset life and due for renewal.

The interaction between trees and built infrastructure is commonly understood and can at times be a point of conflict. This is especially the case when infrastructure is of heritage value, with a subsequent legal responsibility to protect it. While hardscape is an essential part of a botanic gardens, providing the means to service and access the site, it is generally understood that the vegetation (including trees) is of equal importance. For both Gardens this means the long-term viability of the hard infrastructure and the tree collection must be considered in tandem.



Tree roots in conflict with infrastructure

Where conflict between trees and infrastructure does occur, it is generally the result of one of the following:

- Poor planning in relation to trees and their eventual size and location (e.g. tree is too large and too close to infrastructure)
- Planting trees and later installing infrastructure without considering soil and growing requirements (e.g. building too close to a tree)
- Ageing infrastructure paths, drainage, irrigation, and buildings, with many of these heritage structures being built in a way which allows them to be easily compromised by trees (e.g. terracotta drains, poor foundations).

These conflicts must be managed and require a considerable investment in resources to balance and rectify. For Melbourne Gardens in particular, the environment has changed significantly from when many of the trees were planted and infrastructure installed. Adapting our trees and infrastructure to the current and future climate is a significant challenge.

5.11. Community Engagement

A key part of landscape rejuvenation and successful succession planning is developing a shared community understanding of the necessity of careful tree removal and replacement. Effectively communicating the need for this work can sometimes be a greater challenge than undertaking it.¹⁵ The Tree Plan recognises that effective community engagement and communication plays a vital role in developing a resilient tree collection at Melbourne and Cranbourne Gardens, as support and understanding needs to be built for the changes that are required. It is essential that the community be brought along on the journey of how RBGV are managing and caring for their trees.

Separate to this, RBGV seeks to develop a deeper culture of participation and interaction with its unique tree collection. Trees are a draw card for visitors to both sites, particularly at Melbourne, where the established tree canopy provides a rare opportunity for respite in the middle of a bustling, modern city. Recent work by the City of Melbourne, especially their 'email a tree program', has shown how deeply the public care for trees and this provides a valuable opportunity for developing similar community engagement and learning programs.

In addition to engaging the community, RBGV is well placed within the network of botanic gardens to contribute to broader research opportunities, and potentially collaborate on PhD projects. Strong networks through BGANZ, BGCI, IABG (International Association of Botanic Gardens), Arboriculture Australia and the Climate Change Alliance of Botanic Gardens provide opportunities for research and knowledge sharing. RBGV also has strong links with many universities, notably the University of Melbourne and University of Tasmania. As long lived, well known and well documented specimens, RBGVs trees can contribute to research on public responses and behaviour toward trees, ecological benefits, fire response, tolerance to climate change and arboricultural management, as well as contributing to biosecurity and conservation efforts.

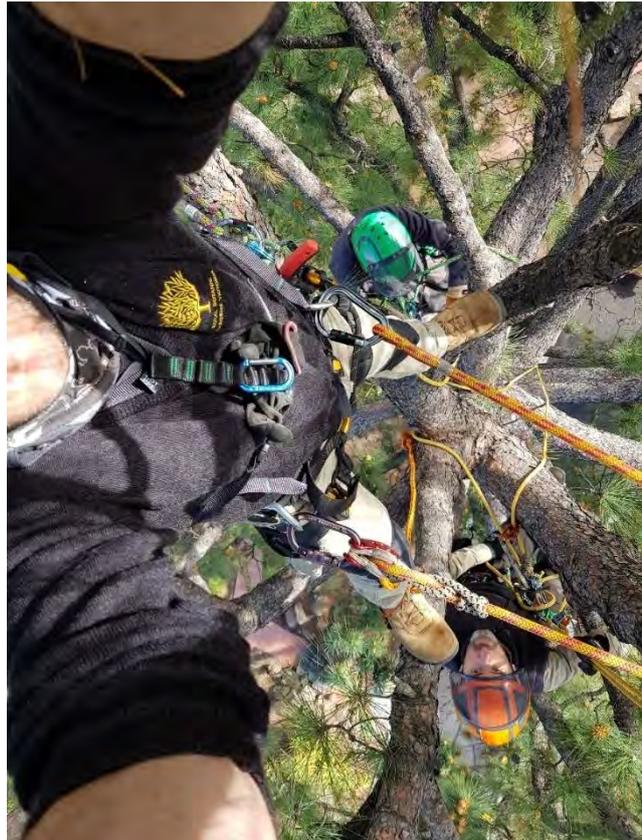


Students participating in an education program at Cranbourne Gardens

5.12. Resourcing

Providing the appropriate resources to responsibly manage the tree collection at both sites is an ongoing challenge. For Melbourne Gardens, the large, mature-tree collection inherently requires substantial arboricultural resources to physically manage it. Addressing this challenge is key to successfully developing and maintaining healthy and amenity trees.

Cranbourne Gardens has not seen a significant investment in tree management since its establishment, somewhat due to the relatively young age of planted specimens. Perhaps the greatest challenge in building a viable tree collection for this site is more proactive planning and investment in its own arboricultural potential and the complex management needs of the site (including the Conservation Zone). This will require additional investment in tree assessment, protection, conservation, succession, and maintenance over the next 20 years.



Tree care is resource intensive

Whichever site is being managed, arboriculture requires applied management and a highly qualified and skilled approach, with this being time, labour, and resource intensive. Without continued investment the practical limitations of the arboriculture team and its strategic outcomes are likely to become even more challenging in the future, subsequently affecting the viability of the tree collection.

5.13. Considerations for Melbourne Gardens

While most aspects of tree management relate equally to trees across Melbourne and Cranbourne Gardens, there are some challenges that are unique to each site. The sites differ considerably in their age, design, location, scientific focus, and the composition of the tree collection. The following two sections discuss management considerations that are unique to either Melbourne Gardens or Cranbourne Gardens.

5.13.1. Landscape Character

Melbourne Gardens is one of the finest examples of a picturesque landscape in the world and has been a treasured part of Melbourne's cultural life for more than 175 years. It is loved by generations of Victorians and respected in both local and international arboricultural circles. The character of the Melbourne Gardens is described in detail in the *Melbourne Gardens Master Plan 2020–2040*, including the fundamental role trees play in the character and heritage value of the place.

The tree canopy is a major contributing factor to the picturesque landscape. It helps define space, frame and screen views, and individual trees act as important focal points, especially the specimen trees in lawns and the silhouettes against the skyline. This landscape design is however vulnerable to change, in part due to the intense care which has gone into its design. Indiscriminate tree planting is one of the easiest ways to damage the landscape character and can easily erode the carefully contrived balance between mass and void. This makes finding locations for new tree planting within the picturesque landscape particularly challenging at Melbourne Gardens.



Palms on Western Lawn, Melbourne Gardens

More scope for planting exists within Melbourne Gardens arboretum areas. These have a distinctly different character to the picturesque landscape, with trees dominating and forming a nearly closed overhead canopy. Arboretum areas include Oak Lawn, Hopetoun Lawn, Palm Lawn, Eucalypt Lawn and Huntingfield Lawn. The relationship of the mass, void and arboretum areas is carefully mapped in the *Melbourne Gardens Master Plan 2020–2040* and provides guidance on locations for new tree planting. While arboretum areas provide opportunities for tree planting without impacting the landscape, they come with complexity of trying to establish new trees in competition to mature ones.

A third type of vegetation character at Melbourne Gardens comes from the remnant indigenous vegetation, including several pre-1846 *Eucalypts camaldulensis* (River red gum) known as Ancient Sentinels, remnant *Bursaria* on the Melbourne Observatory, and patches of *Melaleuca ericifolia* around the margins of the Ornamental Lake (originally a billabong known as *Tromgin*). These remnant and indigenous trees require a different management approach to the planted landscape, including engagement with Traditional Owners.

5.13.2. Ageing Tree Population

The primary arboricultural challenge for Melbourne Gardens is the high number of mature to over-mature trees within an already densely treed landscape. Many of these trees are approaching the end of their life and require substantial applied arboricultural management to support their retention. These aged trees limit new planting opportunities and are more likely to decline and fail in the coming years. This is likely to be further exacerbated by climate change. There is a need to work towards a more balanced ‘mixed age’ tree population whilst maintaining the landscape character.

5.13.3. Tree Risk Management

As discussed in Section 5.5, Melbourne Gardens has a landscape structured around visitor access to mature trees – especially statuesque lawn specimens. This brings particular challenges in terms of risk management, and there is a need to continue a balanced approach between reducing the likelihood of failures (e.g. through pruning or other works) and reducing the potential impact of failure (e.g. through reducing access to the fall zone of a tree).

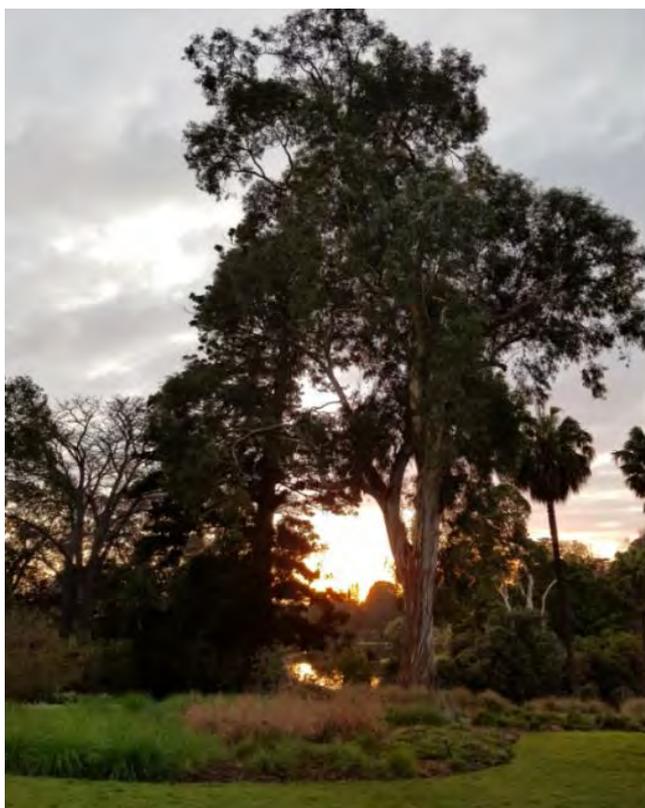
5.13.4. Engagement

Trees at the Melbourne Gardens are loved by the community, with visitors and employees at times feeling very strongly about trees within the Gardens. The need for stakeholders to be informed and have input into the decisions that affect the tree collection is recognised. Building an ‘appetite for change’ and support for long-term decision making is an ongoing process for Melbourne Gardens, yet one that must be tackled if the Gardens are to respond to climate change and maintain the health and character of the tree collection. Without this work, the trees and landscape character which people are so passionate about protecting will be eroded.

5.13.5. Heritage

Melbourne Gardens are included on the Victorian Heritage Register, and as such there is a legal obligation to protect the heritage values of the place. The welfare and placement of trees in the landscape is of particular interest to Heritage Victoria and fundamental to the scientific and aesthetic values of the site. While Heritage Victoria have an active interest in tree planting and selection, especially when replacing the Gardens Significant Trees, RBGV have a further obligation to protect the heritage values of the landscape by ensuring they are not eroded by injudicious management practices. Of all the routine tasks undertaken by RBGV, inappropriate tree planting has the greatest potential to damage the aesthetic value of the landscape by blocking views and diluting the picturesque design. Guidance on protecting the heritage and landscape values of the Gardens is provided by the *Melbourne Gardens Master Plan 2020–2040* and the *Conservation Management Plan: Melbourne Gardens and Melbourne Observatory, Royal Botanic Gardens Victoria* (Context Pty Ltd, 2018).

In addition to the post-colonial heritage of the site, Melbourne Gardens are of great value to the Traditional Owners, with pre-contact trees remaining in the landscape. These values are documented in *Aboriginal Heritage Values: Melbourne Gardens* (Context Pty Ltd 2017). In response, Traditional Owners will be included in decision making around relevant indigenous trees.



Melbourne Gardens Cockatoo Tree
This tree had a major failure in March 2022 with the branch landing within the defined exclusion zone, demonstrating a successful risk management process.

*‘Someone is sitting in the shade today because someone planted a tree a long time ago.’
(Warren Buffet)*

The final consideration from a heritage perspective is the previous, now controversial practice, of replacing ‘like with like’ for heritage trees. While still advocated by some heritage professionals, it is being increasingly recognised that this does not always lead to the best outcomes for the landscape or the heritage values of the site. This is particularly the case when the heritage tree was of a species that is not climate appropriate and a ‘like for like’ replacement specimen is likely to fail or have reduced longevity in the landscape. For a botanical landscape like Melbourne Gardens there is an added imperative to plant botanically interesting and climate appropriate tree taxa, and not merely perpetuate past planting practices. This approach is supported by the Gardens Conservation Management Plan.¹⁶



Exotic and indigenous species seamlessly integrated in the Melbourne Gardens’ landscape

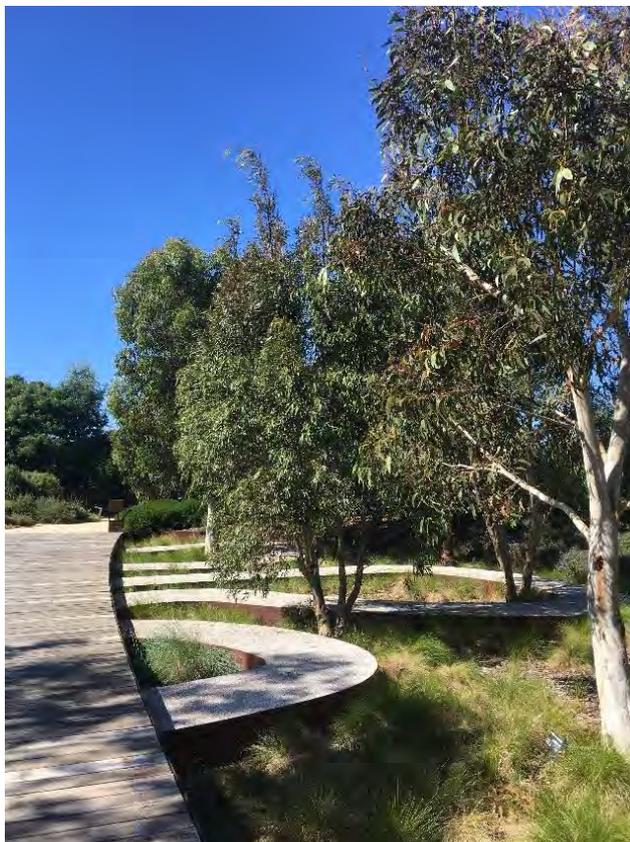
5.14. Considerations for Cranbourne Gardens

From an arboricultural perspective, a key difference between the sites is the younger age of the trees within the manicured garden areas of Cranbourne Gardens, and the limited investment which has been made in terms of arboricultural maintenance. This is especially the case for the Australian Garden. Another distinction is the management of the Conservation Zone and the careful balance that needs to be struck between the conservation and biodiversity value of the trees and the safety of staff and visitors. This applies to all tree collections across all RBGV managed land but is particularly complex in the Conservation Zone. There are also differences in design intent and collections management across the two sites, with this impacting on the management of the tree collection.

5.14.1. Landscape Character and Collections Intent

The design for the Australian Garden at Cranbourne Gardens follows specific guidelines which help determine the placement and selection of trees for the Gardens. From a garden perspective the Australian Garden started as a greenfield site and there was pressure to establish a garden rapidly and effectively. Many trees were planted as pioneers – intended to develop a quick canopy to shelter slower and longer-lived specimens – and now require removal. Other trees are now out of step with the botanical collection. Some species were intentionally overplanted to establish quick cover and now need to be thinned. There was also a requirement to plant more established specimens, putting pressure on the Gardens to grow/procure larger material. This pressure has noticeably affected the quality of nursery stock and the success of the trees in the landscape. The long-term management of the tree collection needs to be undertaken with knowledge and respect for the design intent for the site, and with regard for the living collections.

An emerging focus for Cranbourne Gardens' collections is securing taxa at risk from climate change and establishing an ex-situ conservation collection of Victorian plant species considered to be at risk due to altered wildfire regimes and projected changes to fire frequency and intensity. In this instance species may not necessarily be 'climate matched'. It should be noted though that some species have shown excellent tolerance for the conditions at Cranbourne despite the site having a vastly different climate to their natural distribution. The growing of these species is important for conservation reasons, and because it provides climate risk data for the species, but it can add complexity to the local management of the tree collection.



Maturing trees in the Scribbly Gum walk, Cranbourne Gardens

5.14.2. Tree Establishment

Successfully establishing a viable canopy is a major focus at Cranbourne Gardens. This includes nurturing the current plantings, judiciously removing trees where required, new tree planting, and formative pruning. Key to effective plant establishment is sourcing high-quality nursery stock, which can be complex for Australian taxa, forward planning will be essential. Cranbourne Gardens also faces challenges with soil-borne pathogens and prolific numbers of biotic pests.

Some tree replanting in the Australian Garden requires amelioration and/or replacement of the soil profile in order to provide a suitable growing medium for the replacement trees. Without this work the soil conditions will continue to lead to both poor establishment and performance of trees.

Formative pruning and corrective arboricultural maintenance during a tree's early development is essential in reducing the long-term maintenance burden of the tree.¹⁷ Unfortunately, this has been sporadically undertaken at Cranbourne Gardens in the past. A significant investment is now required to correctly select new stock and undertake the required formative pruning.



Formative pruning is important in establishing good structure for the life of the tree

Trees in the Conservation Zone are managed from a conservation perspective, which includes fire, and are considered part of the overall vegetation community (Ecological Vegetation Class) they exist in. In general, trees here have not been subject to the qualified tree maintenance essential to develop a quality and long-lived tree population. However, natural defects can be beneficial by providing habitat and ecological benefits. Establishment of new trees in the Conservation Zone follows accepted ecological vegetation management practices, which dictate to encourage natural regeneration where possible and only resort to revegetation when natural revegetation fails. If trees are planted, they need to be local provenance indigenous species. A major factor impacting new tree establishment in this area is significant grazing by indigenous fauna, particularly Macropods. This is exacerbated by the island nature of the site, surrounded by housing and agricultural land.

5.14.3. Tree Risk Management

Cranbourne Gardens has a unique and rising tree risk profile. This is associated with the maturing tree population in the Australian Garden, increased visitation to the site (especially the Conservation Zone), and the unique challenges that arise from balancing conservation and safety values in the Conservation Zone.

Like Melbourne Gardens, the tree population in both the Australian Garden and Conservation Zone will require an increased investment in reporting, quantifying, and managing tree risk to bring it into line with industry standards. Collection of arboricultural data at Cranbourne has been limited, and a baseline arboricultural assessment is needed to inform future planning and works scheduling.

Management of the Conservation Zone area is particularly complex. An approach is needed which balances the arboricultural, conservation and biodiversity needs with the landscape intention of the gardens. Bushfire ecology and fire management elements also need to be applied holistically to complement the other management practices that are undertaken in these zones. Best practice in balancing public safety with conservation requirements is to identify high-target areas and more proactively manage trees within these locations, with the aim of improving public safety. This is especially important for play spaces, picnic areas, and where falling trees could block fire tracks and restrict access for emergency services. Establishing a management plan that is not over-prescriptive at Cranbourne is vitally important in responding to the individuality of the site and managing these potentially conflicting but important aims.



View from the Australian Garden to the Conservation Zone, Cranbourne Gardens

5.14.4. Landscape Succession and Conservation

The principles of landscape and arboricultural succession are well defined for RBGV and set a strong horticultural response to climate change. However, Cranbourne Gardens has a clear purpose in the conservation of Australian flora, and particularly the display and cultivation of Victorian taxa, meaning it may not always be possible to plant species with a 'projected future climate match', making succession planting a greater challenge.

The Australian Garden was designed during the Millennium Drought, and while not always the case, much of its plantings have links to dryland regions of Australia and the potential to be suitable to environmental stressors such as extremes in heat, variability in water availability and high levels of solar radiation. Whilst simplistic to suggest that geography and natural distribution alone builds inherent resilience, there is potential for a proportion of the current collection to be reasonably matched to a hotter and drier climate. This requires further testing and to date, few accessions in the Australian Garden have been specifically assessed for climate risk.

There are however some obvious exceptions to potential future 'climate matched' taxa in the current holdings. The Australian Garden aims, through its landscapes and collections, to tell the story of a nation's flora and the diversity of plant communities that support the flora. The exceptions to dryland precincts are sections of the Forest Garden, Gondwana Garden and numerous plants associated with bioregional plantings in the Diversity Garden. Such holdings provide invaluable information about understanding the environmental tolerances of a species growing outside of its natural range/conditions. The resilience and environmental tolerances of many species is not well understood or documented and warrant trialling outside of the growing range indicated by climate matching predictors.

All these factors make landscape succession responses at Cranbourne Gardens challenging, but for the long-term viability of the landscape it is desirable that landscape succession principles be considered for the long-lived and slow to establish tree collection. The suitability of potential new tree plantings must be considered on a case-by-case basis and factor in a range of environmental, display and conservation priorities. Cranbourne Gardens Living Collections Plan provides guidance on this.



Acacia seed pods, Cranbourne Gardens

Landscape succession processes in the Conservation Zone are even more

complex, and the science in regard to indigenous and ecological landscapes is still in its infancy. Current approaches are centred around research and monitoring in natural areas and do not consider trees in isolation, but as part of broader ecosystems. Intervention in these landscapes is currently considered a last resort. In some cases, it may be appropriate to introduce new provenances of local taxa which are struggling under the effects of climate change, but this needs to be considered on a case-by-case basis and underpinned by the latest science. What is most important is acknowledging that RBGVs response to climate change will need to be significantly different between conservation and horticultural settings and requires regular review based on the individual situation and latest research.

5.14.5. Southern Grasslands

Located in the southern section of the Gardens, the Southern Grasslands was set aside in the Cranbourne Gardens Master Plan for an arboretum of larger Australian trees not suited to growing on the sands of the Australian Garden. However, further planning for this area is in progress through the Cranbourne Gardens Place Plan process, and current tree stock may not be suitable for the new direction of the site. The site is adjacent to residential development which is likely to experience changes in land use into the future.¹⁸ Planning of this area must consider the surrounding environment and has the challenge of achieving a public vision for a 'green and leafy botanic precinct' against a reality that will involve a balance of ecological, landscape design, arboricultural and open space fire management considerations.



6 REVIEW AND IMPLEMENTATION

The Tree Plan guides the management of Royal Botanic Gardens Victoria’s tree collections over the next 20 years. As a document that responds to broader conservation, social and biodiversity aims, and which cares for living plants, it is important that it is reviewed and evaluated.

It is anticipated that the Tree Plan will require a 5–year review, to assess how it has responded to targets, and to realign its aims with the organisation’s mission, broader strategic plans, and plant conservation needs. The entire plan would then be reviewed in 20 years, parallel with related documents such as Master Plans, Landscape Succession Strategy and Living Collections Plans. If circumstances change, such as a new iteration of climate change projections, or a significant shift in resourcing levels, then earlier review may be warranted.



View of the city skyline from the top of Central Lawn, Melbourne Gardens



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7.3. Related Documents

The following is a list of document, policies, and other resources of relevance to the implementation of the Tree Plan

International

- British Standards Institute, 2010, BS 3998:2010 *Tree Work – Recommendations*, BSI Standards Publication, London UK.
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National

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7.4. End Notes

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