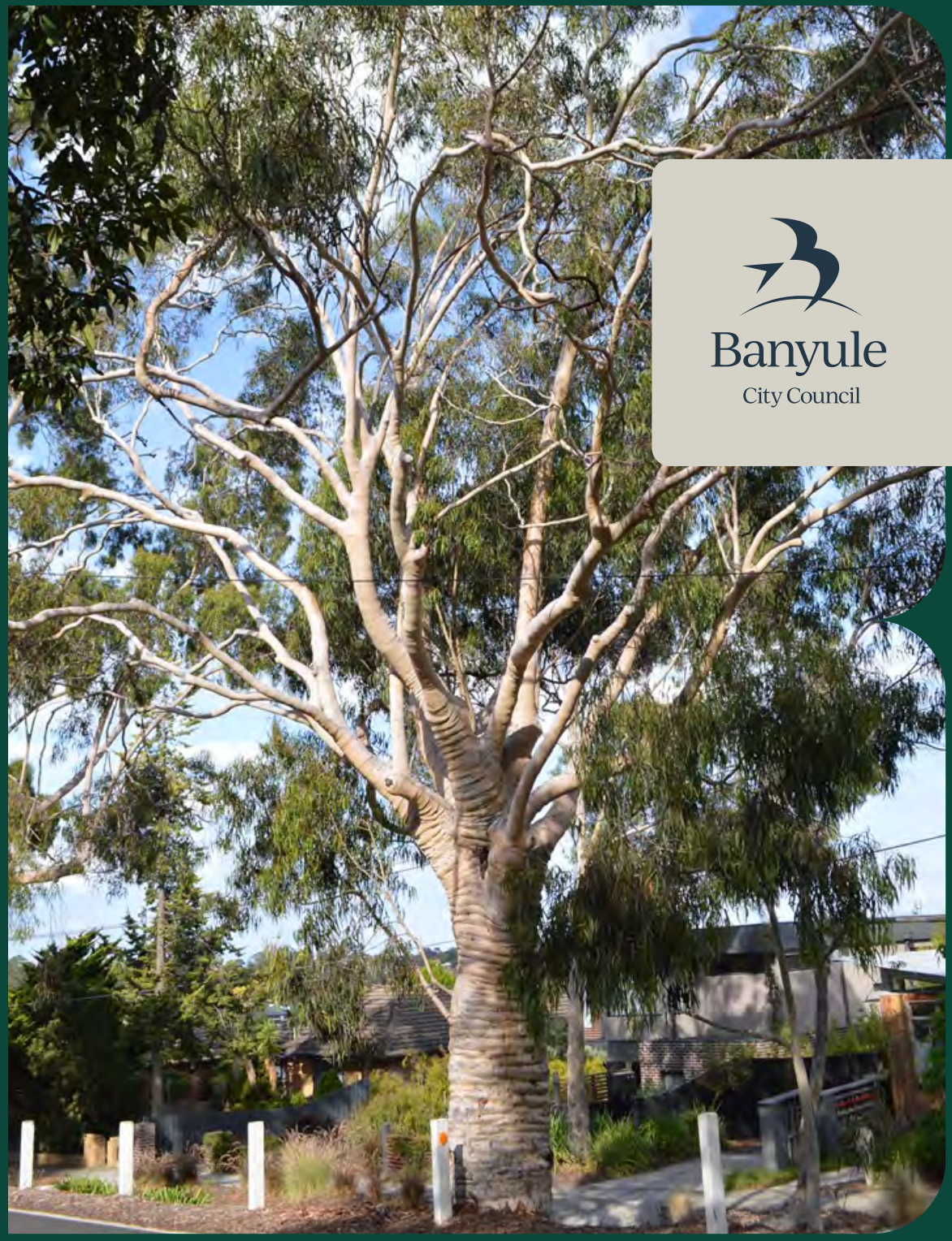
Urban Forest Strategy

Background Technical Report 2023-2033



Banyule
City Council

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Acknowledgements

Banyule City Council is proud to acknowledge the Wurundjeri Woi-wurrung people as traditional custodians of the land and we pay respect to all Aboriginal and Torres Strait Elders, past, present and emerging, who have resided in the area and have been an integral part of the region's history.

Our community is made up of diverse cultures, beliefs, abilities, bodies, sexualities, ages and genders. Council is committed to access, equity, participation and rights for everyone; principles which empower, foster harmony and increase the wellbeing of an inclusive community.

Banyule City Council would like to thank the local residents, organisations and groups who contributed to the development of this Strategy, including the Urban Forest Strategy Community Reference Group and the Banyule Environment and Climate Action Advisory Committee.

Message from the Mayor

Banyule residents have a strong connection to natural and green spaces, including its population of more than 150,000 public trees and many more on private land.

Banyule Council recognises the vital contribution that our urban forest makes to biodiversity and habitat, as well as neighbourhood character and amenity.

With increasing pressures from building growth and climate change, the ecosystem services that these trees provide, including shade and cooling, will be essential to making Banyule a liveable city for present and future generations.

This Urban Forest Strategy has been developed by working closely with the community and undertaking direction to include the community as joint custodians of the urban forest.

It outlines Banyule's vision for the long-term future for the urban forest and provides strategic management actions to get there over the short and medium term. This Strategy will support Council to plan, manage and maintain one of Banyule's highest-valued assets for the next 10 years.

A vision for Banyule's urban forest

This is the long-term community vision for Banyule's future urban forest:

> **Banyule's urban forest is resilient. It is thriving and people are aware and value the role of the urban forest for health and wellbeing and in making Banyule a great place to live.**
>
> **The urban forest is managed as an essential asset for Banyule and decisions about the urban forest are fit for place and purpose, with space provided to support greening and increased tree canopy.**
>
> **People work with Council and are active in the protection, management and maintenance of the urban forest.**

We understand that this vision may not be fully realised for 50 years or more and it describes the far future state of the urban forest for Banyule.

It was developed collaboratively with the community and guides the strategic areas of focus, important areas of work and actions to take over the next 10 years. It was endorsed by Council in February 2022.

We have developed indicators to measure and report on the achievement of this vision. These are outlined in **Section 6**.

What is the urban forest in Banyule?

In February 2022, Council adopted a definition of the urban forest. This definition will assist Council officers and the community to understand the reach of this strategy and consider the urban forest improvements to be made across all areas.

> **Banyule's urban forest is the trees and green assets that exist in the urban area that are strategically planned, designed and managed, and the ecosystems, soils and water that support them.**

This definition highlights that the Banyule urban forest:

- is made up of all trees and green assets (including public and private) that exist in the urban area (not just bushland)
- is a managed asset and therefore not a purely natural system of vegetation
- includes the soils and water needed to support resilience and healthy growth.

Executive summary

Banyule City Council has a long history of valuing and improving its management of the city's urban forest, trees and greening, and developed its first Urban Forest Strategic Plan in 2015. In 2019 Council declared a climate emergency and recognised the need for an updated approach to managing its urban forest.

The Urban Forest Strategy provides a summary of the:

- benefits of the urban forest
- challenges for urban forestry
- current state of the urban forest in Banyule
- strategic framework that will guide action (definition, vision, principles and strategic areas)
- major actions to be taken over the next 10 years
- measures of success.

The Urban Forest Strategy builds on the foundation of the 2015 Urban Forest Strategic Plan (UFSP).

All nine goals set in the 2015 UFSP match to a principle and strategic area in the Urban Forest Strategy.

Of the 40 measures that were identified in the 2015 UFSP:

- 26 are retained and enhanced in the Urban Forest Strategy
- 7 are replaced with an improved alternative target
- 7 are discarded as no longer appropriate.

Of the 94 actions that were set in the 2015 UFSP:

- 15 have been achieved
- 41 are retained in the Urban Forest Strategy
- 34 are replaced with an improved alternative action
- 4 are discarded as no longer appropriate.

The refreshed strategy has been developed with input from a wide range of stakeholders, including the Urban Forest Community Reference Group, Banyule Environment and Climate Action Advisory Committee (BECAAC), councillors, Council officers, other agencies and the wider Banyule community through Shaping Banyule (Banyule's community engagement portal) and public forums.

The feedback from these stakeholders has informed the future direction by:

- clarifying what the term urban forest means for Banyule
- drafting a vision for the urban forest (a 50+ year vision)
- confirming the five principles by which the urban forest will be managed
- developing six key directions with major actions for Banyule
- providing feedback on the actions.

The structure of the Urban Forest Strategy and the relationship of the vision to the measurements of success are in **Figure 1**.

Urban Forest Strategy principles

There are five urban forest principles that provide the focus for Council in the implementation of Banyule's Urban Forest Strategy. These principles were developed collaboratively with the community and councillors and were endorsed by Council in February 2022.

The urban forest principles are:

1. We believe the urban forest is an essential asset for Banyule, shared by all and crucial for the health and wellbeing of the community and natural environment.
2. We believe a healthy urban forest is the result of strong partnerships between Council and community.
3. We act today to respond to the changing climate and to leave a positive legacy for the future community, and we act responsibly, using evidence-based practice in our leadership and management of the urban forest.
4. We plan, design and deliver for the people, places and natural environments of Banyule, including:
    a. Climate change and reduction of the urban heat island effect
    b. Liveability, amenity and neighbourhood character
    c. Banyule's ecosystems and biodiversity
5. We protect and enhance Banyule's natural environment to care for flora and fauna.

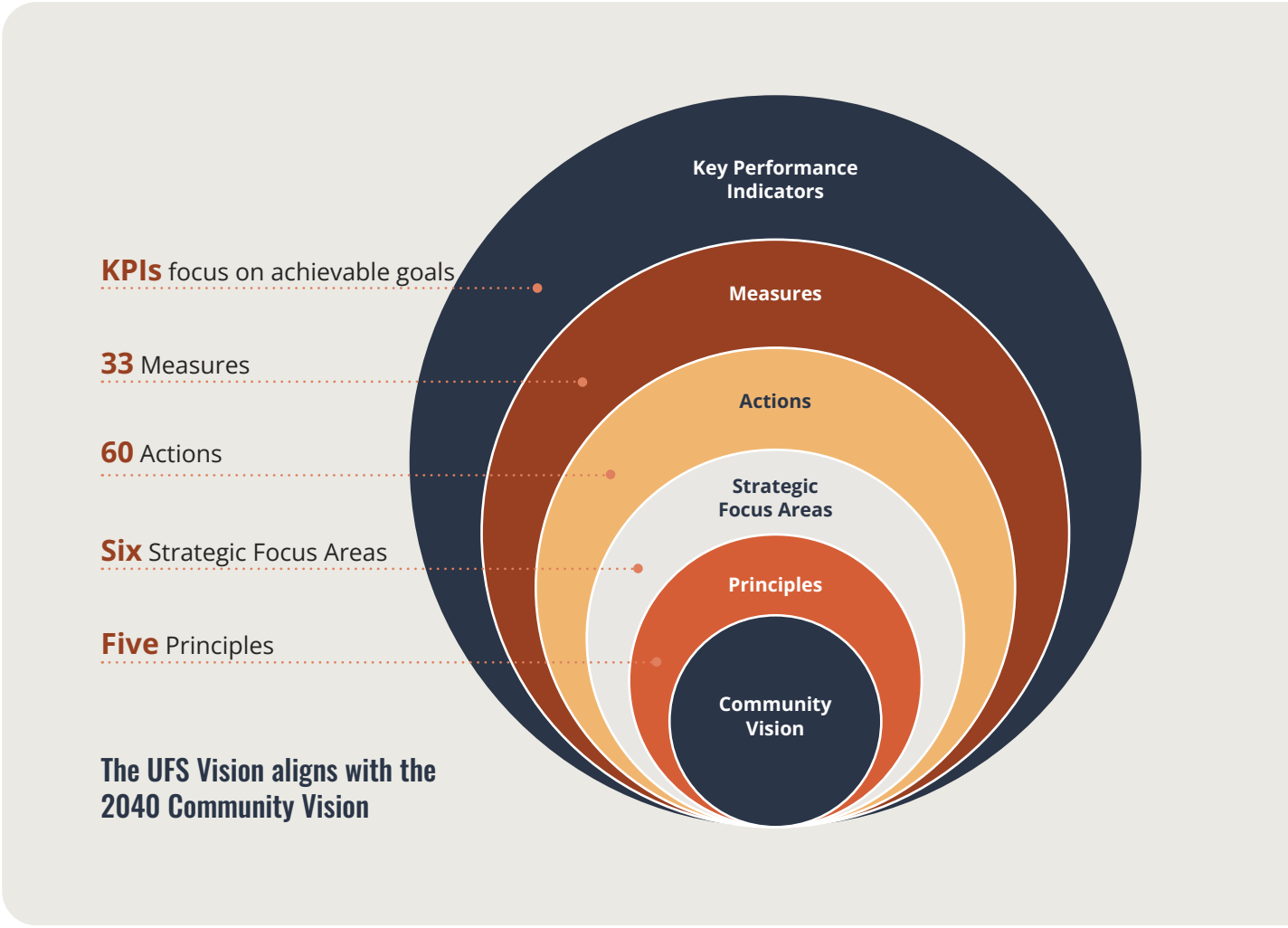


Figure 1. The structure of the Urban Forest Strategy

The Urban Forest Strategy emphasises improving governance and management along with building the capacity of all parts of Council to integrate the urban forest needs into their work. This approach will see greater efficiencies in the planning, design and delivery of infrastructure as green assets are managed alongside and in concert with other non-living (grey) infrastructure.

Urban Forest Strategy focus areas

These six key and strategic focus areas were developed in collaboration with the community and reflect the areas of work most needed to be taken to achieve the Urban Forest Vision.

Each strategic area has a series of major actions to be implemented over the short- and medium-term. Key performance indicators (KPIs) will assist with measuring and reporting on success and supporting a continuous improvement process for the management of the urban forest.

Six strategic focus areas will be delivered using a combination of existing and new staff resources, new grant funding, community and volunteer resources and new initiative funding.

The strategic focus areas are:

1. Prioritise urban forest improvements in the most vulnerable suburbs and places across Banyule
2. Increase the diversity of the urban forest for biodiversity and habitat with ground cover and shrub layer plantings
3. Manage the urban forest across public and private land for resilience to climate change
4. Take a long-term, asset management approach to the urban forest
5. Build and maintain partnerships with others in the protection and management of the urban forest.
6. Integrate urban forest principles in all parts of Council services.

Figure 2 on page 8 illustrates the above framework that underpins the strategic actions proposed in Strategic areas for the Banyule urban forest of the Urban Forest Strategy.

Definition

Banyule's urban forest is the trees and greening assets that exist in an urban area that are strategically planned, designed and managed, as well as the ecosystems, soils and water that support them.

Long-term vision

Banyule's urban forest is resilient. It is thriving and people are aware and value the role of the urban forest for health and wellbeing and in making Banyule a great place to live.

The urban forest is managed as an essential asset for Banyule and decisions about the urban forest are fit for place and purpose and space is provided to support greening and larger tree canopy.

People work with Council and are active in the protection, management and maintenance of the urban forest.

Strategic Areas

- Prioritise urban forest improvements in the most vulnerable suburbs and places across Banyule.
- Increase the diversity of the urban forest for biodiversity and habitat with ground cover and shrub layer plantings.
- Manage the urban forest across public and private land for resilience to climate change.
- Take a long term, asset management approach to the urban forest.
- Build and maintain partnerships with others in the protection and management of the urban forest.
- Integrate urban forest principles in all parts of Council services.

Principles

We believe a healthy urban forest is the result of strong partnerships between Council and community.

We believe the urban forest is an essential asset for Banyule, shared by all and crucial for the health and wellbeing of the community and natural environment.

We act today to respond to the changing climate and to leave a positive legacy for the future community, and we act responsibly, using evidence-based practice in our leadership and management of the urban forest.

We plan, design and deliver for the people, places and natural environments of Banyule including:

- Climate change and reduction of the urban heat island effect
- Liveability, amenity and neighbourhood character
- Banyule's ecosystems and biodiversity

We protect and enhance the Banyule's natural environment to care for flora and fauna.

Figure 2. Framework of the Urban Forest Strategy

Under the six strategic focus areas there are 60 actions described to allow immediate and ongoing work which will respond to the challenge that the urban forest faces, including impacts of climate change and increasing urban development.

With this Urban Forest Strategy, Council will focus its efforts on the actions needed today and over the next 10 years so that by 2033, Banyule is well on its way to achieving the long-term Urban Forest Vision.

We have established 33 measures with reporting intervals to report on the progress towards the vision over the life of the Strategy.

We have also defined Key Performance Indicators (KPIs) to focus reporting on the critical outcomes.

Specific, achievable and timely measures have been set for:

- canopy cover across all suburbs (30% by 2050 with no loss in suburbs exceeding the target)
- canopy cover across the footpath and local road network (45% by 2040 with no loss in suburbs exceeding the target)
- Canopy cover across the open space shared path network and surrounding playgrounds – 50% by 2050

In addition to the metric KPIs, the development of an endorsed tree management framework will include clear and transparent process, procedure and applications, including but not limited to:

- managing tree risk
- processes for removal
- process for reporting and customer engagement
- planning planting and species
- managing complaints and disputes.

This action will integrate existing policy and process and develop new outcomes where gaps exist.

The Urban Forest Strategy will be reviewed every four years with annual results published in Banyule's State of the Environment report.

SECTION 1.
Strategy background

Banyule has inherited an urban forest shaped by many influences, both natural and human. Generations of changing land uses, increased urban development, design and public policy measures have influenced the urban forest that exists today. This Strategy will continue to positively and constructively shape the urban forest to enhance and protect it for future generations.

Banyule's community has clearly set the city's future direction by defining a long-term vision with a 50+ year plan for Banyule.

With this new Urban Forest Strategy, Council is focusing its efforts on the actions we need to take today and over the next 10 years so that by 2033, Banyule is well on its way to achieving the long-term vision. These will influence the future state of the urban forest to the end of the century.

The urban forest in pre-colonial Banyule

The area covered by the municipality of Banyule is on the traditional lands of the Wurundjeri Woi-wurrung People. Over 50 Aboriginal heritage sites have been identified in Banyule, most adjacent to the major waterways of Darebin Creek and the Yarra and Plenty Rivers[1].

Banyule Council's vision for reconciliation, identified in the Innovate Reconciliation Action Plan, is to have a just and equal society where Aboriginal and Torres Strait cultures and heritage are a proud part of our shared national identity.

Banyule continues to work in partnership with Aboriginal and Torres Strait Islander peoples to ensure meaningful relationships are built through shared decision making, fairness, respect and trust.

The development of the city

The 1830s and 1840s saw parts of Banyule become a farming district earlier than most other parts of Melbourne.

In the1840s and 1850s, wooded areas around Heidelberg and further north along the Plenty River were exploited by timber cutters. From the 1870s until the 1950s, quarries operated in and around Heidelberg .

Suburban growth in Banyule was reasonably slow in the late 19th and early 20th centuries. Growth around this time was in the form of large country homes, and smaller stand-alone dwellings, where people were drawn to Banyule for its extant natural beauty. Private greening at this time was influenced by the Garden Suburb movement; this can be seen across Banyule today with the Heidelberg to Eaglemont and Bundoora to Diamond Village to Army Barracks ridgelines.

Suburbia sprawled throughout Banyule from the late 1940s during the post-war housing boom with the development of new affordable homes and large housing estates. Many of the houses were built as 'pre-fab' concrete; early examples of these can be seen in West Heidelberg today. These were often on large blocks, which would later present opportunities for infill development in the early 21st century.

Despite significant interwar and post-war suburban growth, parts of Banyule had a strong drive for tree retention and naturalistic design for homes and gardens. This is evident throughout Heidelberg and pockets of Montmorency and Rosanna today.

The history of the public urban forest can be seen in a rich collection of significant trees and street tree plantings, some from pre-European Banyule, some from early estates and some from more recent plantings.

Remnant scarred trees in what is now Eaglemont and Lower Plenty are surviving pieces of Wurundjeri Woi-wurrung heritage.

Pines, conifers and oaks from Banyule's farming and grazing estate eras remain throughout Heidelberg and Eaglemont. Ornamental pines planted post-war by Italian immigrants are an iconic 20th-century planting that can be seen throughout Ivanhoe[2,3].

Historic urban tree forest management activities and Council initiatives

There is a long history of recognition of the importance of urban forest in Banyule.

Banyule's significant trees were first formally recorded by Warringal Conservation Society, with a focus on trees in Heidelberg that were notable for their size, age, grouping or location.

Banyule City Council later adopted the Significant Tree Register which now falls under the Banyule Planning Scheme.

Banyule's 2013 City Plan, Environmental Sustainability Policy and Strategy and Neighbourhood Character Strategy (2012) both identified the need to protect, retain and manage Banyule's trees. Emerging from the City Plan came the first standalone Urban Forest Strategic Plan (2015).

In 2019 Council declared a climate emergency and set about responding to this and supporting the reduction of greenhouse gas emissions from both Council activities and from the wider community. Community and Council Climate Action Plans were prepared to support the mitigation of emissions with a goal of net zero emissions by 2040.

During this time, it was also acknowledged that the response to climate change must include adaptation and resilience. Resilience has been a seam running through Banyule's strategy work since. Council and the community, in regard to predicted future climates, recognised that the management of the urban forest was critical to adaptation and the future resilience of the community and the built and natural environment.

How this Strategy was developed

The Urban Forest Strategy has been developed in collaboration with a number of stakeholders. Council recognises the important role that other agencies and the community must play in achieving the vision and set about involving these stakeholders at all stages in the project. The flowchart in **Figure 3** outlines the major steps taken to develop this Strategy.

1. Understand current state of the urban forest

We reviewed the current state of the urban forest across Banyule. We looked at the 2015 Urban Forest Strategy and other plans and data that told us what was important for Banyule now and into the future.

2. Drafted early ideas for the Urban Forest Strategy

We reviewed the 2041 Banyule Community Vision themes and strategic objectives as well as the current state of the Banyule urban forest to draft early ideas for action to sustain and grow the urban forest.

3. Engaged with others

We worked with Councillors, the urban forest Community Reference Group, the Banyule Environment and Climate Change Advisory Committee, Council staff and agencies to refine the ideas and establish the draft vision and principles.

4. Developed the urban forest vision + principles

We developed the draft vision and principles that will guide the Banyule urban forest strategy. They were put out to the wider community on Shaping Banyule and input was taken on board. The vision and principles were reported to Council and endorsed in February 2022.

5. Engaged with others

We engaged with all stakeholders to identify the actions needed to be taken by Council and the community to reach the vision.

6. Developed key directions, actions and priorities

We sorted all the action into six key directions and major actions. We developed indicators for success and looked at timing for the actions over the short, medium and longer-term.

7. Engaged with others

We checked in with all stakeholder groups to revise and refine actions and priorities. We posted the draft directions and actions on Shaping Banyule for input from the wider community.

8. Developed Draft Urban Forest Strategy

Figure 3. Steps involved in developing the Urban Forest Strategy

Related Council strategies

Banyule Council has multiple current strategies, plans and programs that are important for supporting a healthy urban forest.

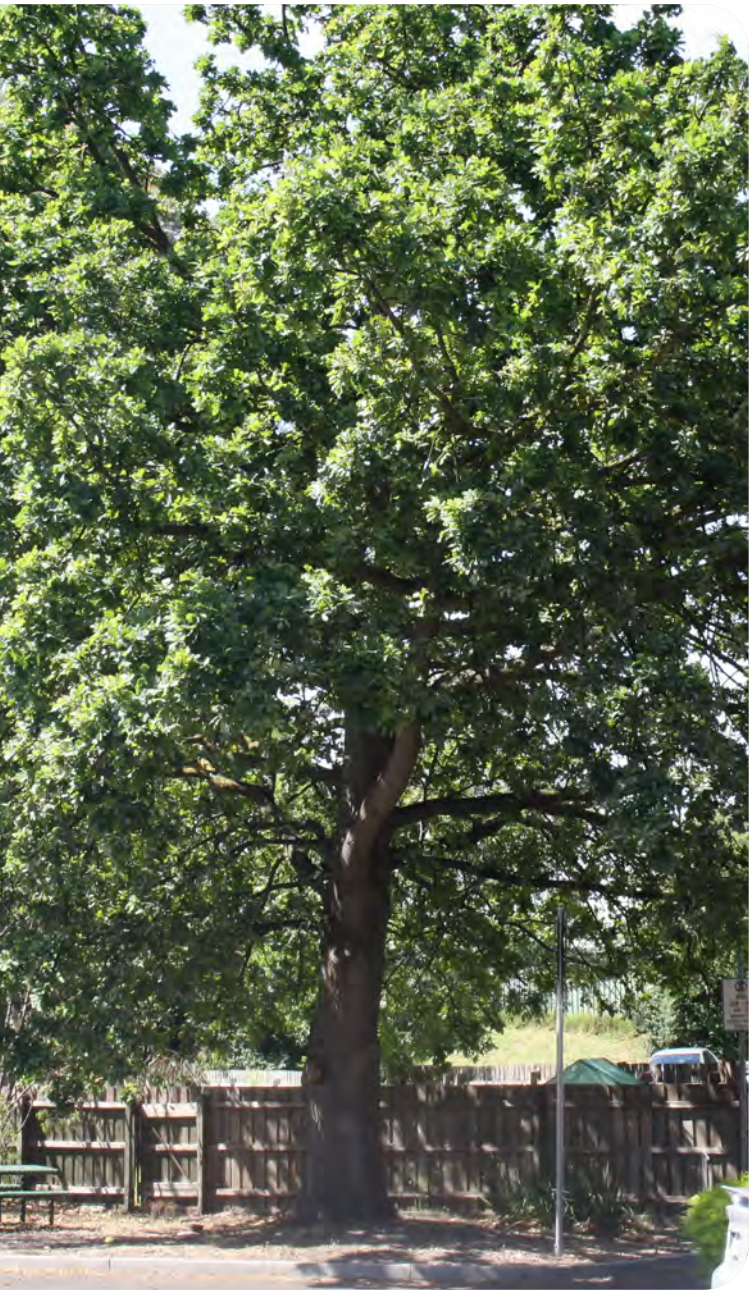
- **Aboriginal and Torres Strait Islander Plan 2017-2021**
- **Actions for zero net emissions 2020-2023**
- **Banyule Bicycle Strategy 2010-2020**
- **Banyule Biodiversity Plan 2019-2022**
- **Banyule Youth Spaces Plan 2021**
- **Community Climate Action Plan**
- **Environmental Stewardship Strategic Plan 2019-2021**
- **Gardens for Wildlife**
- **Integrated Transport Plan 2015-2035**
- **Neighbourhood Character Strategy 2012**
- **Northern Regional Trails Strategy**
- **Public Open Space Plan 2016-2031**
- **Rights of Way Strategy 2014-2024**
- **Safe Travel Plan 2016-2026**
- **Walking Strategy 2018-2028**
- **Water Plan 2019-2023**
- **Weed Management Strategy 2006**

Banyule Council is also a signatory to wider plans that set out commitments and targets for urban greening and positive environmental outcomes:

Living Melbourne – Our Metropolitan Urban Forest

The Northern Metropolitan Framework Plan

The Yarra Strategic Plan (Burndap Birrarung burndap umarkoo) 2022-2032.



SECTION 2.
Why an Urban Forest Strategy?

Local governments around the world are focused on better management of nature in cities and urban areas.

The pressures experienced over the recent years with Coronavirus (COVID-19) lockdowns and more extreme weather as a result of continued climate change have highlighted the importance of healthy and diverse urban vegetation. Trees, canopy, open space and greening are vital for the liveability of cities and the health and wellbeing of the people who live there.

Banyule City Council recognises the value of urban vegetation to the citizens of Banyule and to future generations. We have developed this strategy to present immediate and ongoing action to respond to the impacts of climate change and increasing urban development.

The benefits of urban forests

Although the benefits of urban forests (**Figure 4**) have been a focus of much recent study around the world, the broad benefits of trees and plants in the city are often not known by the wider community.

In this section, we will outline some of the benefits of an urban forest. These underpin the vision, principles and strategic focus areas of the Urban Forest Strategy.

SHADE AND COOLING

Cities and towns frequently experience higher air temperatures than surrounding rural areas due to the Urban Heat Island[4] (UHI) effect.

In these built-up and densely populated urban areas, heat is generated, trapped and stored, creating localised warming. During heatwaves, the UHI effect can not only cause people to feel uncomfortable, but for vulnerable groups[5,6] such as young children and the elderly, it also poses a serious health risk. This risk may lead to health problems such as exhaustion, respiratory illness and heat stroke[7]. As our climate changes, it is expected that in Banyule, heatwaves will happen more often, last longer and be more intense[8].

Increasing the number of trees and other vegetation within the built environment helps mitigate the UHI effect. Through the process of transpiration[9] and the provision of shade, trees help reduce day- and sometimes night-time temperatures.

Trees not only shade streets and footpaths, but their leaves also reflect more sunlight and absorb less heat than built materials reducing the heat absorbed by buildings and roads.

SENSE OF PLACE AND SOCIAL CONNECTION

Access to nature, from large bushland reserves to individual street trees, can have positive effects on people's mental and physical health.

Key social benefits of the urban forest include:

- *Shaping local identity* - Trees and other vegetation define the character and identity of urban places[10]. Trees, whether remnants of the original ecological community or exotics planted in the early settlement of Banyule, contribute significantly to a sense of place. Trees provide seasonal interest, food supply and natural beauty through their interesting colours, shapes, textures of bark, foliage, canopy, flowers and fruit.
- *Improving social cohesion* - Access to trees in green spaces improves various measures of social cohesion including community connection by providing places for events, festivals and celebrations that can bring diverse groups of people together[11].
- *Stress and wellbeing* - Recreation in green space can reduce stress and the psychological toll of urban living and improve mental health[12] among many other health benefits. Access to green space for 120 minutes per week can increase feelings of good health or wellbeing significantly for any age group, including older adults and those with long-term health issues[13].
- *Reducing crime rates* - Increased urban vegetation has been linked to reduced levels of crime.[14]

Figure 4. Benefits of the urban forest for Banyule

HEALTHIER BIODIVERSITY

Biodiversity isn't just about the diversity of trees and their species. A healthy, biodiverse place shows not only a breadth of species, but also a complexity of urban forest structure (such as trees, shrubs, groundcovers). Healthy biodiversity also includes the function (availability of a diverse set of urban forest features which support urban ecosystems, ground cover, tree hollows, feeding and roosting sites), and age, as well as space to allow the urban forest elements to grow, adapt and recover.

Biodiverse, complex and connected plant communities in urban areas are vital to support biodiverse faunal communities and may be far better at supporting humans in Banyule too.

REDUCED POLLUTION

In Melbourne, the main source of air pollution is emissions from vehicles. Combustion (burning) of other fuels (such as gas, wood, and coal) also contributes significantly to poor air quality[15]. Cities are often designed around cars, and there is growing evidence that people travelling outdoors near busy city roads are exposed to high levels of traffic emissions[16].

Creating barriers between roads and people with dense roadside vegetation can shield communities from pollution. Trees and shrubs will assist pollution reduction as part of a road buffer with good structure (understorey and canopy) by reducing particulates such as PM2.5 and PM10[17].

A STRONGER ECONOMY

There are a range of ways that trees contribute to the economies of urban places:

Reducing energy use and costs

When properly placed around buildings, trees can provide significant cooling, thereby reducing air conditioning needs and saving energy[18]. This in turn helps cut energy costs. In 2022 it was found that strategically planting shade trees around buildings can save annual heating and cooling costs by approximately $50-90 per dwelling[19].

Reducing expenditure

Costs of other local government services, such as air pollution removal and storm water infrastructure, can be reduced if trees and greening are present[20], and in some cases, lengthen the lifespan of non-green assets such as asphalt roads by up to 30%[21].

Increasing property values and benefits

The presence of trees in streets and nearby parks can increase residential property values[22]. The benefits of trees to property value are pronounced, with the dollar value of having a leafy street worth double the costs of street tree planting and management[23].

Improving city branding and economic productivity

Green space plays a role in creating a desirable character and city image, encouraging people to live, work and visit, which in turn can increase a city's economic productivity[24].

Better than alternative

Green infrastructure is long-term investment that reduces the need for much greater expenditures in grey infrastructure[25]. An example is using a tree as shade as it has a lifespan greater than 50 years compared with an expensive shade sail that has a much-reduced asset life expectancy and significantly higher installation costs.

Challenges faced by Banyule's urban forest

Of the many challenges facing urban forests and their management, the most widespread and locally important issues for Banyule are climate change, population growth and barriers to forest growth and health.

CLIMATE CHANGE

Climate change is increasing the frequency, severity and duration of heatwaves, droughts and storm events. These changes are likely to have a significant effect on the trees in Banyule's urban forest.

> **48% of species in City of Melbourne were found to be moderately or extremely vulnerable to increasing temperatures predicted for Greater Melbourne**

Heat

Some species that have previously thrived in Banyule may not be able to continue to do so in the decades ahead, and other species may perform better.

Some of Banyule's much-loved tree species, widely planted across our urban areas, do not handle heat well. Trees cool down by losing water from their leaves (evapotranspiration). In doing this, trees also cool the surrounding environment (**Figure 5**). However, when exposed to high or prolonged heat and drought, a tree might suffer modest to extensive dieback (loss of foliage and other outer parts), reducing their ability to cool down. This loss can depend greatly on tree species.

Research undertaken by the School of Ecosystem and Forest Science at the University of Melbourne in 2016[26] found that 48% of the species present in the City of Melbourne, and more than a third of currently planted trees, were moderately or extremely vulnerable to increasing temperatures under a moderate climate change scenario.

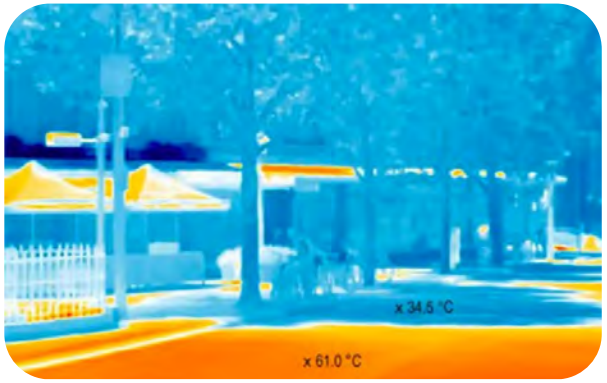


Figure 5. Thermal images taken in a January 2017 heatwave show the impact of urban heat islands in Melbourne. Source: City of Melbourne

Tree canopy has the most significant impact on reducing urban heat while shrubs have a lesser effect. Melbourne has experienced some significant drought and heatwave conditions over the last decade[27]. Trees and canopy, along with water sensitive urban design, can significantly reduce temperatures in urban areas, making it more comfortable for people to move around, socialise and maintain good health and wellbeing[28].

Some of the trees in Banyule will be lost to pests, disease and heat stress in the near future as a result of climate change. This will result in loss of shade and amenity, and contribute to increased maintenance and watering costs. Action on species resilience to climate change ties directly into Banyule's 2019 declaration of a climate emergency[29].

Storms

Climate change brings more frequent extreme weather events. Recent storm events have significantly damaged trees in Banyule (**Figure 6**). Trees that are planted for stability, with appropriate size and feature selection, are best suited to withstand the force of high winds and storms. The physical features of trees, such as size, root structure and branching structure affect how a tree will respond to forces from wind with species being a critical factor.

Figure 6. Banyule Council arborists clean storm damage in Ford St, Ivanhoe. Source: Banyule City Council

POPULATION GROWTH AND URBAN CONSOLIDATION

Up until about 1990, much of Melbourne's residential development consisted of modest-sized detached houses that took up about a third of the typical property lot, and a large backyard[30]. This previously common type of backyard created large areas of private open space that had ecological, cooling, aesthetic and many other benefits.

Urban growth in Melbourne has since trended towards larger houses on smaller plots as well as urban infill in established urban areas. This tendency consolidates the urban population, building more medium to high density development into cities. This sort of growth has reduced garden sizes from the large backyards seen before the 1990s. (**Figure 7**).

Banyule has planning provisions that can assist in protecting the urban forest and replanting trees that are lost due to age, damage and other factors.

Figure 7. Urban development and densification – larger houses on smaller plots and infill housing are eroding the space provided for trees and the urban forest. Source: Banyule City Council

PESTS AND DISEASES

Climate change can alter dynamics of tree pests and pathogens and affect the capacity of forest systems to resist and tolerate attacks.

Figure 8. Myrtle rust (*Austropuccinia psidii*) on Callistemon sp.[31]

Myrtle rust

Myrtle rust is a plant fungal disease. Its presence in Victoria is mainly within commercial nurseries in and around metropolitan Melbourne. When it appears on a plant, it looks like bright yellow egg yolk and is found on the leaf surface.

Myrtle rust threatens trees and shrubs in the Myrtaceae family, which includes Eucalyptus, Angophora and Callistemon species, among many others[32]. It can deform tree leaves, cause leaf loss, reduce fertility, stunt plant growth and result in plant death[33]. Although Myrtle rust has not been detected in Banyule, it is critical that we understand its spread and impact so we can protect the natural environment.

TREE VANDALISM

Trees and vegetation are vandalised when removed, destroyed, pruned or interfered with without permission. Trees, especially public trees, are vulnerable to vandalism. Many mature publicly-owned trees are killed each year throughout Australia[34]. However, young trees are the more common targets of vandalism in the form of theft or destruction.

Figure 9. Tree vandalism

Figure 10. Conflicts with infrastructure means we need to rethink the way we plan and integrate the urban forest with other essential assets. Image Source: ABC Radio Sydney: Fiona Brewer[35]

INFRASTRUCTURE CONFLICTS

Underground and above-ground conflicts for trees are complex and can involve a range of interested parties.

Public space, especially nature strips, needs to be shared by trees with concrete for kerbs and footpaths, utility pipes and wires and for bin collection. Issues or damage can arise when the demands on the space and the tree species are not planned together (**Figure 10**).

Other physical constraints of urban environments on tree planting include:

- conflicting priorities for space such as line-of-sight requirements from pedestrian crossings and streets intersections
- footpath width requirements
- on-street parking requirements (which prevents/ limits planting in the road).

The conditions of weather, soil type and soil volume, aspect, wind and shade can also affect the viability of trees in urban spaces. Providing a tree with the space it needs to grow healthily can avoid conflict with other needs above and below ground.

Figure 11. Poor soil depth, small planting footprint and compacted soils cause damage to footpaths. Source: Banyule City Council

SECTION 3.
Banyule's urban forest today

To plan for the future of the Banyule urban forest, it is important to first understand the current state of the urban forest.

This section explores the state of the urban forest using the available data from Council[36], the Victorian Government (Vegetation Change 2014-2018[37]; Vegetation Extent 2021[38]; Planning Scheme Zones[39]) and the Federal Government Socio-Economic Indexes for Areas (SEIFA[40]) as well as literature on urban forestry. This section provides a snapshot of the current state of Banyule's urban forest.

Banyule's places

The diverse character of Banyule's urban forest and local neighbourhoods means it is important to take a place-based approach to urban forest management. To support this, we have considered the city as a whole, as well as its specific places, such as neighbourhoods, suburbs, natural areas and water catchments.

NEIGHBOURHOOD CHARACTER

Neighbourhood character is the way buildings, vegetation and the topography relate to each other to create a visual sense-of-place. It's what makes one place different from another.

The vegetation and trees that make up the urban forest have a significant impact on character. The Neighbourhood Character Strategy 2012 and Residential Neighbourhood Character Policy assist developers to respect the existing character and/or contribute to the preferred character of an area.

The Neighbourhood Character Strategy lists five types of character areas, each with specific reference to the types of vegetation that contribute to the existing and future desired character (**Table 1** & **Figure 12**).

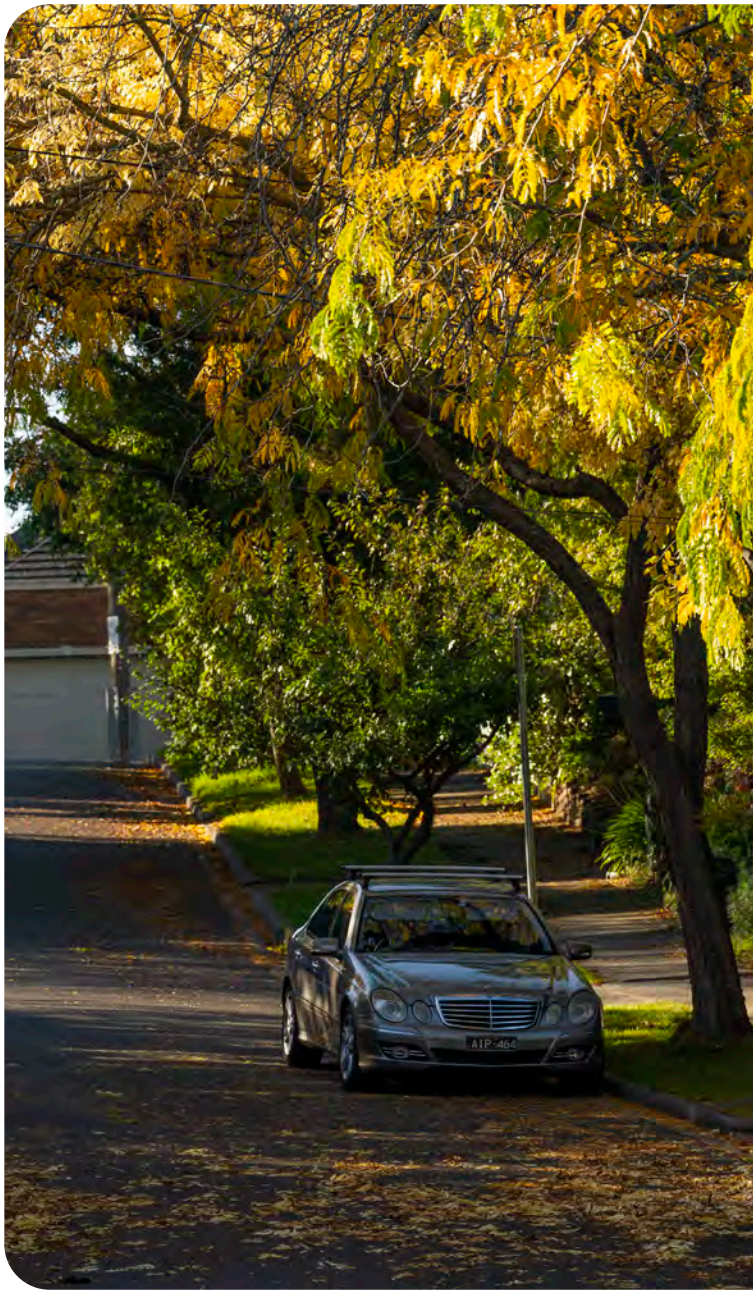


Table 1. Features of the Neighbourhood Character places in Banyule

FEATURES	URBAN FOREST CONSIDERATIONS
GARDEN SUBURBAN	
Occupies most of the Banyule municipality Spacious leafy character Formal garden settings Wide and open street space with mature and exotic vegetation Tree-dominated landscape setting in some streets. Special mention of the Heidelberg to Eaglemont Ridgeline Bundoora to Diamond Village to Army Barracks Ridgeline	Mix of exotic and native Opportunity for range of nature strip gardens (native and exotic) The continuous green, dominant treed canopy and natural vegetated appearance of the ridgelines should be maintained and improved The continuity of the treed canopy should only be punctured by taller developvment at the core of Activity Centres Integrate water sensitive urban design into streetscape and open space plantings
GARDEN COURT	
Occupies a large area of Banyule Spacious, often informal garden settings with a mix of native and exotic plantings Important characteristics of the area are the mature vegetation setting in most of these areas and the tall indigenous native trees that should be retained Bundoora to Diamond Village to Army Barracks Ridgeline	Mix of exotic and native Opportunity for range of nature strip gardens (native and exotic) Courts often have a common identity of vegetation or garden style Courts often have no clear delineation of private garden and public nature strip The continuous green, dominant treed canopy and natural vegetated appearance of the ridgeline should only be punctured by taller development at the core of Activity Centres Integrate water sensitive urban design into streetscape and open space plantings

FEATURES	URBAN FOREST CONSIDERATIONS
BUSH GARDEN	
There are three areas of Bush Garden neighbourhoods across Banyule Stands of substantial large native trees Important characteristics of the area are the canopy of indigenous and other native vegetation Trees and other vegetation dominate the street scene and many longer distance views Dwellings sit beneath the tree canopy, within established gardens The Foothills Ridgeline runs through the Semi Bush Area	Use of local and native species should be preferenced in public plantings Opportunity for habitat nature strip and open space gardens and ecological corridors Encourage through advocacy the planting of indigenous plants on private property Removal of large trees should be avoided The continuous green, dominant treed canopy and natural vegetated appearance of the ridgeline should be maintained and improved Integrate water sensitive urban design into streetscape and open space plantings
SEMI BUSH	
There are two areas of semi-bush neighbourhoods in Banyule separated by a large Bushland neighbourhood character zone Highly valued native vegetation-dominated residential environments At risk of more intense development Important characteristics of the area are the canopy of indigenous trees and abundant vegetation Trees and other vegetation dominate the street scene and many longer distance views The Foothills Ridgeline runs through the Semi Bush Area	Use of local and native species should be preferenced in public plantings Opportunity for habitat nature strip and open space gardens and ecological corridors Encourage through advocacy the planting of indigenous plants on private property Removal of large trees should be avoided The continuous green, dominant treed canopy and natural vegetated appearance of the ridgeline should be maintained and improved Integrate water sensitive urban design into streetscape and open space plantings

FEATURES	URBAN FOREST CONSIDERATIONS
BUSH WOODLAND	
Two areas in the southeast of Banyule Rural, undeveloped character with significant indigenous vegetation Farmland landscape character: meandering or straight country roads without kerbs Important characteristics of the area are the dominant landscape setting of rolling hills and the Yarra River flood plain, together with remnant indigenous vegetation	Mixed use of natives and exotics – use of local native species should be preferenced in public plantings Opportunity for habitat nature strip and open space gardens and ecological corridors to join pockets of bushland and open spaces Encourage through advocacy the planting of indigenous plants on private property Retain unformed kerb and gutter and integrate water sensitive urban design with urban forest management Removal of vegetation should be avoided The continuous green, dominant treed canopy and natural vegetated appearance of this ridgeline should be maintained and improved Integrate water sensitive urban design into streetscape and open space plantings

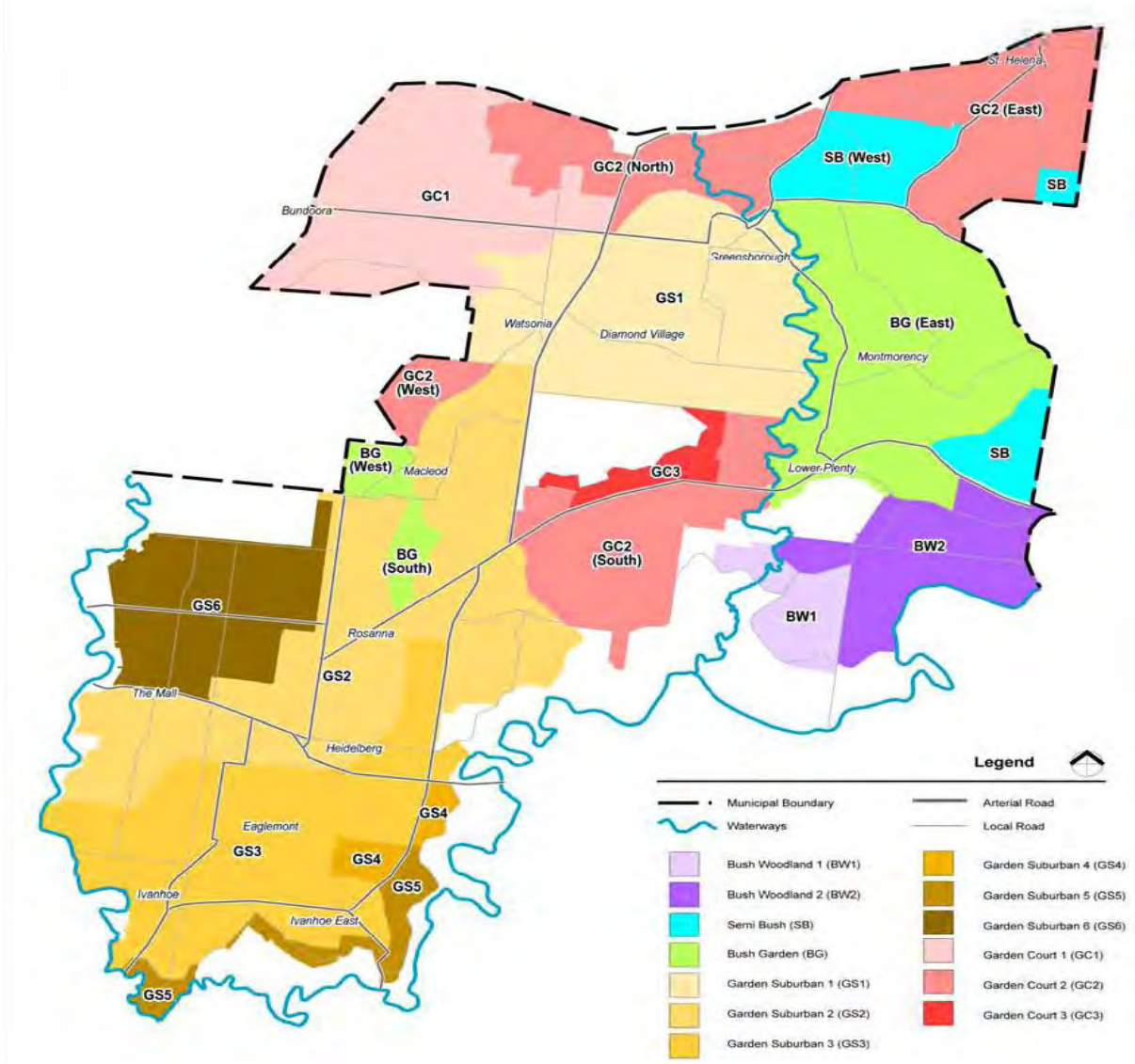


Figure 12. Banyule's Neighbourhood Character Precincts

Tree canopy cover in Banyule

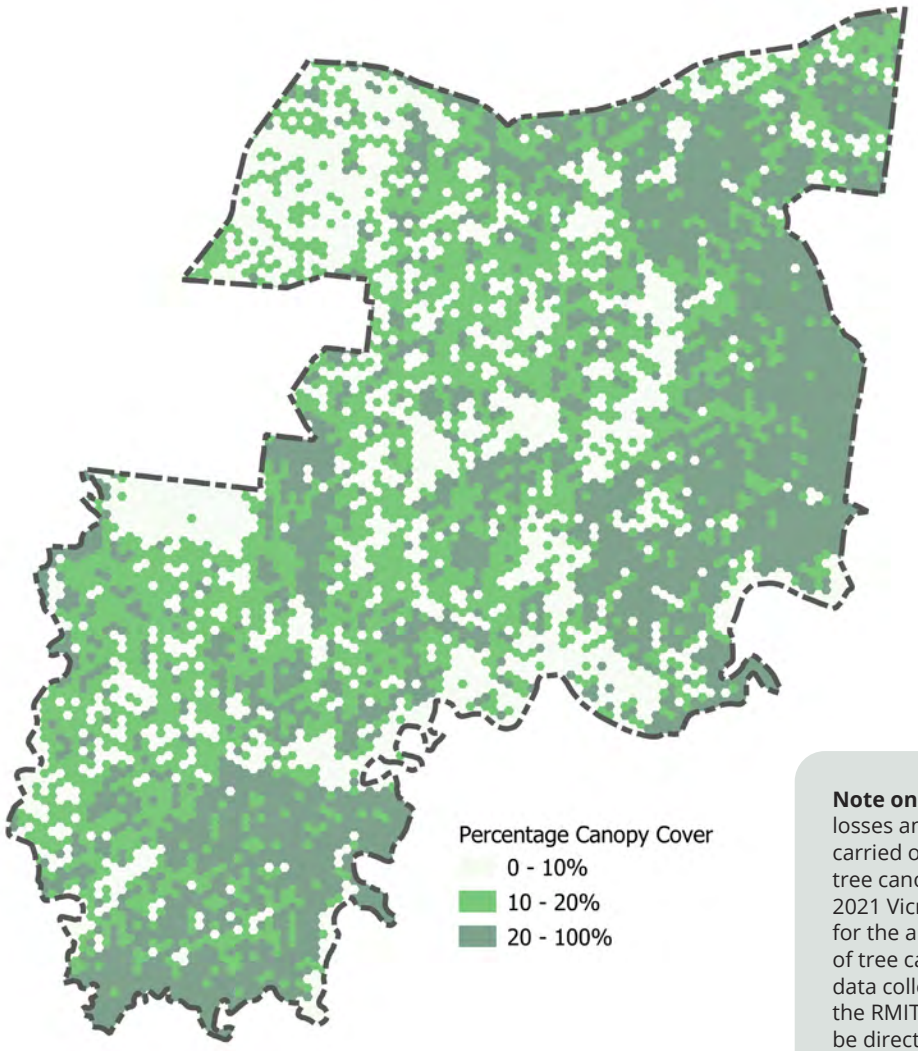
Areas of Banyule with the lowest canopy cover are in the north-west and south-west parts of the Local Government Area

DISTRIBUTION OF CANOPY COVER

The urban forest canopy is not evenly distributed across Banyule (**Figure 13** and **Figure 14**).

Data provided by the Victorian Government show that residential areas with lowest canopy cover are in the north-west of Banyule, in particular Bundoora. The Heidelberg West Business Park has very low canopy cover, typical of industrial estates across Melbourne.

The southern area of Lower Plenty encompasses the floodplain of the Yarra River which is still used for grazing and is the location of a golf course. Both these land uses have low levels of canopy cover. Typical streetscape images of these areas are provided at **Figure 15**.



Note on data:The analysis on losses and gains in canopy was carried out using a different tree canopy data set than the 2021 Vicmap Vegetation used for the analysis of distribution of tree canopy. The different data collection methods mean the RMIT analysis cannot be directly compared to the Vicmap Vegetation data set.

Figure 13. Tree canopy cover across Banyule. Cover is averaged to hexagonal mesh with 100 m long sides. Suburb boundaries are represented by thin black lines. Data collected, quality assured and supplied by the Victorian Government as part of the Vicmap data set released in 2021[41]

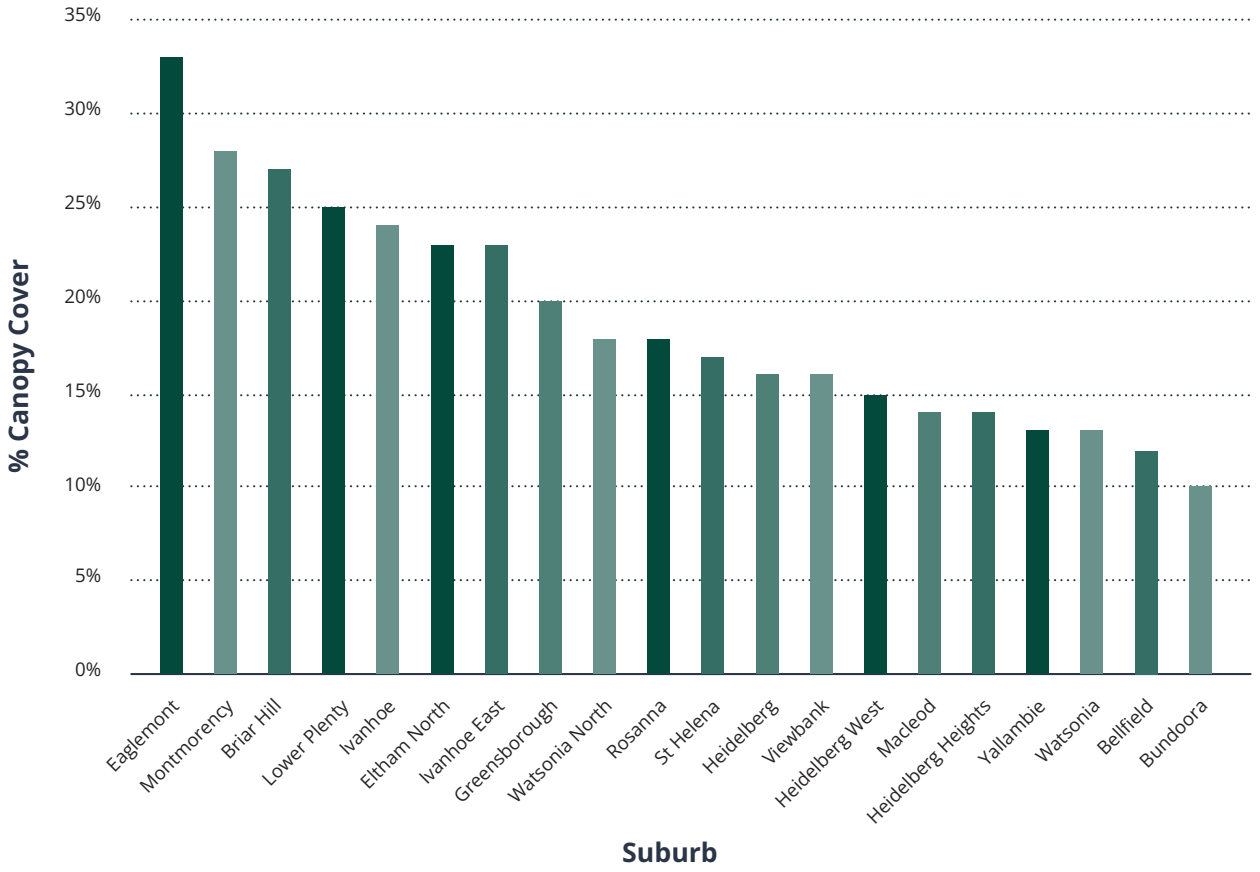


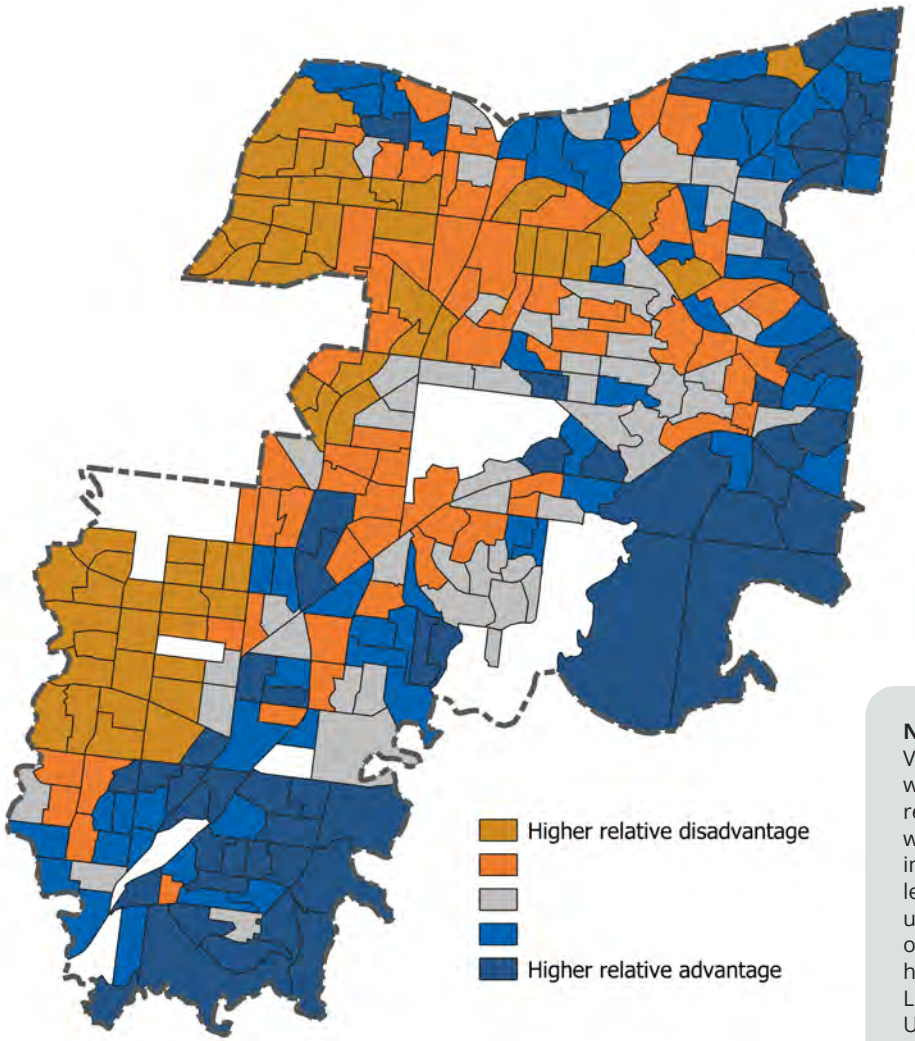
Figure 14. Tree canopy cover by suburb. Data collected, quality assured and supplied by the Victorian Government as part of the Vicmap data set released in 2021[43]

Figure 15. Images from areas of Banyule with low canopy cover: Taunton Drive in Bundoora (top), Orthla Avenue in Heidelberg West (middle) and Orsova Court in Bundoora. Source: Google Maps

Urban forest equity

The uneven distribution of canopy means the benefits of the urban forest are not felt equally across the population. This is problematic when low canopy cover coincides with the location of more vulnerable communities.

The distribution of social advantage and disadvantage across Banyule using SEIFA can be seen in **Figure 16**. The spatial distribution of SEIFA (the Socio-Economic Indexes for Areas, and the Index of Relative Social Advantage or Disadvantage (IRSAD)[42]) in Banyule shows that areas of disadvantage are concentrated in the western areas of Banyule, in particular Bundoora, Watsonia, Heidelberg West, Heidelberg Heights and Bellfield. Greensborough has a mixture of advantage and disadvantage, and most of the eastern area of Banyule shows relative social advantage with respect to Victoria as a whole.



Note on data: Vicmap Vegetation Tree Urban was constructed from high resolution aerial photography which was used as the source information and a machine learning technique was utilised to extract the location of individual trees. A canopy height model derived from LiDAR which covered the tree Urban extent was used to assign height to each of the mapped trees.

Figure 16. Map of SEIFA in Banyule. The red and orange areas have a higher social disadvantage relative to other parts of Banyule and Victoria. The blue parts of this map are areas of relative social advantage.

Combining the canopy cover data with SEIFA shows a relationship between social disadvantage and tree canopy cover. The results show that the most advantaged communities have the highest level of canopy cover, with a general trend towards lower canopy with higher levels of disadvantage (**Figure 17**).

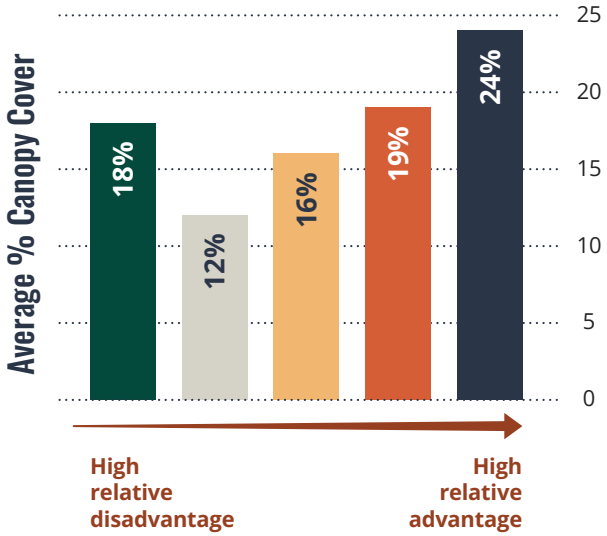


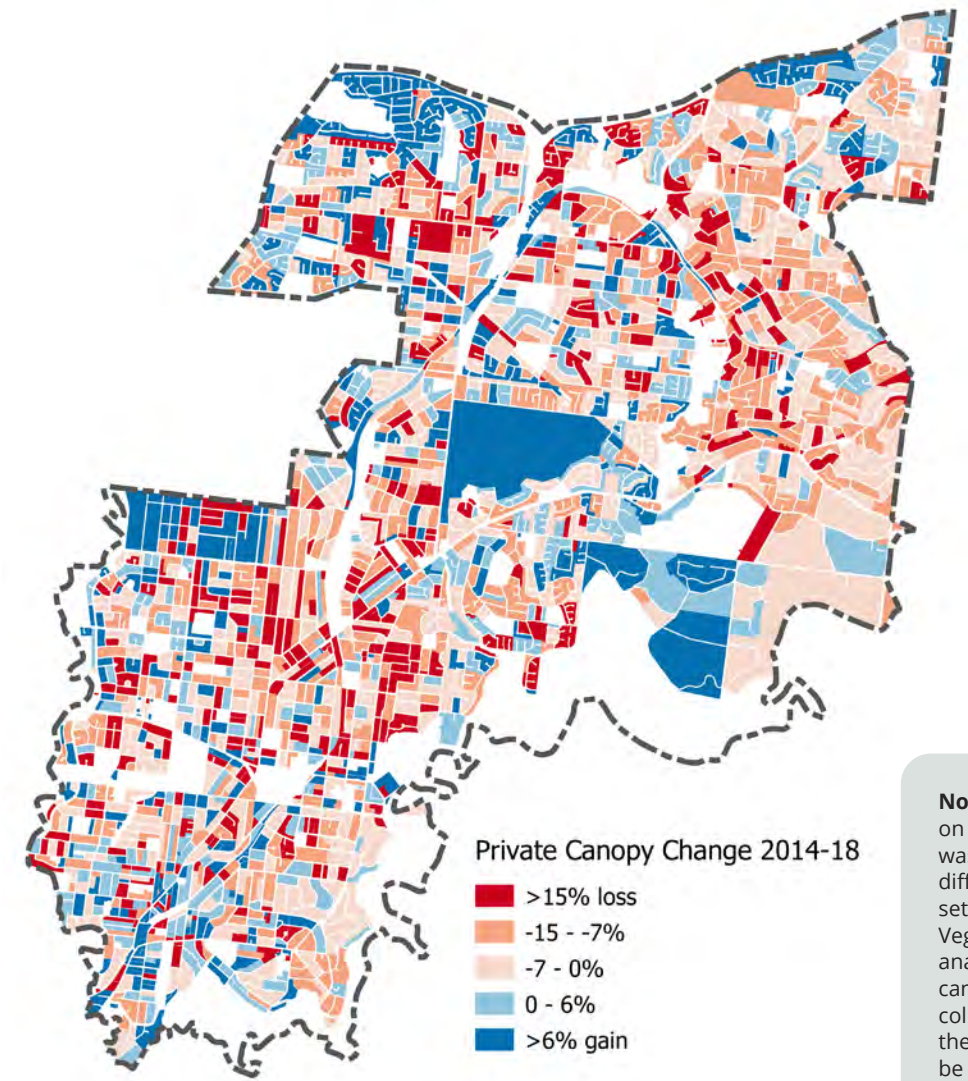
Figure 17. Percentage tree canopy cover by SEIFA

HOW IS CANOPY COVER CHANGING ACROSS BANYULE?

> **Banyule had a net loss of canopy between 2014 and 2018, but there was a net gain on public land**

This can be seen using data that was generated in a 2019 RMIT University report that assessed changes in urban forest canopy between 2014 and 2018[43]. This analysis combined Australian Bureau of Statistics (ABS) data with Commonwealth Scientific and Industrial Research Organisations (CSIRO's) imagery-based classification of varied land surfaces (e.g., roofs, vegetation lawns)[44] to assess change in canopy cover and the relationship between any observed change and land-use categories.

Most of the loss occurred across private land and 97% of the private canopy loss was on residential land. There was a net gain in public canopy over this time (16%), but not enough to balance the canopy losses on private property.



Note on data: The analysis on losses and gains in canopy was carried out using a different tree canopy data set than the 2021 Vicmap Vegetation used for the analysis of distribution of tree canopy. The different data collection methods mean the RMIT analysis cannot be directly compared to the Vicmap Vegetation data set.

Figure 18. The change in canopy cover between 2014-2018 on private land in Banyule (RMIT 2019)

Canopy over footpaths and local roads

Trees in streets provide shade for daily activities and influence the way that people access and experience active travel options such as walking and cycling[45].

Shade from trees provides protection from UV exposure and a comfortable walking environment[46]. Closely spaced shade trees are described as an essential ingredient for designing 'walkable communities for pedestrians'[47]. Street trees also make a substantial contribution to the visual attractiveness of the streetscape and provide important habitat and movement pathways for animals. The value the community places on trees in streets is reflected in the higher prices paid for houses on leafy streets[48].

The current extent of tree canopy cover of public footpaths across the city was measured by analysing data sets that map the current urban forest canopy (using 2020 DELWP data) and footpaths along streets and in parks and reserves. Canopy cover was determined as the extent of canopy polygons sitting over footpath polygons. Tree canopy over footpaths ranges from 24.9% in Bundoora and 26.2% in Bellfield up to 41.4% in Ivanhoe East and 51.1% in Eaglemont.

Figure 19 and **Figure 20** show low canopy in the streetscape of Bundoora. **Figure 21** shows the impact of shaded streetscape in Ivanhoe East which is more amenable to walking.

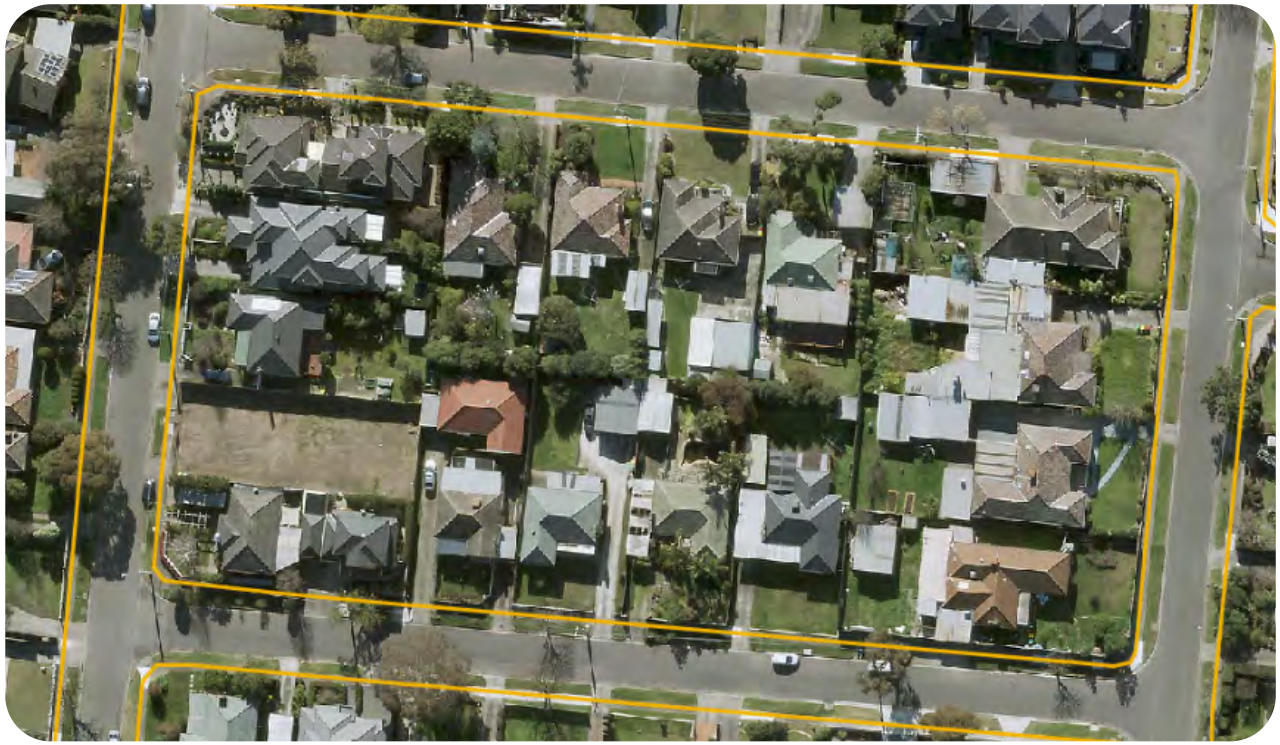


Figure 19. Poorly shaded footpaths in Bundoora. Source: Banyule City Council

Figure 20. Streetscape view of poorly shaded footpaths in Bundoora. Source: Google Maps

Figure 21. Streetscape view of well shaded footpaths in Ivanhoe East. Source: Google Maps

Diversity and age of public trees

DIVERSITY OF SPECIES

Overall, Banyule's species-level diversity at the whole of city area is healthy. **Figure 22** shows the current diversity of species in Banyule's recorded public street tree population (note: current tree records focus on street trees and high use parks, with most of the city's natural area park trees yet to be included in the inventory).

The data shows that of the five dominant species, no single species contributes more than 7% of the public tree inventory.

The most dominant tree is *Eucalyptus melliodora* or Yellow Box, with 6% of the recorded population (7500 out of 125,000 trees).

While the overall diversity of the urban forest tree population is good, there are some neighbourhoods where street trees are much less diverse. In the Semi Bush and Bush Woodland precincts, more than 25% is made up of *Eucalyptus melliodora.*

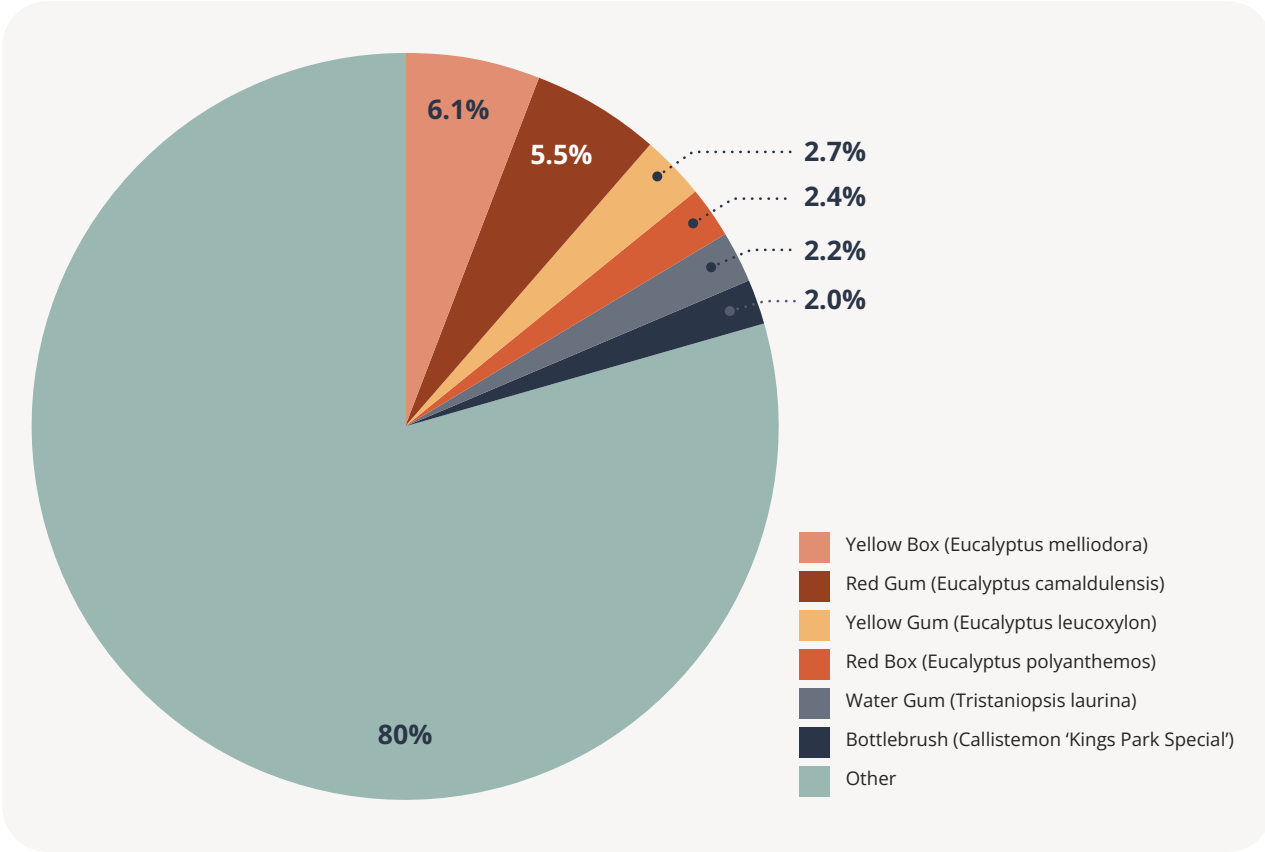


Figure 22. Public tree species in Banyule, based on analysis of Council's tree inventory which includes all street trees and some park trees.

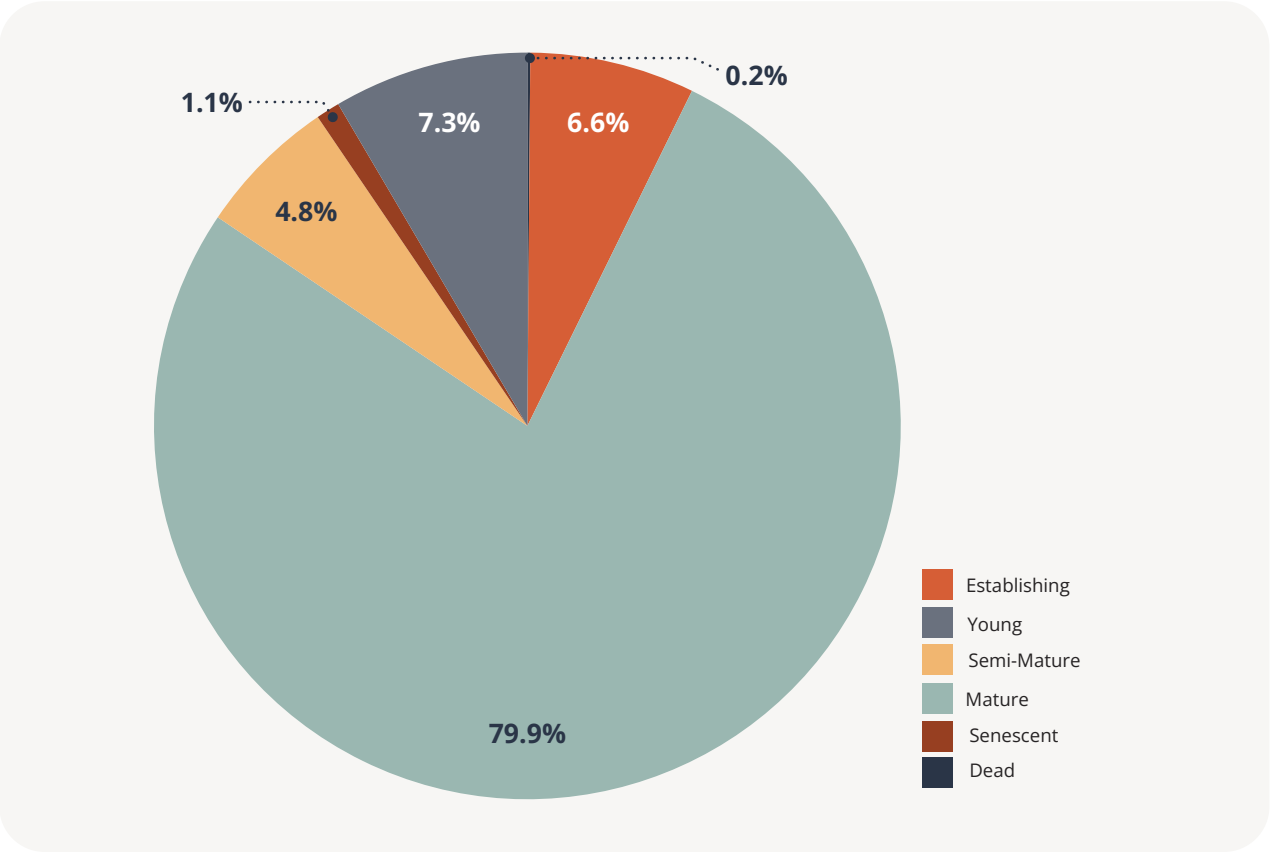


Figure 23. Public tree age across Banyule, based on analysis of Council's tree inventory which includes all street trees and some park trees.

DISTRIBUTION OF AGE

Figure 23 shows the age of public street trees across Banyule. There is not available data for date of planting prior to 2016, so tree age has been estimated.

The majority of trees in the '*mature*' or younger category have an estimated lifespan of over 30 years. Most trees that are in the '*senescent*' category are shorter lived, with a lifespan of less than 30 years.

Most of the street trees in Banyule are mature, a phenomenon seen across each of Banyule's neighbourhoods. In part by nature of their large area, the Garden Court and Garden Suburban Precincts contain the majority of these aging trees.

Climate vulnerability

The impact of climate change on the vulnerability of the most common trees in Banyule is illustrated in **Figure 24**. This projected vulnerability is based on climate vulnerability data used to assess the City of Melbourne's street tree climate vulnerability[49] and CSIRO's climate analogues[50] (**Table 2. Climate change scenarios**).

The analysis shows that under an extreme climate change scenario (3°C increase in mean annual temperature by 2090), common trees that are well adapted to the present climate will become very vulnerable to future conditions.

> **Under an extreme climate future (3°C increase in mean annual temperature by 2090), 40% or more of the public tree population would have moderate to high vulnerability to projected climate change.**

Under a more moderate climate scenario, over 20% of the most common tree individuals may show increased vulnerability to climate change.

Table 2. Climate change scenarios

CURRENT CLIMATE

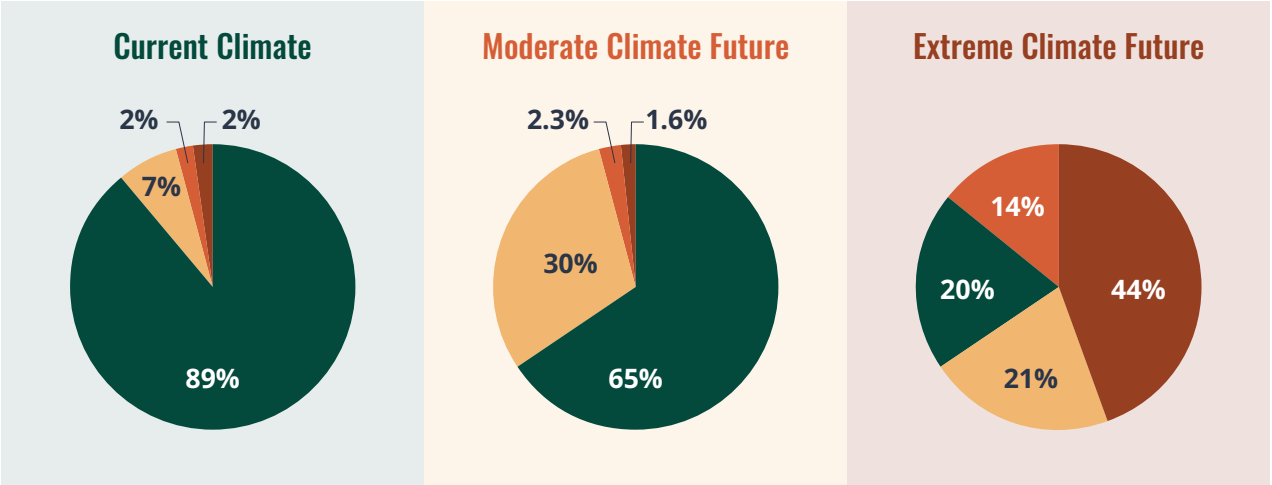
- *Mean annual temp 16.4°C*
- *Extreme maximum temperature 44°C*
- *Extreme minimum temperature of -2.4°C*

MODERATE CLIMATE CHANGE SCENARIO

- 0.8 °C increase in mean annual temperature to 17.2°C
- 0.5 °C increase in extreme maximum temperatures 44.5°C
- 0.5 °C increase in extreme minimum temperatures to -1.9°C
- **Climate changing to resemble Albury-Wodonga**

EXTREME CLIMATE CHANGE SCENARIO

- 3 °C increase in mean annual temperature to 19.4°C
- 2 °C increase in extreme maximum temperature to 46°C
- 2 °C increase in extreme minimum temperature to -0.4°C
- **Climate changing to resemble inland NSW towns of Dubbo, Parkes and Forbes**



KEY: The colours in the charts represent different levels of vulnerability to increased temperatures under different climate scenarios.

Green – species in this group are not considered vulnerable in each climate scenario. The proportion of species in Banyule in this group declines from 89% to 20% in the extreme climate future.

Amber and **amber-max** – species in this group are moderately vulnerable in each temperature scenario. The proportion of species in this group increases from 99% in the current climate to 35% to 32% in the moderate climate future.

Red – species in this group are very vulnerable in each temperature scenario. 44% of the 30 most common species in Banyule would be very vulnerable to climate change, and 35% would be moderately vulnerable.

Figure 24. Vulnerability of Banyule's current public tree composition to climate change, given different scenarios

A Powerful Owl in a Banyule tree Image credit: banyule.vic.gov.au/Events-activities/Whats-on/Council-events/Biodiversity-photo-contest

SECTION 4.

Where is Banyule's urban forest most vulnerable?

A central tenet of the Urban Forest Strategy is that actions should target places in greatest need. To determine where these places are, we looked at the available data to assess the areas of highest need i.e. those that were most vulnerable.

Determining high priority places

There are many ways to define where both the urban forest and the community are most vulnerable and where priority action is needed. Spatial analysis using overlaying data about vegetation in an area and how the community uses that area, is one way we will rank the importance of action in different areas.

Having access to good quality, well-collated data about the trees and vegetation and their urban environment is critical to the delivery of best practice urban forestry[51]. Banyule, the Victorian Government and others have a range of data available that has assisted with the analysis of urban forest vulnerability in Banyule. As data improves, the accuracy of prioritisation will improve.

Data for this analysis has come from:

- Banyule's Tree Inventory (2021)
- Vicmap Vegetation Tree Extent Data (2021)[52]
- Victorian planning scheme zones (2022)[53]
- Socio-Economic Indexes for Areas SEIFA (2016)[54]
- Metropolitan Melbourne Heat Vulnerability Index (2018)[55]
- Victorian Planning overlays, specifically Land Subject to Inundation Overlays (LSIO) and Urban Floodway Zone (UFZ) (2022)[56]

PRIORITISATION MATRIX

A draft prioritisation matrix has been applied to a series of urban forest data to demonstrate the approach and results. The matrix proposes a method to collate and assess climate, urban forest and socio-economic data (historic, current and emerging) to assign weightings against actions.

The matrix is intended to be used as living tool and will be periodically reviewed to refine its application against emerging data and trends.

While there are many elements that could be included in the matrix, the following six elements of the urban forest were considered important to assess priority places for Banyule. The features characterising areas considered more vulnerable or more in need of urban forest action are in brackets.

- Existing canopy cover (Low canopy cover)
- Socio-economic disadvantage (High levels of socio-economic disadvantage)
- Biodiversity (Low levels of biodiversity/habitat)
- Urban heat islands (High levels of urban heat)
- Walking routes (Priority walking and cycling routes present and opportunities for connectivity)
- Flooding hot spots (Nuisance flooding)

Other factors that can be included in the prioritisation matrix in the future include:

- Places with capacity for storm buffer/wind break
- Places that can accommodate large trees
- Relative diversity of tree species
- Trees reaching the end of their life (useful life expectancy - ULE)
- Areas with upcoming maintenance activities or capital works planned e.g. roads, footpaths, traffic calming infrastructure
- Active Transport Routes, such as shared user trails
- An intersectional Gender Impact Assessment (GIS)

EMERGING PRIORITY PLACES FOR URBAN FOREST ACTION

The analysis of data using the draft prioritisation matrix shows that the high priority areas for intervention and urban forest improvements, as shown in **Figure 25**, are:

- Bellfield
- Bundoora
- Eltham North
- Greensborough
- Heidelberg
- Heidelberg Heights
- Heidelberg West
- Ivanhoe
- Viewbank
- Watsonia

These suburbs have a range of factors to make them priorities. For example, Bundoora has low canopy cover and higher disadvantage while areas of Ivanhoe East are prioritised for their pedestrian activity, urban heat and proximity to biodiversity areas. Greensborough, Watsonia and Yallambie have lost significant areas of vegetation since the canopy baseline was taken, due to the construction of the North East Link project. Re-establishing that canopy will require large efforts by the Victorian Government in coordination with Banyule.

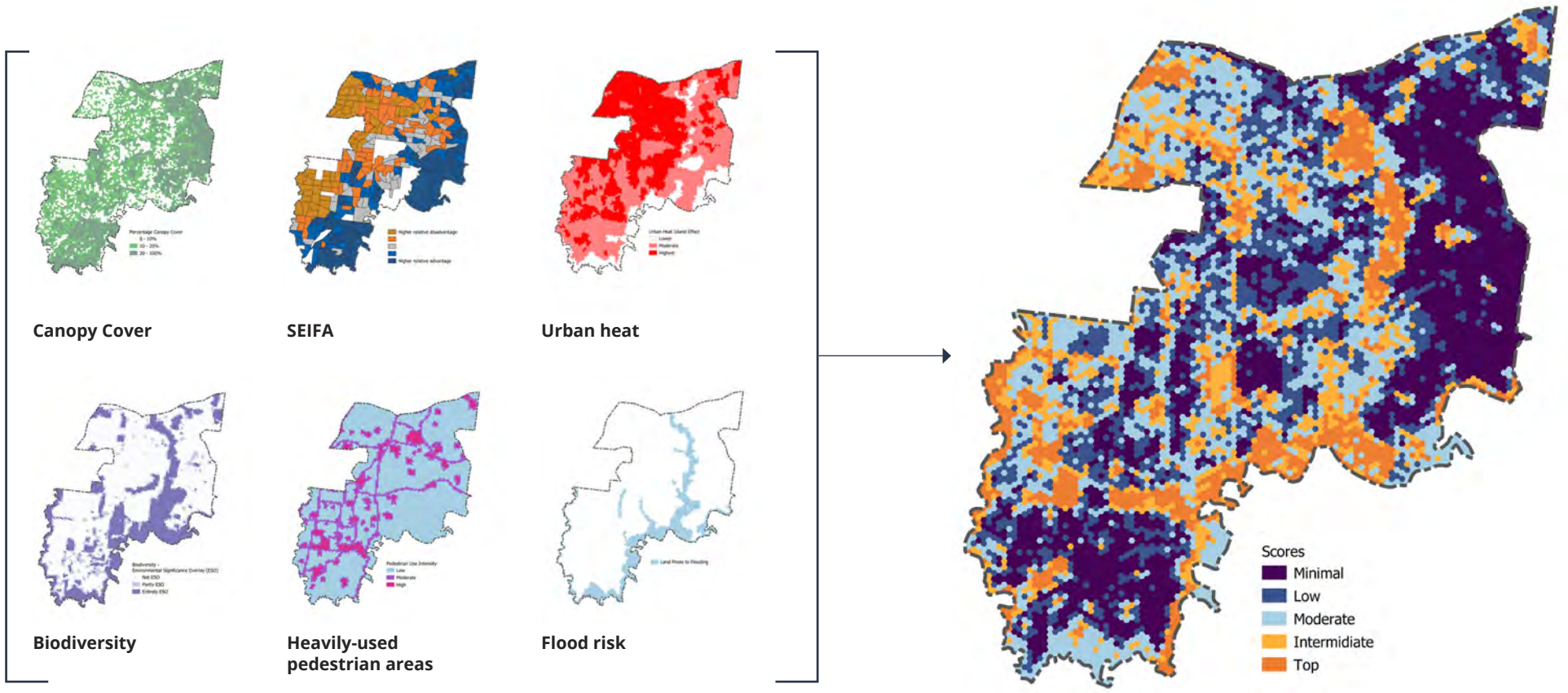
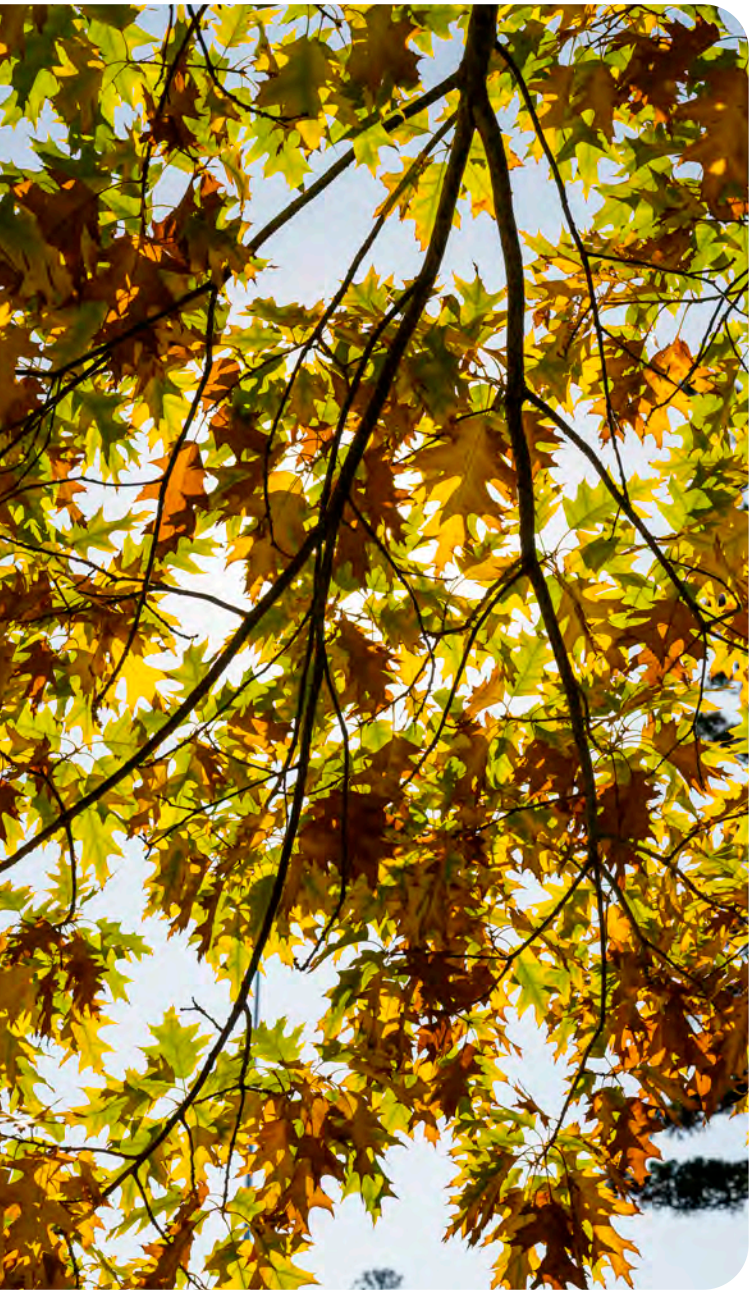


Figure 25. Draft spatial prioritisation of urban forest actions in Banyule with equally weighted factors

Strategic Area 1 – Prioritise urban forest improvements in the most vulnerable suburbs and places has a number of actions to formalise this approach, including developing an agreed weighting of the factors, the need to align action plans with the prioritisation and the periodic review of the matrix as new data becomes available.



SECTION 5.
Monitoring and evaluation of this Strategy

This Urban Forest Strategy has been prepared with a vision for the far-future (50+ years) and with a set of principles, strategic focus areas and major actions to be implemented over a 10-year period.

The implementation of the Strategy is to be managed by the Parks and Natural Environment department, however there is a role for all areas of Council. Being accountable to the community on the delivery of the Strategy is to be done through measures of success that will be reported, with the timeframes and data sources detailed later in this document.

It is recommended that the Strategy is reviewed after five years to assess, refine and update major actions.

It is important that Council can track its progress towards the Urban Forest Vision, against the achievement of the ten-year strategic areas and against the major actions.

To support the monitoring and evaluation of the Strategy, there are three scales of measures:

1. A series of **Key Performance Indicators** (KPIs) – to be measured throughout the life of this Strategy
2. A series of **indicators** to measure progress on the Vision – these are to be measured throughout the life of this Strategy and beyond
3. A series of **measures** that have been carried over from the 2015 Urban Forest Strategic Plan

Key Performance Indicators of major actions

To drive the performance of the Strategy, three **Key Performance Indicators** (KPIs) are used:

1. Canopy cover across all suburbs - 30% by 2050 with no loss in suburbs exceeding the target
2. Canopy cover across the footpath and local road network - 45% by 2040 with no loss in suburbs exceeding the target
3. Canopy cover across the open space shared path network and surrounding playgrounds – 50%by 2050

SUBURB CANOPY COVER TARGET

Banyule has committed to achieving 30% canopy cover across all suburbs by 2050.

With the principle that the urban forest should be shared by all the communities in Banyule, this level of canopy cover should be the minimum target for all suburbs, not just for Banyule as a whole. **Figure 26** shows the current canopy cover in Banyule's suburbs and the results of modelling additional canopy gain from new and vacant street tree plantings.

Although one suburb currently exceeds the 30% target, and some only require a small addition of canopy by 2050 to achieve the target, the majority of Banyule suburbs need substantial increases over current canopy to achieve the target of 30%.

Major canopy gain outside of street tree and open space planting is required to achieve the target.

The additional canopy needed to reach the desired 30% target across all suburbs will need to be met through:

- Private land canopy gain and gains on land held by other authorities
- Growth of canopy from existing established trees
- Growth of canopy in open space and Council-managed sites from the established trees
- Changing the way that public trees are planted in roadways and other Council land that would require significant infrastructure changes to give them more space and water.

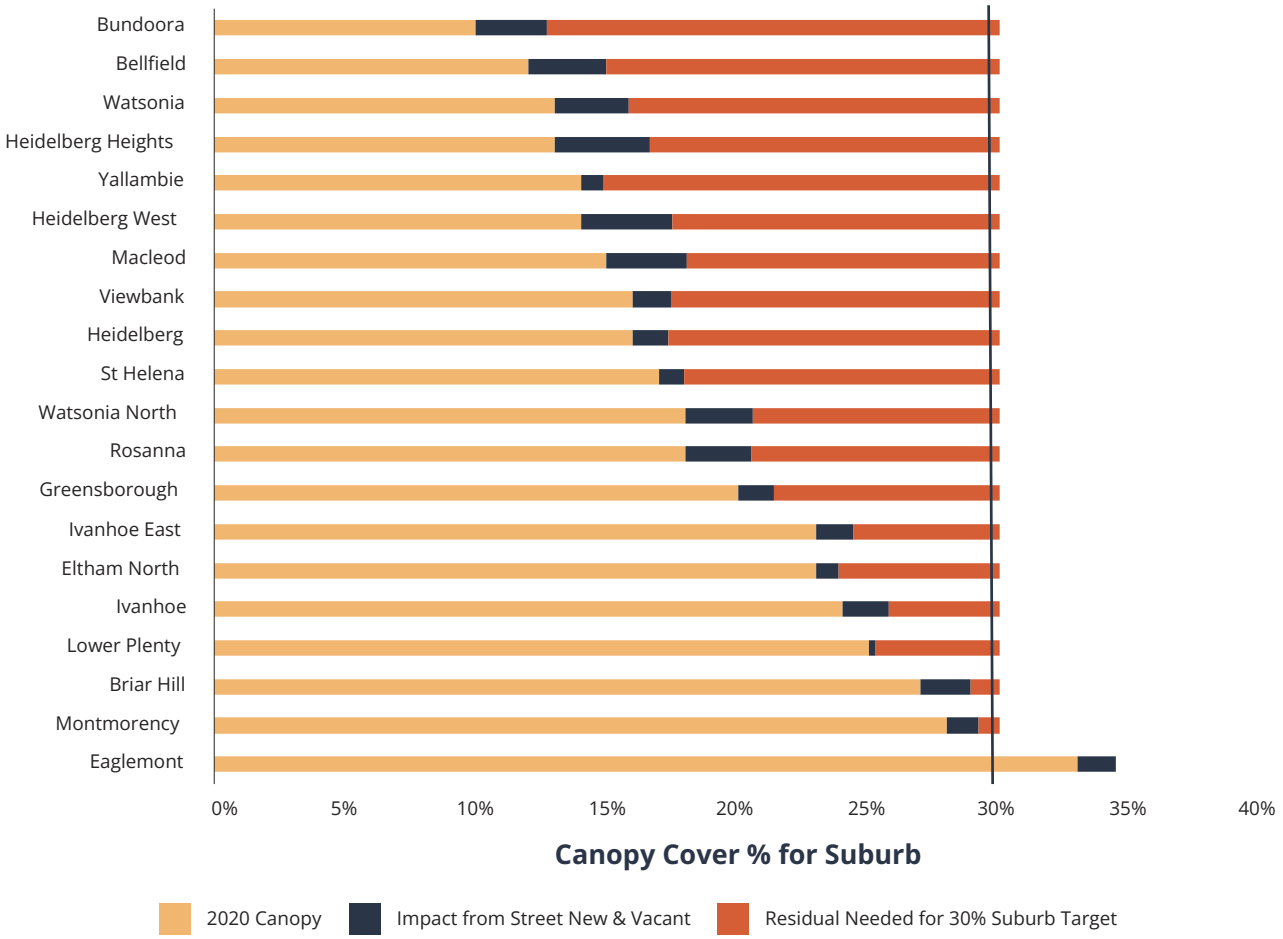


Figure 26. Suburb canopy cover - gap to 30% Target (yellow bars indicate current canopy, blue bars indicate projected canopy increase from street tree planting, orange bars indicate the gap between projected canopy cover and needed canopy cover)

FOOTPATH AND LOCAL ROADS CANOPY COVER TARGET

> **Banyule has committed to achieving 45% canopy cover across the footpath and local road network by 2050**

The current extent of tree canopy cover of public footpaths across the city was measured by analysing data sets that map the current urban forest canopy and footpaths along streets and in parks and reserves.

The inequality of existing canopy by suburb footpath was in line with the canopy cover of the suburb as a whole described above. Suburbs with long established street trees have much better canopy cover over footpaths, making walking more accessible and inviting. (**Figure 27**).

The potential future increase in footpath canopy cover was estimated by creating a 'future canopy' data set that modelled future canopy increases from tree planting in known vacant tree planting sites and the growth of trees that have been planted recently.

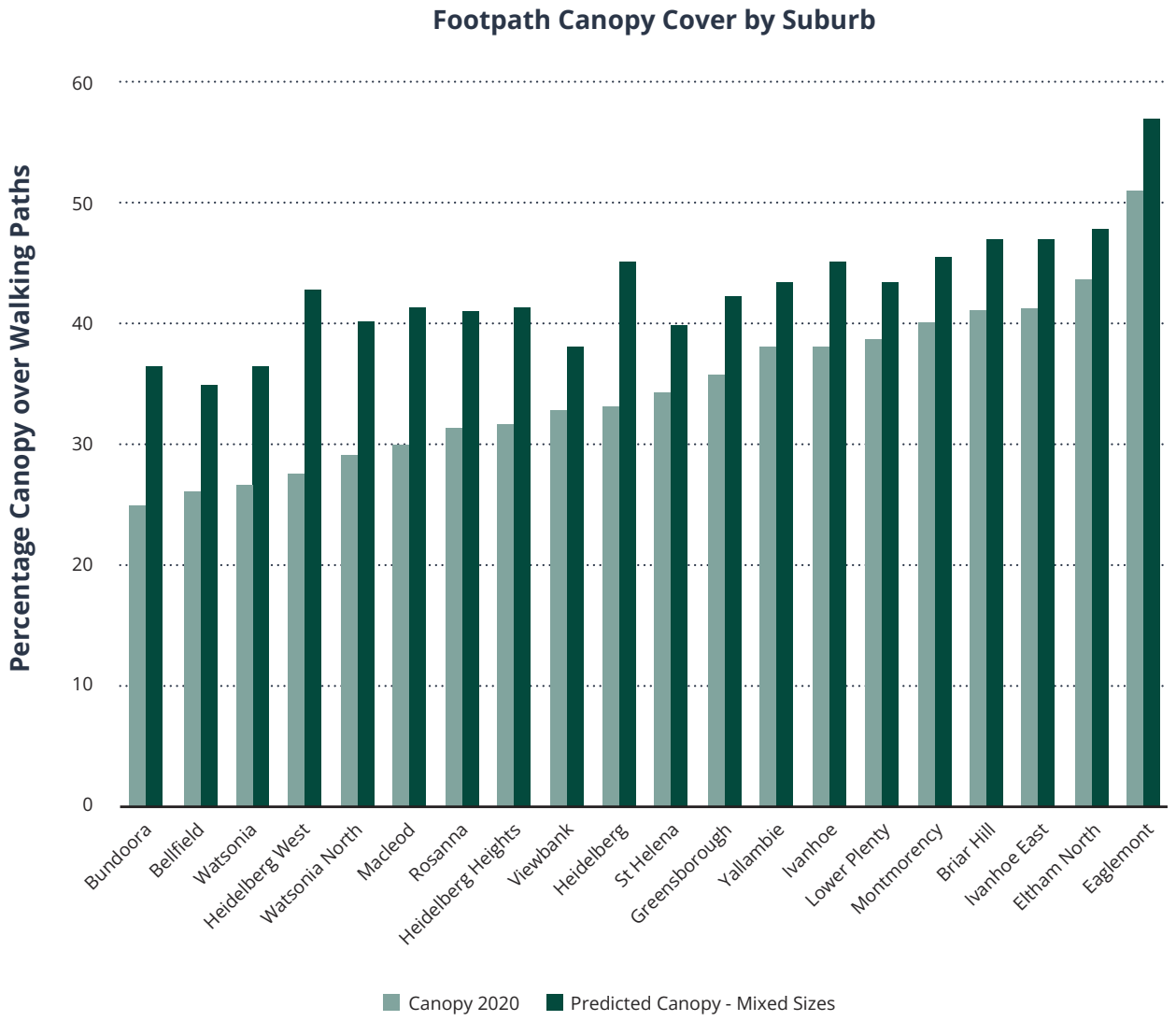


Figure 27. Footpath canopy cover - current and predicted

OPEN SPACE PATH NETWORK CANOPY COVER TARGET

> **Banyule has committed to achieving 50% canopy cover across the open space path network by 2050**

Following the principle of shade for daily activities in open spaces, including walking, exercising, cycling and visiting playgrounds, the Draft Urban Forest Strategy proposes the open space path network and surrounding playgrounds canopy target is 50% by 2050.

ACCELERATED INFILL PLANTING PROGRAM

Action S1.6 is for the delivery of a program to promptly plant street trees in all vacant viable spaces. In 2022, the street tree inventory has a figure of nearly 10,000 vacant sites.

Each year, there are removals from the streets that need replacing, either trees that have been removed as they have less than 5 years' useful life expectancy or that have prematurely been lost from pest, weather or other damage.

The current capability of the Parks and Natural Environment depot nursery and the contractor panel arrangements does not allow jumping from the current planting level to 5000 trees per annum. It is proposed to increase capability progressively to allow time to improve facilities and ensure that all sites are mapped with appropriate species in line with the numerous actions that deliver recommended species lists, decision-making guidelines and place-based plans. Increasing to 5000 trees planted per annum in 2026 and 2027 would fill all vacancies; the total number of trees to be planted in the initiative period is 16,000. After 2027, the planting level would return to the current funding level of approximately 2000 trees per year which enables the continued maintenance of the inventory.

Monitoring progress towards the Urban Forest Vision

The Banyule vision for the urban forest is a long-term statement.

Indicators for the four core aspects of the vision have been developed to assist Council to monitor and report on progress (**Figure 28**). The indicators, source of information and frequency of collection are outlined in **Table 3**.

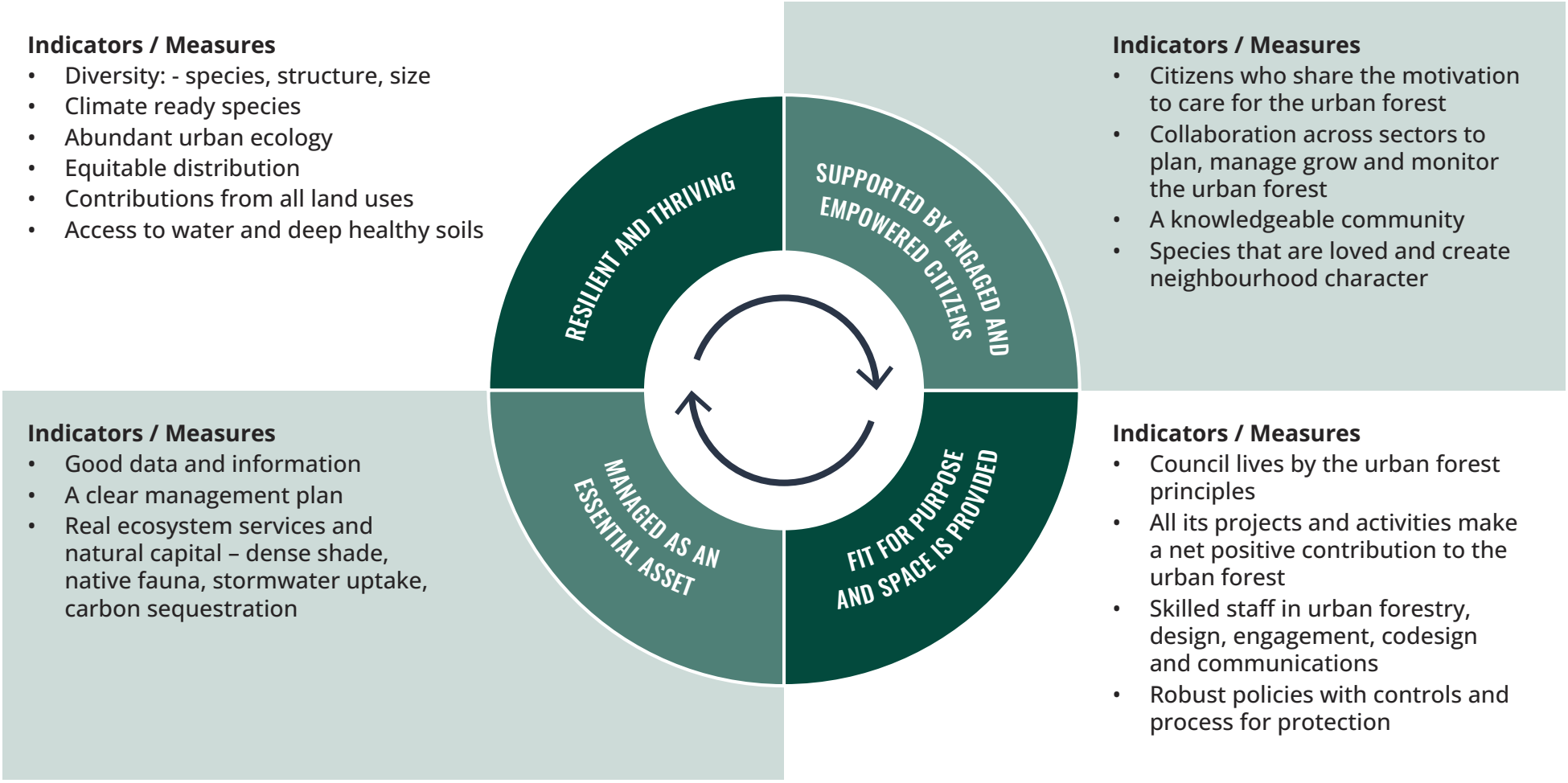


Figure 28. Indicators to assist Council to track progress towards achieving the Urban Forest Vision

Table 3. Measuring progress towards the Urban Forest Vision

	INDICATOR	DATA SOURCE	FREQUENCY	CHANNEL
Resilient and thriving	Diversity - species, structure, size	Tree inventory + maintenance program data	Annual	State of the Environment
	Climate-ready species	Tree inventory Recommended species lists	Annual	State of the Environment
	Abundant urban ecology	Flora and Fauna analysis Citizen science	5 years Annual	State of the Environment
	Equitable distribution	Canopy analysis Prioritisation method	5 years	Urban Forest Strategy update
	Contributions from all land uses	Canopy data	Annual	State of the Environment
	Access to water and deep healthy soils	Number of capital works integrating Water Sensitive Urban Design (WSUD) and urban forestry	Annual	Annual Report
Supported by engaged and empowered citizens	Citizens who share the motivation to care for the urban forest	Number of participants in urban forest programs	Annual	State of the Environment
	Collaboration across sectors to plan, manage, grow and monitor the urban forest	Number of partners or projects initiated for urban forest development not delivered by Council	Annual	State of the Environment
	A knowledgeable community	Community satisfaction (attitudes, values) survey	2 years	Annual Report
	Species that are loved and create neighbourhood character	Community satisfaction (attitudes, values) survey Change in attitude to trees and species selection – sentiment tracking	2 years Continuous	Annual Report

	INDICATOR	DATA SOURCE	FREQUENCY	CHANNEL
Managed as an essential asset	A clear management plan	Asset management plan for the urban forest is in place A renewal plan is in place for increasing the urban forest in the most vulnerable areas	Annual Annual	Annual Report
	Good data and information	Systems to prioritise, measure, monitor, resource and report for assets are in place	Annual	Annual Report
	Real ecosystem services and natural capital – dappled shade, native fauna, stormwater uptake, carbon sequestration	A valuation method is adopted and used to measure/ estimate the benefits from urban forest assets	5 years	Urban Forest Strategy update
Fit for purpose and space is provided	Council lives by the urban forest principles	Internal learning and development program results - attendance at training Areas in Council that include urban forest action in plans and programs	Annual	Annual Report
	All its projects and activities make a net positive contribution to the urban forest	Number of projects including urban forest outcomes	Annual	Annual report
	Skilled staff in urban forestry, design, engagement, codesign and communications	Internal Learning and development program results - attendance at training Areas in Council that include urban forest action in plans and programs	Annual	State of the Environment
	Robust policies with controls and process for protection	Regular policy review Thorough policy review (evidence, review, update, communicate, train/inform, monitor)	5 years	Urban Forest Strategy update

SECTION 6.

Strategic areas for the Banyule urban forest

This Strategy outlines six key strategic areas of focus. Each strategic area has a series of major actions to be implemented over the short- and medium-term.

Key Performance Indicators assist with measuring and reporting on success and supporting a continuous improvement process for the management of the urban forest.

This section outlines each strategic area and provides:

1. An overview of the issue being addressed
2. The major action areas to be implemented by Council and its partners over the next 10 years
3. Case studies of best practice by other local government agencies

The details of the actions in each strategic area are listed below with classification of their timeframe, investment commitment level, funding model and departments to lead the action:

Existing	Council can adopt these actions within the current proposed budgets. They can be integrated into existing programs or investigated without additional staff or infrastructure requirements.
$	<$10k. Low-cost action.
$$	$10k-$100k. Council should plan for budget beyond the current proposed budget. Investment in additional research, infrastructure, staffing or funding is required to realise the action.
$$$	>$100k. Council will require significant additional budget to realise the action, due to the need for new infrastructure, additional staff or introduction of regulations and / or requirements.
Short term	1–3 years.
Medium	4–8 years.
Ongoing	Commencing from 2023.

Summary of investment and timeframe

NO. OF ALL ACTIONS	ACTIONS USING EXISTING CAPACITY	SHORT TERM 2023 – 26	MEDIUM TERM 2027 – 30	ONGOING
60	18	23 actions over years 1-3	14 actions over years 4 – 8	19 actions ongoing

Strategic Area 1 – Prioritise urban forest improvements in the most vulnerable suburbs and places

OVERVIEW

This direction will see Council and the community take affirmative action to address the inequity in canopy cover and urban forest quality in the areas with the lowest canopy, the highest proportion of lower socio-economic communities, areas of highest urban heat and exposure to the impacts of climate change (Figure 25).

MAJOR ACTIONS

ACTIONS FOR STRATEGIC AREA 1: PRIORITISE URBAN FOREST IMPROVEMENTS IN THE MOST VULNERABLE SUBURBS AND PLACES ACROSS BANYULE

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S1.1	Develop an agreed urban forest prioritisation method that is based on the Urban Forest Principles to identify areas in most need of planning and intervention.	Determine a weighting for combining spatial factors of canopy cover, socio-economic disadvantage, UHI priority, flooding, wildlife corridors, intersectional gender equity, etc. The output is a map to allocate the relative priority of taking action in different locations.	Short	$$	Project	Urban Forestry	
S1.2	Review the urban forest priorities every 3 years (using the prioritisation method) and include actions in asset management and annual operational plans.	To be reflected in service levels and annual operational plans with a workshop review with the output of a report.	Medium	Existing	Ongoing	Urban Forestry	

ACTIONS FOR STRATEGIC AREA 1: PRIORITISE URBAN FOREST IMPROVEMENTS IN THE MOST VULNERABLE SUBURBS AND PLACES ACROSS BANYULE

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S1.3	Develop and improve the urban forest prioritisation method as new data become available.	Update the matrix as new information becomes available such as Census, canopy or ecological data.	Medium	$	Ongoing	Urban Forestry	
S1.4	Program annual planting in areas with highest priority.	Focus annual street and park planting, and replacement of underperforming trees, in locations of high priority.	Ongoing	$	Ongoing	Urban Forestry	
S1.5	Identify vacant street tree sites and program infill plantings to be completed in the medium to long term.	Plant out the approximately 10,000 vacant street tree sites by 2027, in addition to replacement of approximately 2500 annual removals in that time.	Medium	$$$	Project	Urban Forestry	
S1.6	Work with local indigenous plant nurseries or community nurseries to provide local provenance.	Obtain tree and plant stock from locally sourced seed. Engage nurseries to grow trees to advanced stage for street tree planting or bring in-house to Council.	Short	$	Ongoing	Urban Forestry	Bushland

Case study: Frankston City Council's approach to getting the right tree in the right place

Frankston City Council (FCC) manages around 62,000 trees in streets, with many more trees located in parks. Canopy cover is not evenly distributed across the city's suburbs.

FCC has a substantial tree planting budget and has identified vacant sites for tree planting throughout the municipality. They developed a prioritisation process to strategically focus tree planting where it is most needed, in a way that benefits the community the most at the lowest cost.

Five prioritisation criteria were identified for their relevance to Frankston's low canopy cover precincts:

- Current tree canopy cover
- Heat vulnerability
- Pedestrian intensity
- Biodiversity
- Flooding

Each criterion was assigned a score. These were added to give an overall score for each section of road and open space managed by FCC. Areas were grouped into high, medium and low priority based on this overall score, and this informed a 10-year planting plan.

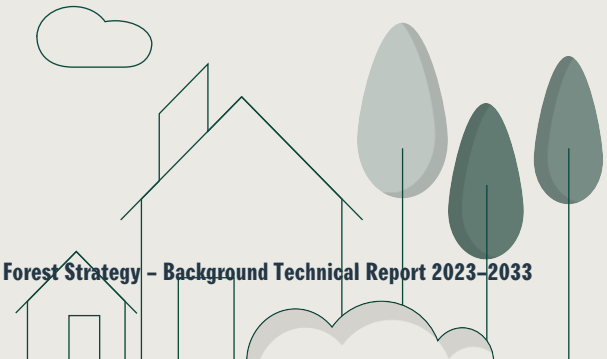
Banyule could use a similar method to identify its own priority areas for greening. Criteria may be similar to those used in FCC or differ to reflect the specific aims and objectives of Banyule's UFS as described in Prioritisation Matrix on **page 35**.

RELEVANT BANYULE KEY DIRECTION

Prioritise urban forest improvements in the most vulnerable suburbs and places across Banyule.

RELATED ACTIONS

- S1.1 - Develop an agreed urban forest prioritisation method that is based on the Urban Forest Principles to identify areas in most need of planning and intervention.
- S1.2 - Review the urban forest priorities every 3 years (using the prioritisation method) and include actions in asset management and annual operational plans.
- S1.3 – Develop and improve the urban forest prioritisation method as new data become available.
- S1.4 - Program annual planting in areas with highest vulnerability.
- S1.5 - Identify vacant street tree sites and program infill plantings to be completed in the medium to long term.
- S2.1 - Identify suitable sites in reserves, roadsides and underutilised land where mown. turf can be improved to include trees, shrubs, native grasses or groundcovers.



Strategic Area 2 - Increase the diversity of the urban forest for biodiversity and habitat with ground cover and shrub layer plantings

OVERVIEW

Banyule, like most other local government areas across Australia, has a low level of diversity in its urban forest in certain neighbourhood character areas.

This strategic area will see Council and the community continue the work to extend the urban forest beyond trees and introduce more diversity into the structure of the forest. If successful it will see a range of trees, shrubs and groundcovers/grasses across the Banyule local government area. It will also see an increase in partnership between Council and the community and enhance community biodiversity actions already activity occurring across Banyule.

Figure 26 shows the contributions to streetscapes that can be made by nature strip plantings.

As a managed system, selection of species to plant within the urban forest is influenced by many factors. To assist Council staff and the community, it will be important that the rationale for the selection of certain species for street trees is understood and communicated.

MAJOR ACTIONS

ACTIONS FOR STRATEGIC AREA 2: INCREASE THE DIVERSITY OF THE URBAN FOREST FOR BIODIVERSITY AND HABITAT WITH GROUND COVER AND SHRUB LAYER PLANTINGS

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S2.1	Identify suitable sites in reserves, roadsides and underutilised land where mown turf can be improved to include trees, shrubs, native grasses or groundcovers.	Year 1, map suitable locations and develop a program for implementation.	Ongoing	$	Project	Parks & Natural Environment	Open Space Planning & Design, Environment
S2.2	Establish and maintain new planting locations of shrubs, native grasses and groundcovers.	Year 2 would be a pilot program of a small number of sites. Funding sought in Year 3 to roll out to larger number of sites. Resource staff to establish and maintain planting locations.	Short	$$$	Project	Parks & Natural Environment	Urban Forestry
S2.3	Encourage the co-management of new planting sites within the Urban Forest with the community.	Initial target groups will be community groups such as friends' groups or scouts.	Ongoing	$	Ongoing	Urban Forestry	Communication

ACTIONS FOR STRATEGIC AREA 2: INCREASE THE DIVERSITY OF THE URBAN FOREST FOR BIODIVERSITY AND HABITAT WITH GROUND COVER AND SHRUB LAYER PLANTINGS

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S2.4	Develop the nature strip planting program, provide guidelines, and promotion of the benefits to residents.	Implement through a permit system and/or change to the local law to allow residents to plant nature strips where appropriate. Utility owners to be consulted in the process.	Medium	$	Project	Open Space Design	Urban Forestry, Municipal Laws & Public Assets, Communication, Waste
S2.5	Map the ecological corridors (wildlife connection and known fauna movements) to integrate with the urban forest data to identify opportunities for planting sites and habitat structures.	This will include spatial mapping based on fauna movement from an urban ecologist.	Short	$$	Project	Environment	Bushland/ Urban Forestry
S2.6	Provide recommended species lists for a fit-for- purpose urban forest i.e., the 'right-tree-right-place'. This will include species that are climate ready, suitable for the site and consider the benefit for urban ecology.	Develop an online, location-based list of appropriate species for public and private plantings including a set of suitable substitutes to overly-used or inappropriate species. For example, using deciduous tree for houses north facing in a streetscape.	Short	$$	Project	Urban Forestry	Open Space Planning & Design
S2.7	Provide training and information for Council staff on the urban forest – its definition, vision and principles and what it means for their work.	This will run in tandem with S1.2 'Staff training' specifically including the induction process.	Short	$	Ongoing	Urban Forestry	

Strategic Area 3 – Manage the urban forest across public and private land for resilience to climate change

OVERVIEW

This strategic area will focus Council's efforts on active management of the urban forest to help the community adapt to a changing climate and help the urban forest increase its resilience so it can thrive. This will respond to the current areas of highest urban heat and exposure to the impacts of climate change and to public and private tree resilience by selecting the tree species that will not only survive but thrive in a changing climate.

MAJOR ACTIONS

ACTIONS FOR STRATEGIC AREA 3 – MANAGE THE URBAN FOREST ACROSS PUBLIC AND PRIVATE LAND FOR RESILIENCE TO CLIMATE CHANGE

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S3.1	Provide support for the protection and survival of listed significant trees on private lands; include tree owners and neighbours in the communication and engagement around significant trees.	Support may include access to a grant for arboricultural tree assessments and/or tree works. The amount of investment will be reviewed annually.	Ongoing	$	Ongoing	Environment	Development Planning / Urban Forestry
S3.2	Provide care and protection of listed significant trees on public land.	After an annual arboricultural inspection for each significant tree, care may include additional pruning, watering, mulching and understory planting or risk reduction by moving targets.	Ongoing	$	Ongoing	Urban Forestry	Environment / Development Planning

ACTIONS FOR STRATEGIC AREA 3 – MANAGE THE URBAN FOREST ACROSS PUBLIC AND PRIVATE LAND FOR RESILIENCE TO CLIMATE CHANGE

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S3.3	Work with private and non-council land holders to improve the urban forest on their land via place-based programs and development processes.	As an example, this may include schools, encumbered open space under transmission power lines and water easements.	Ongoing	$	Ongoing	Urban Forestry	Environment / Development Planning
S3.4	Implement passive irrigation (WSUD) for public realm trees and make this business as usual for capital projects and new developments.	Run a trial of small scale WSUD systems that can be easily replicated, incorporate into standard kerb or footpath and street tree planting design as well as carparks to achieve canopy cover.	Ongoing	$	Ongoing	Environmental Operations	Capital works / Urban Forestry
S3.5	Provide the public with a recommended species lists for a fit-for-purpose urban forest i.e. the 'right-tree-right-place'. This will include species that are climate-ready, suitable for the site and consider the benefit for urban ecology.	The same species list as developed for S2.6, this action is to share and promote the recommended species list with the public. The place-based plans will be available online for residents to view which neighbourhood place/area they are in.	Short	$	Project	Urban Forestry	
S3.6	Review the recommended species lists annually or when new information comes to light and communicate to community and Council staff.	The list will be maintained in a live format that will enable easy updating as tree species and climate data becomes available.	Ongoing	$	Ongoing	Urban Forestry	Development Planning (arborists)

Case study: Wyndham's significant trees

Many trees within Wyndham City Council (WCC) are important to the community and have significant scientific, social, historic and amenity attributes, yet they were not uniformly assessed or recorded.

WCC called on residents to nominate public and private trees for potential inclusion in the Wyndham Significant Tree Register, giving the following nomination guide:

- Trees are deemed significant based on the Natural Heritage Trust's criteria of scientific, social, historical and amenity values
- Property owners are contacted if a tree has been nominated on their land
- Every nominated tree receives an arboriculture and heritage assessment
- WCC identifies options to assist residents with managing trees that are included in the final Significant Tree Register
- Any tree can be nominated by any person

Residents use a spatial tool (below) to identify a potentially significant tree. Though it already has a significant tree register, Banyule may benefit from a spatial tool similar to that used in WCC.

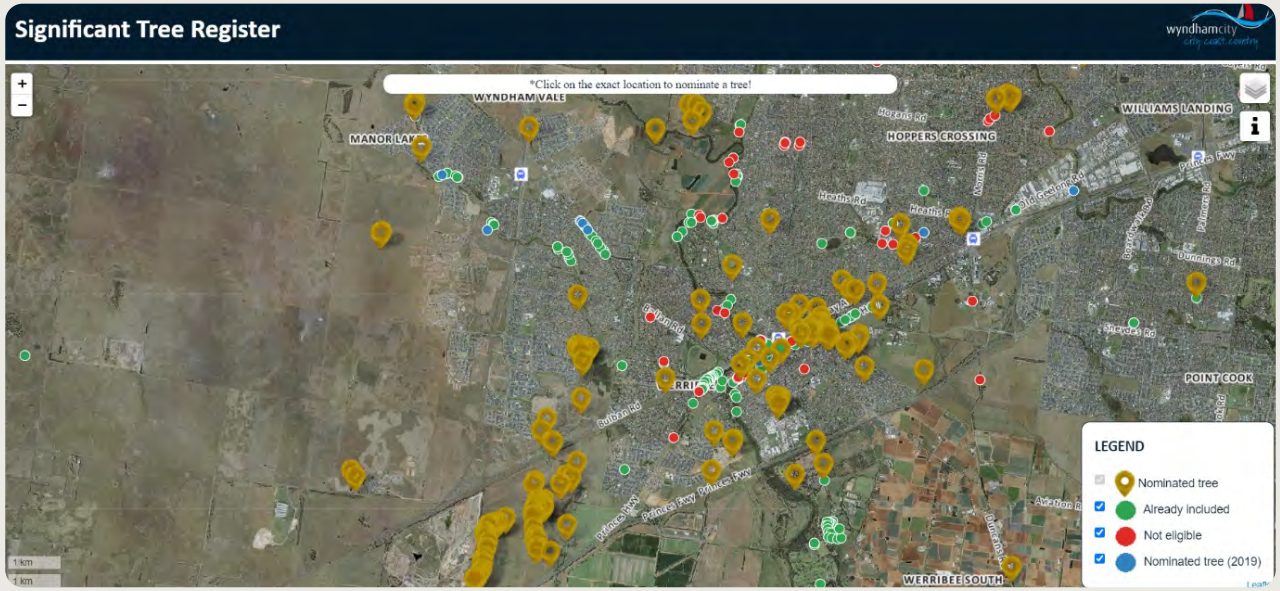
The spatial tool would allow residents to see the nomination status of trees across their area, and to draw attention to additional private and public trees which may be formally registered as significant.

RELEVANT BANYULE KEY DIRECTIONS

- Manage the urban forest across public and private land for resilience to climate change
- Build and maintain partnerships with others in the protection and management of the urban forest.

RELATED ACTIONS

- S3.1: Provide resources and support for the protection and survival of culturally significant trees on public and private lands, include tree owners and neighbours in the communication and engagement around significant trees.



WCC Spatial tool to assist with identification and tagging of Significant Trees

Strategic Area 4 – Take a long-term, asset management approach to the urban forest

OVERVIEW

Managing the urban forest as an essential asset for Banyule is outlined in A vision for Banyule's urban forest. The definition of an urban forest for Banyule clearly states that the urban forest is a green asset that is strategically planned, designed and managed. This brings urban forest elements into line with other public assets or grey infrastructure.

With this approach, there is a clear need for:

- clear and accurate data
- an asset management plan that considers timing, resourcing and risk
- resourcing to maintain and renew the urban forest
- monitoring and reporting for continuous improvement
- integration of greening assets with other asset management planning.

The focus of this strategic area is on establishing an asset management approach to the urban forest elements.

The business case for investing in formative pruning of young trees is compelling. Ryder & Moore[57] assessed the number of defects in a population of commonly planted trees in Melbourne, the time required to prune juvenile trees and time required to manage the defects in mature trees. Allowing for inflation, when the cost of pruning a 20-year-old tree is compared to the cost of two formative pruning cycles after three and six years, totalling less than $10, there is a 13–18-fold increase.

Proactive controls for managing tree risk will adhere to Banyule's risk management framework and will inform the inspection time frames for trees depending on the location. This will determine that all trees will be inspected for risk in streets, parks, reserves, council facilities, bushland and along the path network with appropriate frequency depending on the risk profile for the area.

MAJOR ACTIONS

STRATEGIC AREA 4 – TAKE A LONG-TERM, ASSET MANAGEMENT APPROACH TO THE URBAN FOREST							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S4.1	Develop place-based plans to manage the urban forest, considering use, neighbourhood character, ridgelines and climate. Including: In-fill planting program, maintenance, street tree renewal.	The place-based plans will be available online for residents to view which place/area they are in.	Short	$$	Project	Urban Forestry	
S4.2	Implement a tree valuation policy including amenity value and ecological value then link the urban forest amenity value to current asset management processes.	Tree amenity and ecological valuation methodologies are widely used by local governments around Melbourne. Revenue for trees that are removed for development would be expended through the Future Canopy fund (S6.3.3). Track the amenity and ecosystem service value of trees in the tree asset system, link the tree asset records to Council's central asset management system.	Short	$	Project	Asset Management, Finance	Urban Forestry, Development Planning
S4.3	Adopt a canopy cover assessment method to measure canopy gains and losses annually.	Acquire canopy data and analyse the drivers for canopy losses and gains on public and private land.	Short	$$$	Project -> Ongoing	Urban Forestry	Development Planning
S4.4	Develop a comprehensive urban forest database to allow the analysis of effort and outcome of the urban forest strategy and asset management programs.	Essential systems upgrade to allow for the core delivery of the Urban Forest Strategy including tree planting program.	Short	$$$	Project -> Ongoing	Urban Forestry	IT

STRATEGIC AREA 4 – TAKE A LONG-TERM, ASSET MANAGEMENT APPROACH TO THE URBAN FOREST							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S4.5	Develop a comprehensive urban forest interactive mapping portal that includes information on street, facility and park trees as well as urban forest understorey plantings.	Essential system upgrade to enable management of the existing tree population, design future plantings and collect tree risk data. Facility trees surround Council-owned buildings such as kindergartens, halls and community centres. Inclusions for external engagement item such as ward newsletters, Banyule Banner as well as digital platforms.	Medium	$$	Project	Urban Forestry	Urban Forestry
S4.6	Develop reporting to include urban forest distribution, tree health, species and structural diversity, risk, maintenance.	Resilience and benefits provided by trees such as shade and cooling are linked to the health, complexity and diversity of the urban forest. Structural diversity will be increased with the focus on shrubs and non-tree vegetation.	Medium	$	Project -> Ongoing	Urban Forestry	IT
S4.7	Develop an “Our Trees” web-based tool using collected data for residents to engage with the urban forest.	A public facing web-based tool that is accessible from mobile devices to allow for finding significant trees, generation of requests and has potential for citizen science.	Medium	$$	Project	Urban Forestry	Customer Service / IT
S4.8	Prepare a communication plan and program that includes reporting to share information with internal and external audiences.	Inclusions for external engagement item such as ward newsletters and Banyule Banner as well as digital platforms.	Short	$	Project	Communications	Urban Forestry

STRATEGIC AREA 4 – TAKE A LONG-TERM, ASSET MANAGEMENT APPROACH TO THE URBAN FOREST							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S4.9	Build relationships with key research partners to investigate the benefits of 'smart planting' programs for street trees and quantify the benefits of the urban forest including carbon sequestration.	Opportunity for universities to have Masters or PhD students work on several projects. This may also include Water Sensitive Urban Design (WSUD) and new tree trials.	Medium	$	Ongoing	Urban Forestry	
S4.10	Develop Tree Risk Management Framework	An asset, risk and customer-focused framework to tree management that includes a documented method for the controls for tree risk. Framework will include a proactive inspection regime in streets, facilities and open space for all trees Banyule is responsible for and that is consistent with Banyule's risk management framework and risk appetite. Clear and transparent process, procedure and application for managing tree removal and tree planting customer workflows from requests to completion or complaints and disputes that recognises risk profiles for person and property.	Short	$$	Project	Urban Forestry	Risk, Development Planning

STRATEGIC AREA 4 – TAKE A LONG-TERM, ASSET MANAGEMENT APPROACH TO THE URBAN FOREST							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S4.11	Continue to build on community engagement programs and educate the public about the importance of individual tree retention/removal decisions on the urban forest.	Transparent data should be available for residents when trees must be removed, e.g., due to risk.	Short	$	Ongoing	Environment / Planning	Urban Forestry / Comms
S4.12	Create a process for repurposing tree material with a hierarchy for reuse to contribute to the circular economy and waste diversion.	Repurposing of material from removed council trees for habitat, art, outdoor furniture, playgrounds and use in new buildings	Medium	$	Ongoing	Urban Forestry	Open Space Planning

OPPORTUNITIES FOR URBAN FOREST IN BANYULE'S STREETS

The following figures demonstrate the opportunities to enhance the urban forest within the streets of Banyule. These streets have been chosen as they represent some typical street typologies found across Banyule. They are used here as a demonstration only.

Each set of figures shows the current street (taken from Google Maps) and the possible urban forest improvements that could be accommodated:

- **Figure 29** shows a street with a wide nature strip
- **Figure 30** shows a street with a wide landscaped median strip
- **Figure 31** shows a street with a narrow nature strip

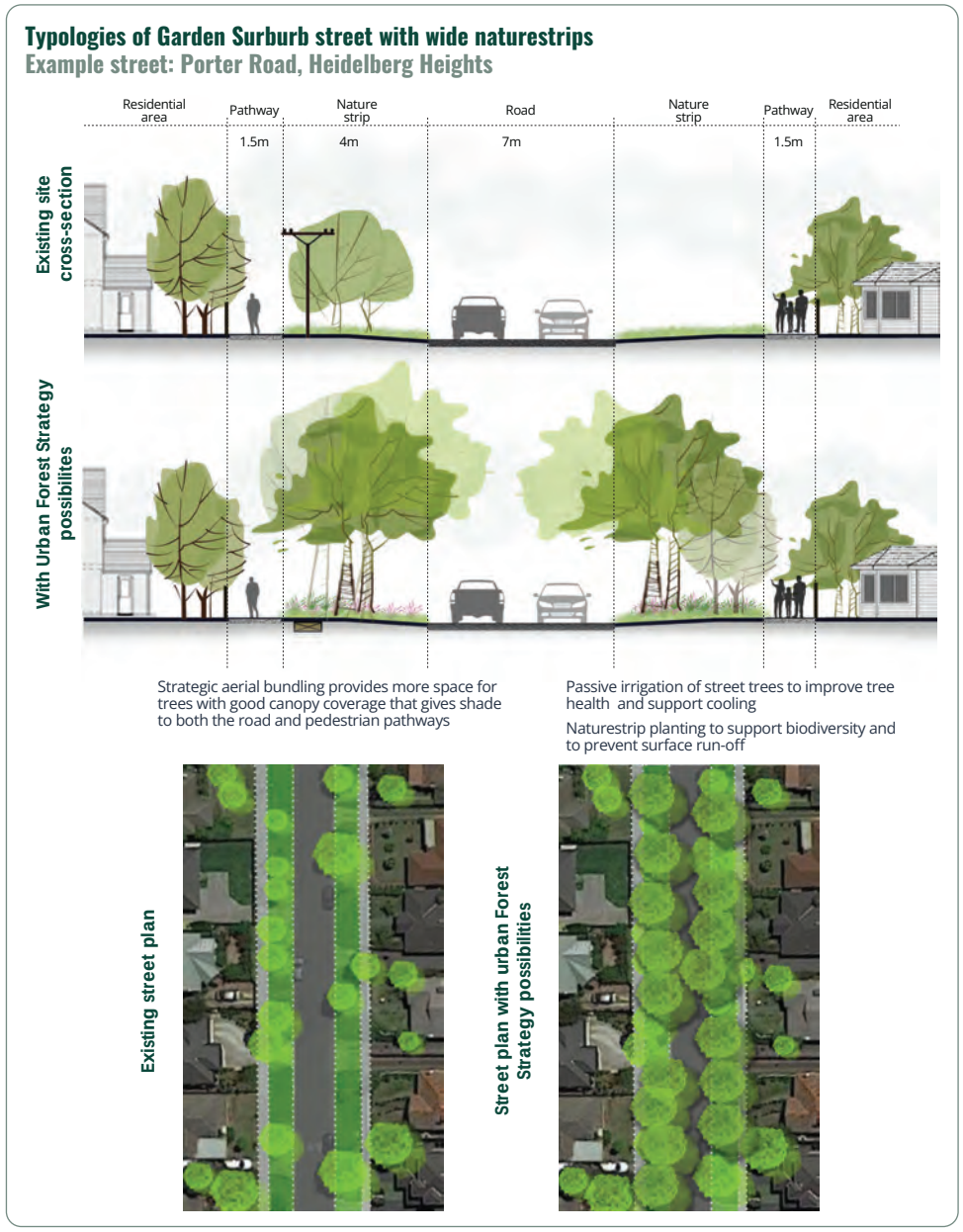
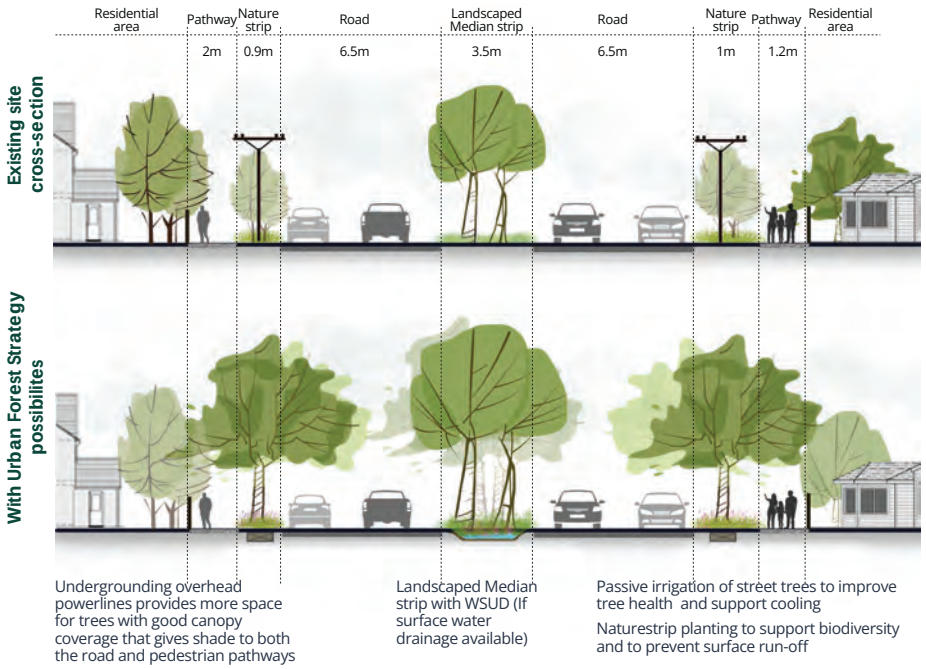


Figure 29. Urban forest possibilities in a street with a wide nature strip

Garden suburb and entrance way for the municipality, that has median strip with sizable trees

Example street: Oriel Road, Ivanhoe



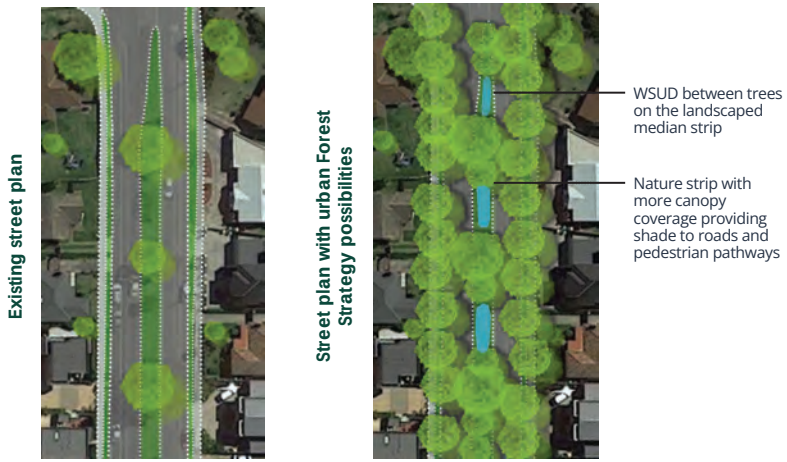
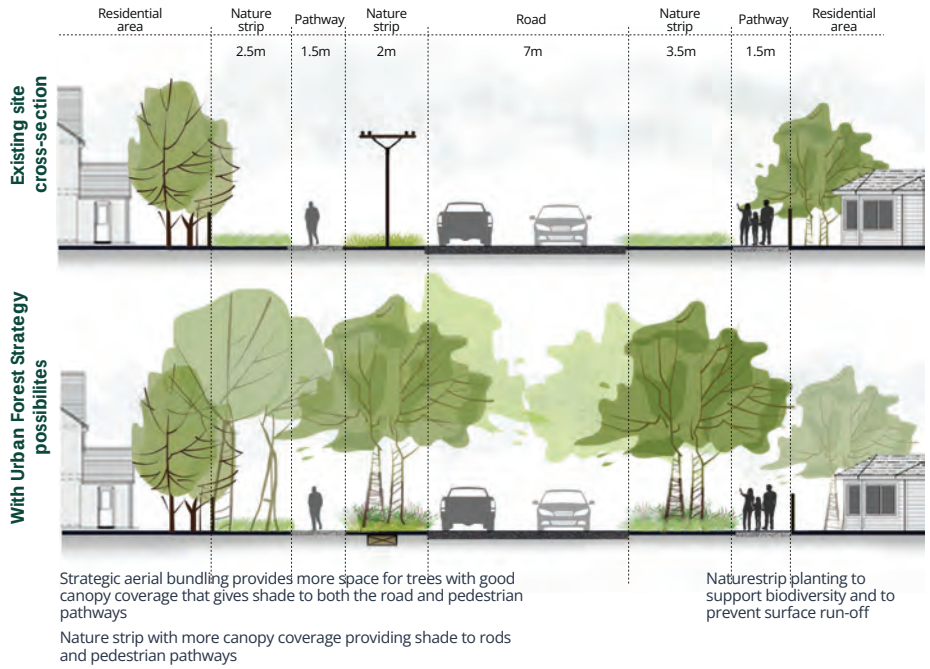


Figure 30. Urban forest possibilities for a street with a wide landscaped median

Typologies of Garden Surburb street with narrow naturestrips

Example street: St. James Road, Heidelberg



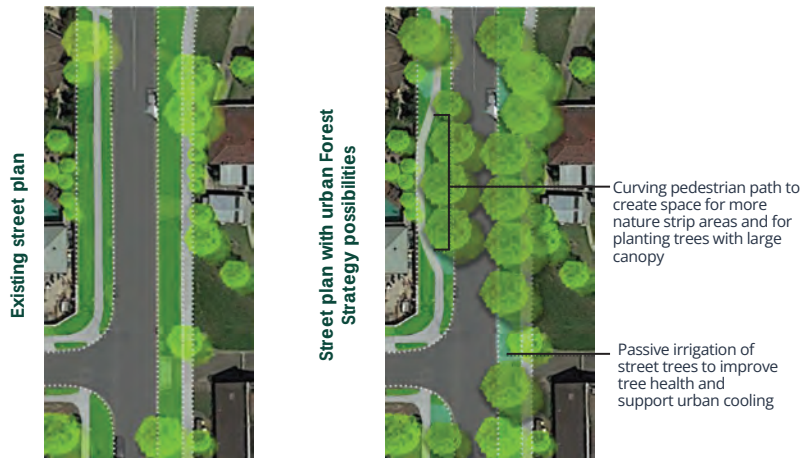


Figure 31. Urban forest possibilities on a street with a narrow nature strip

Case study: City of Melbourne's tree valuation, retention and protection

A critical component of urban forest management is the protection and retention of existing trees. The City of Melbourne (CoM) developed an approach to the management of the important public tree assets using a valuation formula.

Assigning a value to the trees allowed CoM to recover compensation for the community for trees that were damaged or where trees are required to be removed for development. Developers can make an informed decision about design when the cost of the tree removal is quantified.

TREE VALUE CALCULATION

A Tree Amenity Value Formula Calculating a Tree's Amenity Value (2006) informs CoM's Tree Retention and Removal Policy (2012). This is a calculation of the value of the public tree to be paid by the property owner prior to removal.

Value calculation criteria include:

1. Removal costs
2. Amenity value – calculated using CoM's Amenity Formula.
3. Ecological services value – calculated using i-Tree valuation tool
4. Reinstatement costs – the greening required to replace the loss to the landscape

AMENITY VALUE COMPENSATION FUND

The compensation paid through the removal of public trees operates as a dedicated fund for CoM to invest in replacing vegetation in the community. This fund is designed to increase greening in the private realm, including rooftop urban farms, green walls and greening of private laneways.

Banyule's ability to protect, retain and gain compensation would be greatly enabled through development of policy and a valuation methodology.

RELEVANT BANYULE STRATEGIC AREAS

- Prioritise urban forest improvements in the most vulnerable suburbs and places across Banyule
- Take a long-term, asset management approach to the urban forest
- Integrate the urban forest principles into all parts of Council services.

RELATED ACTIONS

- S4.2: Implement a tree valuation policy, including amenity value and ecological value, then link the urban forest amenity value to current asset management processes.

Case study: Technologies for measuring canopy

Understanding the current extent and characteristics of the urban forest, including private land, across the entire municipality is an important input for urban vegetation management.

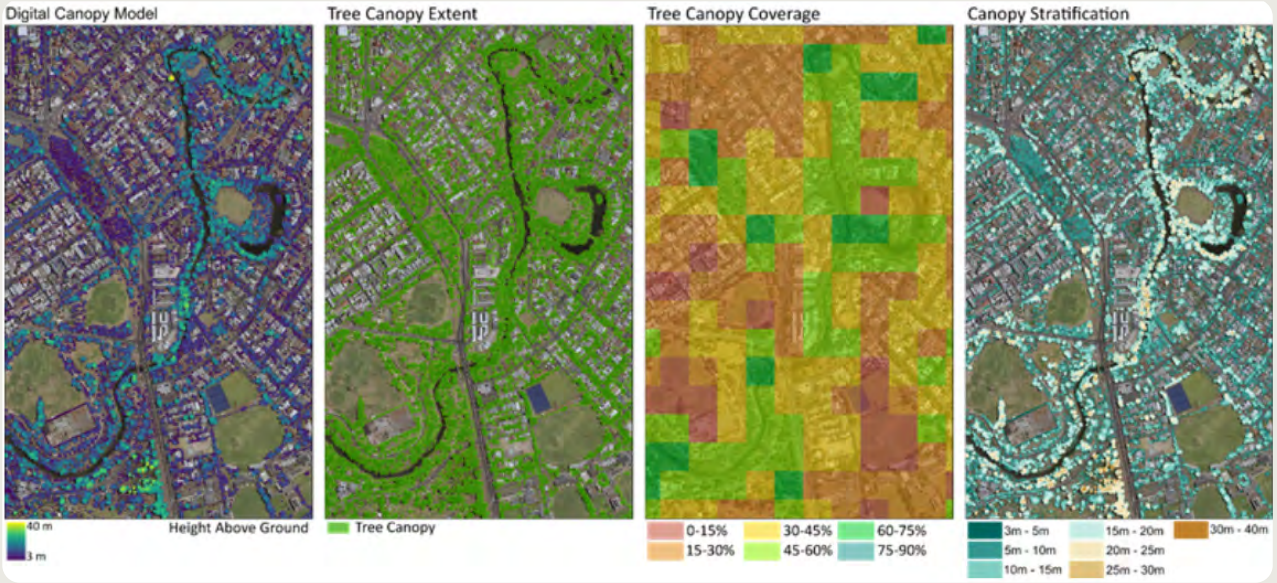
With the increased focus from governments and the community on climate change and adaptation, urban canopy has become a valuable indicator of liveability and adaptation to increasing urban heat. Methods of canopy data collection differ in their degree of accuracy, feasibility and ease of use.

Technologies:

Multi and hyper spectral imagery captures image data from a fixed wing plane. Analysis of data is done with a combination of AI deep learning and human assessment. ***High accuracy, high cost, moderate usage ease.***

AI deep learning uses algorithms to undertake image recognition that can identify and track features of interest from aerial surveys, including canopies and vegetation. ***Medium-high accuracy, moderate cost, moderate usage ease.***

I-Tree canopy is a free-use software canopy measurement tool that randomly lays points onto Google Earth imagery to measure canopies and vegetation. ***Low accuracy, low cost, moderate usage ease.***



LiDAR + 3D photogrammetry involves using airborne measurements of earth's surface to accurately measure the landscape in three dimensions. ***High accuracy, high cost, moderate usage ease.***

RELEVANT BANYULE STRATEGIC AREAS

- Prioritise urban forest improvements in the most vulnerable suburbs and places across Banyule
- Take a long-term, asset management approach to the urban forest.

RELATED ACTIONS

- S4.3: Adopt a canopy cover assessment method to measure canopy gains and losses annually.

Case study: Tree Cities of the World

"The Tree Cities of the World programme is an international effort to recognise cities and towns committed to ensuring that their urban forests and trees are properly maintained, sustainably managed, and duly celebrated."

Becoming a Tree City of the World can aid in building local, national and global recognition of a city's dedication to its healthy and sustainable urban forestry.

For a city to become a Tree City of the World, it must meet five standards:

1. **Establish responsibility** – for this standard to be met, the city must have clear, written delegation of tree care to a single person, department and/or community, which forms the 'Tree Board'.
2. **Set the rules** – Tree management and protection is governed by law or through official council policy. The rules may be shaped by industry best practice, and there are penalties for non-compliance.
3. **Know what you have** – The city has an up-to-date inventory of its trees, and this guides the long-term 'planting, care, and removal of city trees'.
4. **Allocate the resources** – There is an annual budget which is dedicated to the city's tree management plan.
5. **Celebrate achievements** – There is an annual celebration of trees within the city, which raises the profile of the tree management plan for the city and showcases the staff and community members who are involved.

A number of Australian cities are currently recognised as Tree Cities of the World and most of these are in South Australia. No cities in Victoria have Tree City of the World status yet. Cities can apply for Tree City of the World status through **www.treecitiesoftheworld.org**

RELATED ACTIONS

- S5.7: Celebrate trees and the urban forest through becoming a recognised Tree Cities of the World – apply for recognition in July 2024.

Strategic Area 5 – Build and maintain partnerships with others in the protection and management of the urban forest

OVERVIEW

This strategic area is focused on developing a strong network of urban forest 'actors' or 'champions' who can work collectively or individually to enhance and protect the urban forest across Banyule. It is focused on supporting existing community programs and delivering urban forest outcomes through them.

Most of the research around best practice urban forestry highlights the need for the community to play a significant role. Communities need to be part of the discourse and the decisions if we are to enable the significant change required to urban planning and management along with the social change needed to bring about a healthy urban forest.

Fundamentally, community engagement can be broad. In best practice urban forestry, the best form of engagement is where Council staff proactively seek out community. The values, concerns and aspirations of the community are heard while expert information about the problem is shared. In this way, an ongoing partnership with the community is established and decision-making is well understood.

Research into the attitudes, values and behaviours of residents around trees shows that:

- more people value both the personal and community benefits from trees on their properties
- there is a need to address landowners' concerns about property damage
- interpersonal communication is the most preferred way to learn about urban trees
- personal networks are invaluable in sharing information about tree care
- women may play a crucial role in fostering urban forests
- almost all parents believe it is important for their children to spend time in nature
- millennials own fewer trees but are more likely to volunteer for trees
- Baby boomers have more concerns related to existing trees
- reaching new audiences requires focusing on landowners with lower education and income levels.

Proactive approaches to community engagement include public participation campaigns (before and during the development of plans) and co-management partnerships. Volunteer involvement in citizen science programs is a positive shift from traditional approaches, with many potential benefits[58].

Although mostly focused on community involvement, developers can play a significant role in enhancing the urban forest through the actions of this strategic area.

MAJOR ACTIONS

STRATEGIC AREA 5 – BUILD AND MAINTAIN PARTNERSHIPS WITH OTHERS IN THE PROTECTION AND MANAGEMENT OF THE URBAN FOREST

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S5.1	Ensure advisory committees are engaged and informed throughout implementation of the Urban Forest Strategy.	Advisory committees such as The Banyule Environment and Climate Action Advisory Committee (BECAAC) will be updated on the progress and timing of actions being implemented and when new data on the success of the Strategy is available.	Ongoing	Existing	Ongoing	Environment	Urban Forestry
S5.2	Engage with community through a range of educational activities to build understanding and value of the urban forest.	Ensure events inform the community about urban forestry including information packs for new residents.	Ongoing	$	Ongoing	Environment	Urban Forestry
S5.3	Incorporate citizen science projects and data into Banyule's annual monitoring programs.	Greater use will be made of data sourced from citizen science initiatives to report on biodiversity in Banyule and aid our annual monitoring programme. Sources such as Birdlife Australia, frog ID and iNaturalist.	Ongoing	$	Ongoing	Environment	Urban Forestry
S5.4	Engage with Wurundjeri Narrap team on the implementation of this strategy.	The Wurundjeri Narrap team is an established Natural Resource Management team of the Wurundjeri Council.	Ongoing	Existing		Bushland	

STRATEGIC AREA 5 – BUILD AND MAINTAIN PARTNERSHIPS WITH OTHERS IN THE PROTECTION AND MANAGEMENT OF THE URBAN FOREST

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S5.5	Engage specific community groups and traders in the design and delivery of particular urban forest projects, especially in priority areas.	These areas may be near encumbered open space or near sensitive biodiversity reserves. An example is the Heidelberg West Business Precinct which is within a priority area.	Short	Existing	Ongoing	Urban Forestry	Economic Development, Strategic Planning & Urban Design
S5.6	Celebrate the neighbourhood character trees for each area.	Specific trees (including on significant register) and avenues are vital to recognise so that we can continue to have strong neighbourhood character in specific areas.	Medium	$$	Project	Urban Forestry	Urban Forestry
S5.7	Celebrate trees and the urban forest through becoming a recognised Tree Cities of the World – apply for recognition in July 2024.	The Tree Cities of the World Program is an international effort to recognise cities and towns committed to ensuring that their urban forests and trees are properly maintained, sustainably managed and duly celebrated. Currently 7 cities in Australia are recognised and none from Victoria.	Short	Existing	Project	Urban Forestry	Urban Forestry
S5.8	Implement a program to make available a free tree to all residents, clubs and businesses in Banyule.	To increase vegetation on private land, this program will be promoted through Council's channels offering a free tree to all residents who request one. The program will be supporting the planting of trees on private land and influencing the diversity and climate suitability of trees that are planted. The trees will be monitored and engage with citizen science.	Short	$	Project	Urban Forestry	Environment

Case study: Sutherland Shire's community consultation

Sutherland Shire Council (SSC) aims for no net canopy loss from a 2014 canopy cover baseline. However, competition for public space by urban programs and infrastructure projects (e.g., footpaths, electrical works, open space conflicts) was a key process affecting canopy cover.

To address this competition, SSC had been on a seven-year community journey garnering support for its trees. To build strong community support, SSC developed a communication plan, including regular milestones and key messages targeted to SCC precincts, and a means of collecting public feedback through an interactive mapping tool.

The Community Consultation Interactive Map is a crucial tool for SSC's community engagement process. The Interactive Map (below) displays proposed trees around SSC, across the neighbourhood. Each proposed tree has an icon on the Interactive Map which expands to show images of the species, its species characteristics and tree growth.

Using the tool, residents can submit an enquiry about trees on their frontage, requesting a call to discuss species, position, the program and any concerns. In this way SCC have increased awareness and appreciation for the street trees.

Banyule could build the profile of its trees and other vegetation and use targeted communication to inform and involve the broader Banyule community with urban canopy.

RELEVANT BANYULE STRATEGIC AREAS

- Build and maintain partnerships with others in the protection and management of the urban forest
- Manage the urban forest across public and private land for resilience to climate change.

RELATED ACTIONS

- S5.5: Engage specific community groups and traders in the design and delivery of particular urban forest projects, especially in priority areas.
- S4.7: Develop an "Our Trees" web-based tool using collected data for residents to engage with the urban forest.

Strategic Area 6 – Integrate the urban forest principles into all parts of Council services

OVERVIEW

For this Strategy to be successful it is critical that all parts of Council take a role. This strategic area focusses on the Council activities needed to embed the urban forest principles into the organisation, its culture, policies and practices.

The fundamental capacity for local governments to keep pace with society and community demands is of great importance in this area. Research tells us that local government must support staff and communities to match the rapid societal change needed to respond to current urban pressures.

Solutions to better practice revolve around improvements to the way the urban forest is managed, which requires:

- integration of the physical elements of urban tree planting and vegetation with biodiversity, climate, heat, water, social and cultural benefits
- use and collection of appropriate information and knowledge
- adequate resourcing planning, design and delivery, policies and procedures that respond to the Urban Forest Vision
- maintenance, evaluation and continuous improvement.[59]

MAJOR ACTIONS

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S6.1	Integrate the Banyule urban forest principles into the operational plans for all teams across Council.	Integral to the Strategy being a living powerful document, we need Council to work as a holistic team for implementation. E.g. understand the physical and mental benefits that the urban forest provides for residents.	Ongoing	Existing	Ongoing	Urban Forestry	All
S6.2	Advocate with Victorian Government agencies and public authorities about the Banyule Urban Forest Strategy and seek support for the vision and actions.	For example this may include ensuring funding, protecting or planting vegetation on land not controlled by Council.	Ongoing	Existing	Ongoing	Strategic Planning & Urban Design	Urban Forestry, Transport, Development Planning

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S6.3	Work with Council's capital works and public realm design teams (parks, streets, town centres) to program design work a year ahead of implementation to allow for value add, resourcing.	Many projects are already passed design stage for FY22-23 and FY23-24, and this will be reflected with limited influence until FY24-25.	Ongoing	Existing	Ongoing	Capital Works	Assets, Operations, Urban Forestry
S6.4	Integrate urban forest principles and action into public domain design and delivery and make space for trees and vegetation in the design through a Blue-Green Working Group/Design Review Panel.	Design capital projects that will include successful tree canopy through passive and supplementary irrigation and providing adequate root volumes. Multidisciplinary team during the design stage to achieve urban forestry outcomes. An allocation of resources for maintaining vegetation planted as part of capital projects is vital for high quality ongoing outcomes.	Ongoing	Existing	Ongoing	Capital Works	Assets, Operations, Urban Forestry
S6.5	Create a future fund for canopy and greening enhancement to capital projects.	The fund should have $250k for expenditure on capital projects to achieve 30% canopy cover where possible, and greening outcomes to improve human comfort when 30% canopy is not achievable. To be funded through budget allocation and revenue collected as amenity value for trees that are removed for external and internal projects.	Medium	$$$	Project	Capital Works	Urban Forestry

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S6.6	Develop guidelines and training for streetscape and playground vegetation design and maintenance.	This will include technical planting specifications, passive irrigation and WSUD (Water Sensitive Urban Design). Also, a recognition that funding requirements may change if increased sweeping of leaves is required.	Short	Existing	Ongoing	Strategic Planning & Urban Design	Urban Forestry, Open Space Planning & Urban Design
S6.7	Progress the review of policies and plans that relate to tree protection and management, including planning scheme controls, neighbourhood character, housing and heritage strategies.	This includes tree protection during development and other stages to ensure no gaps in protection.	Short	Existing	Project	Strategic Planning & Urban Design	Development Planning
S6.8	Share data and analysis of canopy/ tree losses in the private domain and focus responses on priority causes.	Using the canopy data acquired in S4.3, the results will be shared with the public to promote drivers for change. Areas with losses will be targeted with information on how to make positive changes such as encouraging the take-up of Council tree give-away program (S5.8).	Medium	Existing	Project	Development Planning	
S6.9	Regularly review and update approach to enforcement in response to trends in urban forest actions.	Currently audits take place, but numbers are conditioned and recorded. We require a target to measure success.	Medium	Existing	Ongoing	Development Planning	Municipal Laws & Public Assets
S6.10	Share data and analysis of canopy / tree losses in the private domain and focus responses on priority causes.	Using the canopy data acquired in S4.3 the results will be shared with the public to increase awareness of the drivers for the changes. Areas with losses will be targeted with information on how to make positive changes such as encouraging the take up of council tree give-away program (S1.8).	Medium	Existing	Ongoing	Planning	Municipal Laws & Public Assets

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S6.11	Regularly review and update approach to enforcement in response to trends in Urban Forest actions.	Currently audits take place, but numbers are conditioned and recorded. We require a target to measure success.	Medium	Existing	Ongoing	Planning	Municipal Laws & Public Assets
S6.12	Trial small scale passive irrigation to benefit tree growth with a long-term goal to move toward a new standard.	Small scale Water Sensitive Urban Design (WSUD) includes diverting of stormwater to a well below the nature strip that is close to new or existing street trees. To be assessed using smart technologies to determine whether it is appropriate to make a component of standard kerb and channel or footpath design in Banyule.	Short	$$	Project	Environmental Operations	Urban Forestry
S6.13	Make space for large trees in urban places and plan for trees to maximise the use of the available space for tree canopy.	If space allows, a canopy tree should be planted as many locations are under pressure from development and urbanisation.	Ongoing	Existing	Ongoing	Urban Forestry	
S6.14	Improve data and knowledge about the species that contribute to neighbourhood character. To assist in planning for tree replacement in private and public spaces.	This will be part of the digital information available to residents to allow resident to make informed decisions on private vegetation. Enabling residents to use digital tools and references developed by Council to guide their decisions about tree selection and planting on private land. Supporting officers to use evidence-based species selection for tree planning and planting in the public realm	Short	Existing	Project	Urban Forestry	

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES							
ACTIONS		**FURTHER DETAIL**	**TIME FRAME**	**INVESTMENT**	**PROJECT OR ONGOING**	**LEAD TEAM (S)**	**ADDITIONAL TEAMS (S)**
S6.15	Integrate urban forest principles and outcomes into initiatives, programs and strategies as they are developed and reviewed.	As strategies and initiatives are developed or reviewed, the principles of the Urban Forest Strategy will be incorporated to ensure all parts of Council are working towards the community's Urban Forest Vision.	Ongoing	Existing	Ongoing	All	
S6.16	Prioritise opportunities to deliver on urban forest objectives through amendments to the Banyule Planning Scheme. Investigate urban forest opportunities while considering current zones and overlays e.g., Environmental planning overlay.	Urban forest principles should be considered with strategic planning work.	Short	$	Project	Strategic Planning & Urban Design	
S6.17	Masterplan of avenues and gateways for urban forest.	Key avenues and gateway roads will have vegetation masterplans developed to ensure the long-term character is maintained and enhanced.	Short	$$	Project	City Futures	Urban Forestry
S6.18	Use the latest vegetation information and recommended planting lists when providing guidance on vegetation selection for landscape plans and permit conditions.	Recommended species lists to guide landscape plans and tree replacement conditions will be through a living document.	Short	Existing	Project	Development Planning	

STRATEGIC AREA 6 – INTEGRATE THE URBAN FOREST PRINCIPLES INTO ALL PARTS OF COUNCIL SERVICES

ACTIONS		FURTHER DETAIL	TIME FRAME	INVESTMENT	PROJECT OR ONGOING	LEAD TEAM (S)	ADDITIONAL TEAMS (S)
S6.19	Undertake analysis to determine reasons for tree loss in the private realm and any related outcomes that affect the extent, health and diversity of the urban forest.	Accurate and ongoing mapping of the urban forest is required to aid in these investigations and is a foundation prerequisite action for several other outcomes and is critical for the success of the Urban Forest Strategy and other cross-organisational strategic goals.	Medium	$$	Project	Strategic Planning & Urban Design/ Urban Forestry/ Development Planning	
S6.20	Update the Banyule Tree Planting Zone Guidelines (2011) to best practice and to support the Urban Forest Strategy. Include guidelines as a Background Document in the Banyule Planning Scheme.	Terminology such as drip lines requires modernisation and alignment with Australian standards.	Short	$	Project	Development Planning/ Strategic Planning & Urban Design	Urban Forestry
S6.21	Continue to use General Local Law No. 1 (2015) to recognise and protect street trees as a Council asset.	Local law will be the on-ground protection of public trees.	Ongoing	Existing	Ongoing	Municipal Laws & Public Assets/ Development Planning	Urban Forestry, Development Planning

Case study: Stonnington City Council - tree protection through tree bonds

The cumulative effect of individual developers and property owners felling or damaging trees with or without permission can result in significant loss of mature trees and canopy. Penalties, monitoring and enforcement by tree protection bylaws have not kept pace with the pressures of urban change and the scale of canopy loss that is being experienced in cities.

Stonnington City Council (SCC) has introduced a *Tree Bond* – a general local law that protects significant trees on private land. A tree bond requires the land developer to deposit a money guarantee protection for significant trees before starting development.

The tree bond is only returned if the developer has adequately protected existing trees. If the tree or trees are removed or damaged, the bond is lost. To date, SCC only applies tree bonds to private urban land.

A key advantage of a tree bond for councils is the placement of the 'onus of proof' on private developers rather than on the council itself.

Banyule might work to introduce similar protections for trees on private land. Like SCC, Banyule might choose to apply this protection to trees defined as 'significant' or go further and apply the bond to other kinds of vegetation as well.

RELEVANT BANYULE STRATEGIC AREAS

- Integrate the urban forest principles into all parts of Council service

RELATED ACTIONS

- S6.7: Progress the review of policies and plans that relate to tree protection and management, including planning scheme controls, neighbourhood character, housing and heritage strategies.
- S6.9 - Regularly review and update approach to enforcement in response to trends in Urban Forest actions.

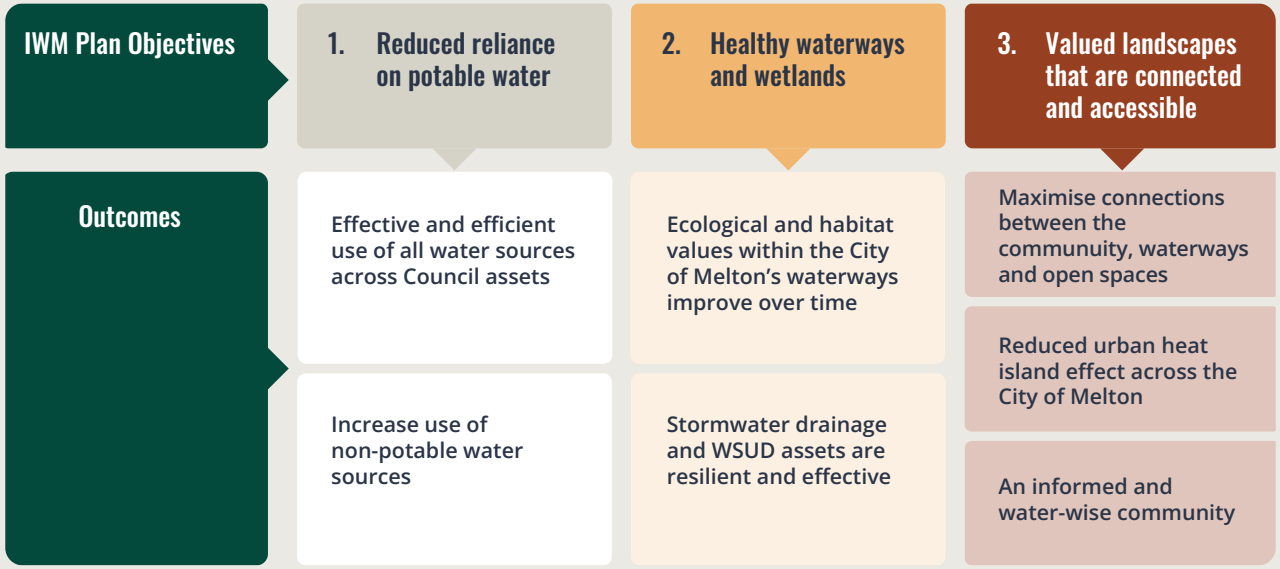
Case study: Passive irrigation for street trees

Melton City Council (MCC) anticipated growing their street tree population by 130,000 new trees, predominantly within residential streets. As part of their Integrated Water Management (IWM) Plan, MCC aimed for as many of these new trees as possible to include water sensitive urban design (WSUD) and be planted with passive irrigation from stormwater. They were the first council in Australia to require this.

Passive street tree designs aimed to:

- Use stormwater particularly during tree establishment
- Improve tree establishment, growth and health
- Improve amenity through improved tree health
- Drought-proof trees
- Reduce infrastructure damage from trees chasing water.

MCC invested substantially in early research and planning into passive irrigation, and this contributed to its widespread uptake within new estates. Since implementation, watering costs have significantly reduced, and passive irrigation may become a requirement of developer planning permits.



Banyule might aim to include passive irrigation as a feature in as many new street tree plantings as possible and integrate it as a design requirement in new and retrofitted developments.

RELEVANT BANYULE STRATEGIC AREAS

- Strategic area 3: Manage the urban forest across public and private land for resilience to climate change
- Strategic area 6: Integrate urban forest principles into all parts of Council services.

RELATED ACTIONS

- Implement passive irrigation (WSUD) for public realm trees and make this business as usual for capital projects and new developments
- Integrate urban forest principles and action into public domain design and delivers and make space for trees and vegetation in the design though a Blue-Green Working Group – Design Review Panel
- Consider a 5% allocation from every capital project towards urban forest outcomes

Glossary of terms

TERM	WHAT IT MEANS
Canopy	The uppermost branches of the trees in a forest, forming a more or less continuous layer of foliage.
Urban forest	Banyule's urban forest is the trees and greevn assets (such as vines and climbers, shrubs, groundcovers and grasses) that exist in an urban area and are strategically planned, designed and managed. The urban forest also includes the ecosystems, soils and water that support our trees and green assets
Urban forest vulnerability	The areas of Banyule where there is a risk of the urban forest not thriving or demonstrating resilience. Areas with low canopy, aging street trees, increased urban development, negative community health outcomes, or the urban forest exhibits stress and disease.
Social vulnerability	Social vulnerability is a widely recognised way of assessing the sensitivity of a population to natural hazards and its ability to respond to and recover from them[60].
Useful life expectancy (ULE)	The length of time that a tree is expected to remain healthy and provide ecosystem services within its environment before it begins to decline. This length of time can vary between trees and between species as it depends on tree health, condition, safety and location. Note: where possible, trees with hollows should be seen as potentially valuable for habitat depending on the suitability of their structure or location.
Resilience	The ability of the urban forest to adapt, survive and thrive in a changing climate.
Water sensitive urban design (WSUD)	The approach to planning and designing urban areas and buildings that considers how to make use of the valuable resource of stormwater, make places cooler and reduce harm to waterways, rivers and creeks.

TERM	WHAT IT MEANS
Urban infill[61]	Redevelopment within established urban areas, typically using previously undeveloped or underutilised land (grey field) or redeploying previously developed land (brown field).
Ecosystem services	The benefits people derive from ecosystems (such as clean air, clean water, shade, cooling, stormwater filtration, pollination etc) – the support of sustainable human wellbeing that ecosystems provide[62,63].
Socio-Economic Indexes for Areas (SEIFA)	A product developed by the Australian Bureau of Statistics that ranks areas in Australia according to relative socio-economic advantage and disadvantage based on people's access to material and social resources, and their ability to participate in society.
Climate change[64]	Changes to the Earth's climate caused by human activity including burning fossil fuels (coal, gas, petrol and diesel) and clearing vegetation. Impacts include a global temperature increase as well as local droughts, floods, extreme hot and cold spells, and more intense rainfall.
Green infrastructure	The green spaces and water systems that intersperse, connect and provide life support for humans and other species in urban environments. Green infrastructure ranges in scale from residential gardens to local parks and housing estates, streetscapes and highway verges, services and communications corridors, waterways and regional recreation areas. Green infrastructure has many benefits for society and the environment.[65]
Grey infrastructure	Human-built physical structures and systems, such as buildings, water and electrical supply, sewers, stormwater drains, dams, reservoirs, fences, paths, roads and bridges.[9]
Habitat structures	In an urban environment, these can be nesting boxes, created hollows or suitably placed logs.
Facility tree	A tree located in a Council property such as a library or located in a leased property such as a sporting facility or kindergarten.

Reference list

1 Context (2018) *Banyule Thematic Environmental History*, prepared for Banyule City Council, electronic copy, https://shapingbanyule.files/5015/4404/7951/Banyule_thematic_history_final_3.12.18.pdf Accessed September 2021

2 Context (2018) *Banyule Thematic Environmental History*, prepared for Banyule City Council, electronic copy, https://shapingbanyule.files/5015/4404/7951/Banyule_thematic_history_final_3.12.18.pdf Accessed September 2021

3 Banyule City Council (2020) *Banyule Significant Tree and Vegetation Assessments*, electronic copy, https://shaping.banyule.vic.gov.au/download_file/2473/927, Accessed September 2021

4 Haider Taha, Heat Islands and Energy, Editor(s): Cutler J. Cleveland, Encyclopedia of Energy, Elsevier, 2004, Pages 133-143

5 Jay, O., Capon, A., Berry, P., Broderick, C., de Dear, R., Havenith, G., Honda, Y., Kovats, R. S., Ma, W., Malik, A., Morris, N. B., Nybo, L., Seneviratne, S. I., Vanos, J., & Ebi, K. L. (2021). Reducing the health effects of hot weather and heat extremes: from personal cooling strategies to green cities. The Lancet, 398(10301), 709-724. https://doi.org/10.1016/S0140-6736(21)01209-5

6 Heaviside, C., Macintyre, H. & Vardoulakis, S. The Urban Heat Island: Implications for Health in a Changing Environment. Curr Envir Health Rpt 4, 296–305 (2017).

7 Twohig-Bennett, C. and Jones, A., 2018. The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. Environmental research, 166, pp.628-637.

8 Clarke, J.M., Grose, M., Thatcher, M., Hernaman, V., Heady, C., Round, V., Rafter, T., Trenham, C. and Wilson, L., 2019. Victorian Climate Projections 2019 Technical Report. Melbourne Australia.

9 (Taha et al., 1988, Grimmond and Oke, 1991)

10 Threlfall, C.G., Ossola, A., Hahs, A.K., Williams, N.S., Wilson, L. and Livesley, S.J., 2016. Variation in vegetation structure and composition across urban green space types. Frontiers in Ecology and Evolution, 4, p.66.

11 Hartig, T., Mitchell, R., De Vries, S. and Frumkin, H., 2014. Nature and health. Annual review of public health, 35, pp.207-228.

12 Francis, J., Wood, L.J., Knuiman, M. and Giles-Corti, B., 2012. Quality or quantity? Exploring the relationship between Public Open Space attributes and mental health in Perth, Western Australia. Social science & medicine, 74(10), pp.1570-1577.

13 White, M.P., Alcock, I., Grellier, J. et al. Spending at least 120 minutes a week in nature is associated with good health and wellbeing. Sci Rep 9, 7730 (2019)

14 Yang, B.Y., Zhao, T., Hu, L.X., Browning, M.H., Heinrich, J., Dharmage, S.C., Jalaludin, B., Knibbs, L.D., Liu, X.X., Luo, Y.N. and James, P., 2021. Greenspace and human health: An umbrella review. The Innovation, 2(4), p.100164.

15 Victorian Department of Health (2021) *Air pollution* Department of Health, State Government of Victoria, viewed 30th June 2022 https://www.betterhealth.vic.gov.au/health/healthyliving/air-pollution

16 Forehead H, Barthelemy J, Arshad B, Verstaevel N, Price O, Perez P (2020) Traffic exhaust to wildfires: PM2.5 measurements with fixed and portable, low-cost LoRaWAN-connected sensors. PLoS ONE 15(4): e0231778

17 Diener, A. and Mudu, P., 2021. How can vegetation protect us from air pollution? A critical review on green spaces' mitigation abilities for air-borne particles from a public health perspective-with implications for urban planning. Science of the Total Environment, 796, p.148605.

18 Yenneti, K., Ding, L., Prasad, D., Ulpiani, G., Paolini, R., Haddad, S. and Santamouris, M., 2020. Urban overheating and cooling potential in Australia: An evidence-based review. Climate, 8(11), p.126.

19 BDO EconSearch 2020 *OPTIONS ANALYSIS: Costs and Benefits of Urban Tree Canopy Options for Minor Infill Development in the Planning and Design Code A Report to the Attorney-General's Department* South Australian Attorney-General's Department (AGD) Planning Reform area Accessed 30th June 2022 https://plan.sa.gov.au/__data/assets/pdf_file/0008/730745/Options_Analysis_-_Costs_and_Benefits_of_Urban_Tree_Canopy_Options_for_Minor_Infill_Development.pdf

20 Roy, S., Byrne, J. and Pickering, C., 2012. A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. Urban forestry & urban greening, 11(4), pp.351-363.

21 McPherson, E.G. and Muchnick, J., 2005. Effects of street tree shade on asphalt concrete pavement performance. Journal of Arboriculture 31 (6): 303-310, 31(6), pp.303-310.

22 Pandit, R., Polyakov, M., Tapsuwan, S. and Moran, T., 2013. The effect of street trees on property value in Perth, Western Australia. Landscape and Urban Planning, 110, pp.134-142.

23 Plant, L.J., Morrison, T. and Rambaldi, A., 2016. Street trees: paying their way in property value benefits. Acta Horticulturae, (1108), pp.13-24.

24 Roy, S., Byrne, J. and Pickering, C., 2012. A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. Urban forestry & urban greening, 11(4), pp.351-363.

25 Schwab J (2009) The principles of an effective urban forestry program. In: Schwab J (ed) Planning the urban forest: ecology, economy, and community development. American Planning Association (APA), Chicago, pp 25–41

26 Kendal and Baumann, 2016, The City of Melbourne's future urban forest: identifying vulnerability to future temperatures, Report to the City of Melbourne

27 e.g. Victorian Government Department of Human Services (2009) January 2009 Heatwave in Victoria: an Assessment of Health Impacts, Electronic access, https://www.health.vic.gov.au/chief-health-officer/heatwave-in-victoria, Accessed June 2022

28 Nice, K. (2021). Managing urban heat in water sensitive cities: research and policy responses. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

29 Banyule City Council (2019) *Climate Action*, Electronic access, https://www.banyule.vic.gov.au/Waste-environment/Environment-sustainability/Climate-action, Accessed July 2022

30 Hall, T., 2010. The life and death of the Australian backyard. CSIRO publishing.

31 Agriculture Victoria (2022) *About Myrtle Rust*, electronic access, https://www.awe.gov.au/biosecurity-trade/invasive-species/diseases-fungi-and-parasites/myrtle-rust, Accessed June 2022

32 Agriculture Victoria (2022) *Myrtle rust host plants and symptoms* Victorian State Government Department of Jobs, Precincts and Regions Accessed 30th June 2022 https://agriculture.vic.gov.au/biosecurity/plant-diseases/shrub-and-tree-diseases/myrtle-rust/myrtle-rust-host-plants-and-symptoms

33 Agriculture Victoria (2022) *About Myrtle Rust*, electronic access, https://www.awe.gov.au/biosecurity-trade/invasive-species/diseases-fungi-and-parasites/myrtle-rust, Accessed June 2022

34 Moore, G. (2015) *Acts of arboreal violence: tree vandals deprive us all*, Electronic article, The Conversation Media Group Ltd https://theconversation.com/acts-of-arborial-violence-tree-vandals-deprive-us-all-41342, Accessed June 2022

35 Bolger, R (2022) *Pruning street trees around powerlines could be reduced under Ausgrid plan*, https://www.abc.net.au/news/2022-10-18/pruning-street-trees-around-powerlines-ausgrid-compromise/101538168

36 Banyule City Council (2021) Banyule Public Urban Forest Tree Inventory

37 DELWP (2019) *Change in Vegetation Cover in Metropolitan Melbourne between 2014 and 2018*, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning, http://services.land.vic.gov.au/SpatialDatamart/dataSearchViewMetadata.html?anzlicId=ANZVI0803008491&extractionProviderId=1, Accessed 21st December 2021

38 DELWP (2021) *Vicmap Vegetation: Tree Extent*, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning https://tiles.arcgis.com/tiles/GB33F62SbDxJjwEL/arcgis/rest/services/Vicmap_Vegetation_Tree_Extent/MapServer

39 DELWP (2022) *Planning scheme zones - Vicmap Planning*, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning, https://discover.data.vic.gov.au/dataset/planning-scheme-zones-vicmap-planning

40 Australian Bureau of Statistics (2016) *The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)* [Census TableBuilder], Accessed 21st December 2021.

41 DELWP (2021) Vicmap Vegetation: Tree Extent, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning https://tiles.arcgis.com/tiles/GB33F62SbDxJjwEL/arcgis/rest/services/Vicmap_Vegetation_Tree_Extent/MapServer.

42 Australian Bureau of Statistics (2018) *IRSAD*, Electronic Access, https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~IRSAD~20, Accessed September 2021

43 Hurley, J., Saunders, A., Both, A., Sun, C., Boruff, B., Duncan, J., Amati, M. and Caccetta, P., 2019. Urban vegetation cover change in Melbourne: 2014-2018.

44 Commonwealth Scientific and Industrial Research Organisation (2021) *Urban Monitor*, Electronic Access, https://www.csiro.au/en/research/technology-space/data/urban-monitor, Accessed December 2021

45 Sun, Q et al 2021, A human-centred assessment framework to prioritise heat mitigation efforts for active travel at city scale, *Science of The Total Environment*, 763

46 White, M and Langenheim, N 2014, Impact assessment of street trees in the City of Melbourne using temporal high polygon 3D canopy modelling, 7th *International Urban Design Conference Designing Productive Cities*

47 Ewing, R and Bartholomew, K 2013, *Pedestrian & Transit-Oriented Design*

48 Pandit et al 2013, 'The Effect of Street Trees on Property Value in Perth', *Landscape and Urban Planning* 110 (1), pp. 134-142

49 Kendal D., Baumann, J. (2016) The City of Melbourne's Future Urban Forest: Identifying vulnerability vulnerability to future temperatures. School of Ecosystem and Forest Sciences The University of Melbourne, Accessed December 2021 http://www.melbourne.vic.gov.au/news-and-media/Pages/world-leading-research-tells-us-which-trees-to-plant-.aspx

50 CSIRO (2020) Climate Change in Australia: Climate Analogues, Accessed August 2022 https://www.climatechangeinaustralia.gov.au/en/projections-tools/climate-analogues/analogues-explorer

51 Best Practice Urban Forest Planning and Management, Literature Review, Mosaic Insights 2021

52 DELWP (2021) *Vicmap Vegetation*: Tree Extent, electronic dataset Victorian State Government Department of Environment, Land Water and Planning, https://tiles.arcgis.com/tiles/GB33F62SbDxJjwEL/arcgis/rest/services/Vicmap_Vegetation_Tree_Extent/MapServer

53 DELWP (2022) *Planning scheme zones - Vicmap Planning*, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning, https://discover.data.vic.gov.au/dataset/planning-scheme-zones-vicmap-planning

54 Australian Bureau of Statistics (2016) *The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)* [Census TableBuilder], Accessed 21st December 2021.

55 DELWP (2018) *Metropolitan Melbourne Heat Vulnerability Index 2018*, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning, Accessed 21st December 2021

56 DELWP (2022) Planning scheme overlay - Vicmap Planning, electronic dataset, Victorian State Government Department of Environment, Land Water and Planning, https://discover.data.vic.gov.au/dataset/planning-scheme-overlay-vicmap-planning

57 Ryder, C.M. and Moore, G.M., 2013. The arboricultural and economic benefits of formative pruning street trees. Arboriculture & Urban Forestry, 39(1), pp.17-24.

58 Best Practice Urban Forest Planning and Management, Literature Review, Mosaic Insights 2021

59 Best Practice Urban Forest Planning and Management, Literature Review, Mosaic Insights 2021

60 Ogie, R, Pradhan, B. (2020) Social vulnerability to natural hazards in Wollongong: comparing strength-based and traditional methods. Australian Journal of Emergency Management, Australian Institute for Disaster Resilience https://knowledge.aidr.org.au/resources/ajem-january-2020-social-vulnerability-to-natural-hazards-in-wollongong-comparing-strength-based-and-traditional-methods/

61 Cooperative Research Centre for Water Sensitive Cities Ltd (2021) *Urban Infill*, https://watersensitivecities.org.au/urban-infill/ , Accessed 21st December 2021

62 Costanza, R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S.J., Kubiszewski, I., Farber, S. and Turner, R.K., (2014) *Changes in the global value of ecosystem services*. Global environmental change, 26, pp.152-158.

63 Millennium Ecosystem Assessment (2005) *Ecosystems and human well-being: synthesis*. Island, Washington, DC.

64 Banyule City Council (2020) Community Climate Action Plan (CAP) Accessed July 2022 https://www.banyule.vic.gov.au/files/assets/public/about-us/strategies/banyule-community-climate-action-plan.pdf

65 Living Melbourne Strategy https://resilientmelbourne.com.au/wp-content/uploads/2019/09/LivingMelbourne_Strategy_online3.pdf

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