Urban Forest Management Plan

Urban Trees – Making Choices for a Changing Climate

"Urban Trees - making choices for a changing climate" is supported by the Victorian Government and funded through the Sustainability Fund - Supporting Our Regions to Adapt program.

Acknowledgement of Country

Ararat and a number of surrounding towns are located on the traditional, unceded territory of the Djab Wurrung people. We acknowledge the Djab Wurrung people, Traditional Custodians of the land where we live and pay our respects to their Elders, past and present.
We recognise the Djab Wurrung peoples continuing deep, spiritual connection to the land and their rights to their Country.

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Introduction

The purpose of this paper is to collate all the relevant data and information related to establishing and managing an urban forest. It is a tool designed to be used by Ararat Rural City Council to inform on decisions and programs in cities planting urban trees for the future.

The paper contains information on:

- How urban trees help combat climate change in cities and future-proof urban areas for human habitation
- The benefits of urban trees, including social, economic and environmental benefits
- The responses of Ararat residents to a survey designed to assess their knowledge and attitudes towards urban trees
- Management guidelines and steps required for establishing and maintaining a successful urban forest

Challenge of Mitigating and Adapting to Climate Change

Climate refers to the prevailing weather conditions in an area over a long period of time. For many years, it has been understood that an increase in greenhouse gases in the atmosphere caused by human activities is changing our climate. Victoria has already seen an increase in average annual temperatures by 1.5ºC since the 1960s and is a trend that is likely to continue.

By 2030, Victoria is predicted to experience:

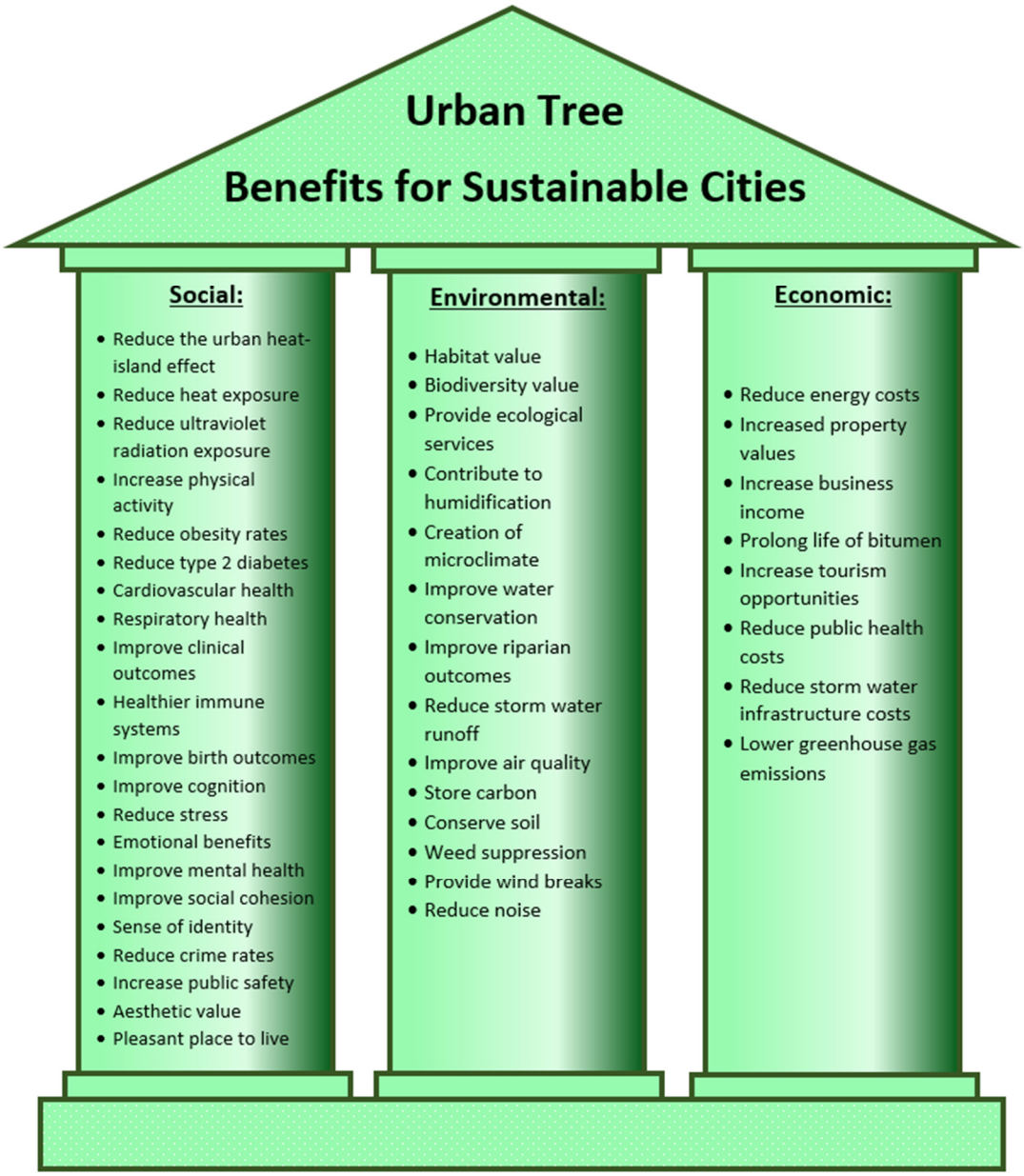
- An average annual temperature increase of 0.6-1.2ºC
- Additional hot days
- More frequent and severe heat waves
- More frequent and severe droughts
- Increased frequency and intensity of storms
- Overall decrease in rainfall by almost 10%, particularly in spring and autumn

The urban heat-island effect and global warming will have a significant impact on the incidence and severity of heat exposure, resulting in serious adverse health effects for citizens. Urban vegetation, particularly shade providing trees, have considerable cooling capability and have been shown to keep temperatures at 24-28ºC even on very hot days of 40+ degrees.

The increase in temperature and decreases in rainfall will also have an effect on vegetation in the region. Established trees are more likely to survive heat stresses and drought than new plantings. However, some species previously suitable for Ararat may no longer be viable options as environmental conditions in the region change. The proposed Ararat Rural City Council Street Tree Guide (see Appendix) contains a compiled list of heat and drought tolerant tree species that are expected to do well in Ararat now and into the future. As plantings are carried out and real-world data is collected this list may require some adjustments moving forward.

Benefits of Urban Trees

Urban trees are a crucial component of urban areas and maintain their liveability. Due to the sheer amount of benefits provided by urban trees it is difficult to place a monetary value on their worth and it could be easily argued that large, urban trees are priceless: without them, most cities would become uninhabitable. Urban trees are universally acknowledged to pay for themselves multiple times over in benefits provided throughout their lifetime.



Economic Benefits

- **Reduce energy costs:** Trees planted in close proximity to housing can help to reduce energy demand throughout the year. Trees provide shade and lower temperatures, resulting in less demand on electrical cooling systems such as air conditioning over the summertime (Donovan 2016). Urban trees can also decrease heating costs by sheltering buildings from wind and acting

as insulators (Mullaney, Lucke & Trueman 2015). A 10% increase in canopy cover can decrease heating and cooling energy use by 5-10%, resulting in a savings of AU$66-AU$119 annually (McPherson, Nowak & Rowantree 1994). It is estimated that 100,000 large urban trees in Australia would save AU$510,000 per year on energy costs related to heating and cooling (Fisher 2007). In Los Angeles, USA, the additional energy costs caused by the increased temperatures associated with the urban-heat effect compared to surrounding land is estimated at AU$100 million per year (Akbari, Pomenrantz & Taha 2001). In Australia, it was found that urban trees located to the west and south of a house had the biggest impact on cooling costs (Donovan & Butry 2009).

- **Increased property values:** The presence of large, established, broad-leaved trees as street trees were found to increase the median property values in Perth by AU$16,889 (Pandit et al. 2012).
- **Increase business income:** Treescaping around businesses can increase business income by 20% (Mullaney, Lucke & Trueman 2015). Including street trees near retail outlets resulted in customers willing to spend up to an additional 9% on an item when compared to the same item in non-treescaped stores (Wolf 2005). Patrons of treescaped businesses were also found to have more positive perceptions about the atmosphere, comfort levels and pleasantness of their experience and found the stores more visually appealing (Wolf 2005).
- **Increase tourism opportunities:** Urban trees help to give cities and town's character and a sense of identity, which can help make them more marketable to tourists (Mullaney, Lucke & Trueman 2015). Street trees also create more beautiful and liveable urban areas where people are much more likely to spend time.
- **Prolong life of bitumen:** Shady, urban trees shelter bitumen from extreme heats and excessive runoff and are estimated to prolong the life of bitumen by approximately 10 years and save AU$225 per m^2 of bitumen (Moore 2009).
- **Decreased healthcare costs:** In the United States, urban trees are conservatively estimated to save AU$30 billion per year based on healthcare costs alone (Donovan 2016). Improved health outcomes of citizens is one of the most lucrative economic benefits of urban trees and research into this sector is continuously improving and expanding.

Environmental Benefits

- **Habitat value:** The use of Australian native trees as street trees provide usable habitat for many species of native bats, birds and insects (Rhodes et al. 2006). Native streetscapes act as wildlife corridors, which are more advantageous for native birds than introduced species (White et al. 2004). The corridors facilitate movement between remnant vegetation and parks, diffusing the abrupt edges of these habitat areas and reducing levels of isolation between parks (White et al. 2004). Similarly, native insect diversity was found to be highest on streetscapes where a diverse range of native species were planted. Native species interplanted with non-native species placed the native trees at significantly increased risk of overuse and defoliation due to the 'biological fence effect' (Clem & Held 2018) as insect numbers accumulated in a single tree over multiple generations due to limited ability to disperse.
- **Biodiversity value:** Large, native trees have also been found to play a consistent, strong and positive role on bird diversity and have been unequivocally identified as keystone structures that provide crucial habitat resources for wildlife within an urban setting (Stagoll et al. 2012). Indigenous eucalyptus species were found to produce the greatest diversity of insects and native diversity bird species in urban Melbourne streetscapes (White et al. 2004). Areas with the greatest complexity of native habitat (i.e., well-established ground, shrub and canopy layers) also increased bird diversity (White et al. 2004). Structural vegetation of well-established ground,

shrub and canopy layers also help better safeguard urban green spaces against the effects of climate change on existing vegetation (Lohr, Kendall & Dobbs 2016). They also provide shade and organic matter that help soils retain moisture and provide an environment more habitable for soil biota (Czaja, Kolton & Muras 2020). High levels of species and genetic diversity within assemblages of street trees is also of vital importance to mitigate the risk of rapidly losing large numbers of urban trees, particularly under increasing environmental stresses due to climate change (Lohr, Kendall & Dobbs 2016).

- **Provide ecological services:** Urban trees provide many ecological services that underpin essential ecosystem services, including erosion control, climate regulation, soil renewal, vegetation generation, water filtration, purification of the air, maintenance of biodiversity, and greenhouse gas mitigation. In Australia, the value of 100,000 large, urban trees for carbon sequestration was estimated to be AU$25 million (Moore 2009).
- **Creation of microclimate:** Urban trees add moisture to the surrounding air via transpiration which can help to offset the effects of heat and drought in urban areas (Carlyle-Moses et al. 2020). Provision of shade and humidity by urban trees can have significant cooling effects in summer and provision of insulation and shelter from wind and frost can create less extreme winter weather (Mullaney, Lucke & Trueman 2015). This not only benefits people living in urban areas, but also improves the environment and growing conditions for other plant life in the area (Czaja, Kolton & Muras 2020). In this way, the presence of trees creates beneficial conditions for all vegetation in urban areas by alleviating stress factors.
- **Improve water conservation:** Through provision of shade and microclimates in summer, urban trees can decrease evaporation rates and alleviate some stress factors of drought for surrounding vegetation. This reduces the water requirements of plants compared to areas with an absence of urban street trees (Czaja, Kolton & Muras 2020). Urban trees also increase the amount of water infiltrating soils, keeping water in the ecosystem for longer, helping to decrease the effects of drought, increasing humidification and allowing more plants to access and use the water, thereby creating a greener environment (Mullaney, Lucke & Trueman 2015).
- **Improve riparian outcomes:** Planting trees within riparian zones in urban areas creates myriad benefits, and riparian zones have been repeatedly identified as one of the key areas for tree planting and biodiversity conservation work throughout the world (Palmer & Bennett 2006). Riparian zones in urban environments have been heavily utilised and are usually degraded (Gkiatas et al. 2021). Riparian habitats are considered keystone structures in many ecosystems, particularly within semi-arid and arid landscapes, and when properly restored and functioning can transform landscapes into significantly greener environments (Palmer & Bennett 2006). Planting trees along riparian zones improves their function by reducing water pollution, reducing runoff, reducing flooding and erosion events, reducing evaporation and in some instances slowing water movement (Dwyer et al. 1992). It is also increasingly recommended and recognized that riparian zones should, wherever possible, be planted with flora species native to the local area as they have been investigated as habitat hotspots on a number of continents, including Australia, and have been frequently reported to harbour rich and abundant fauna assemblages in comparison to that of surrounding non-riparian habitat (Palmer & Bennett 2006).
- **Reduce stormwater runoff:** Planting trees over impervious surfaces, such as along streets, was shown to have the biggest impact on stormwater runoff rates as roads have the highest runoff rate of all groundcovers in urban areas (Donovan 2016). Urban trees reduce stormwater runoff in at least three different ways: canopy interception, reducing throughfall and stemflow, and through transpiration (Carlyle-Moses et al. 2020). Throughfall occurs via canopy drip, when water caught on leaves falls to the ground. Stemflow refers to water that runs down the stem of a plant, or branches and trunk of a tree, to reach the ground, often carrying with it nutrients from the canopy. Throughfall and stemflow rates reduce as canopies become denser and larger and also help to prevent erosion and soil degradation. Canopy interception refers to water that is caught in the canopy and successfully evaporates from the leaves, never reaching the ground. Mature deciduous trees intercept between 1,890L and 2,650L of water every year (Seitz & Escobedo 2011), while

mature evergreen trees intercept over 15,410L of water per year (Cappiella, Schuler & Wright 2005). Reducing stormwater runoff reduces the likelihood of floods by decreasing peak catchment runoff volumes and increasing the amount of water infiltrating soils. Reducing erosion and runoff rates and improving soil filtration helps to keep stormwater clean, decreases water pollution rates, reduces turbulence and pollution levels downstream and minimises the need for expensive and hard to install stormwater treatment systems (Mullaney, Lucke & Trueman 2015).

- **Improve air quality:** Placing trees in high pollutant areas - such as along freeways, in car parks and near houses - can maximise the benefits provided by urban trees (Donovan 2016). Trees intake a number of pollutants including carbon dioxide, nitrogen dioxide, very fine particulate matter, volatile organic compounds, ozone, carbon monoxide and sulphur dioxide (Mullaney, Lucke & Trueman 2015). Trees can also help improve air quality by intercepting airborne pollutant particles on their leaves and branches (Mullaney, Lucke & Trueman 2015).
- **Store carbon:** Trees sequester carbon for the duration of their lifetime. The net rate of carbon uptake is greatest when trees are young and growing rapidly, and slows over time, but large, old trees act as a much larger carbon storage system than young trees (Mullaney, Lucke & Trueman 2015). Street trees also assist in building up carbon storage in soils through creation of leaf litter and other by-products, improving soil structure through their root systems and reducing instances of erosion and other soil disturbance events (Czaja, Kolton & Muras 2020).
- **Weed suppression:** The allelopathic qualities of some urban trees can aid in weed suppression in urban landscapes where high rates of soil disturbance and foreign seed traffic provide an environment where weeds have the potential to thrive (Rathinasabapathi, Ferguson & Gal 2005). The use of shredded and chipped wood mulches and establishing groundcover species are also useful in suppressing weeds and assist in improving soil health and soil conservation (Rathinasabapathi, Ferguson & Gal 2005).

Social Benefits

- **Protect against the urban heat-island effect:** The urban heat-island effect is created by the difference in temperature between towns and nearby country areas. It is usually hotter in urban areas than in non-urban areas. Hard, dark surfaces in urban areas retain and radiate more heat than natural materials like grass and vegetation, which contributes to the urban heat-island. In Switzerland, street temperatures were recorded at 37ºC and roof temperatures were recorded at 45ºC, but tree temperatures ranged from 24ºC to 29ºC on the same day (Leuzinger, Vogt & Korner 2010). Street trees can decrease daytime temperatures in summer by between 5ºC and 20ºC (Killicoat, Puzio & Stringer 2002).
- **Reduced heat exposure:** The presence of trees help to mitigate excessive heat and keep the thermal temperature within a range comfortable for the human species. Trees provide shade, which cools the air around them, increasing the moisture levels in the air and creating microclimates. The provision of shade by street trees is estimated to account for 80% of the cooling effect of street trees (Shashua-Bar, Pearlmutter & Erell 2009). The presence of adequate amounts of urban vegetation was modelled to reduce heat-related deaths in three U.S. cities in 2050 by 40% to 99%, saving hundreds of lives (Wolf et al. 2020). Furthermore, heat-related stress is accountable for approximately 1,110 premature deaths every year in the UK, which increases by a significant margin in years with extreme heat events (Doick & Hutchings 2013).
- **Reduced ultraviolet radiation exposure:** Ultraviolet radiation exposure is a major risk factor for most skin cancers. Large, shady trees with limited views of the sky through their leaves significantly reduced the risk of ultraviolet radiation exposure (Wolf et al. 2020).
- **Encourage physical activity:** High densities of large, shady urban trees increase neighbourhood walkability and encourage physical activity among residents (Wolf et al. 2020). It is most likely

due to the natural promotion of physical activity that greener urban areas also have lower prevalence of overweight and obese populations and reduced incidence of type 2 diabetes (Wolf et al. 2020).

- **Improved cardiovascular health:** The presence of urban street trees have been shown to lower blood pressure, improve blood oxygenation, slow heart rate, increase parasympathetic activity and promote digestion (Wolf et al. 2020). In conjunction with other health benefits of urban street trees, such as increased physical activity levels and lower prevalence of obesity and type 2 diabetes, a high density of urban trees can have a dramatic effect on the heart health of residents in the area.
- **Improved respiratory health:** Urban areas with high tree populations were found to have lower prevalence of lung cancer, lower prevalence of asthma among children and reduced asthma hospitalisation rates when compared with limited street tree density (Wolf et al. 2020). Reduced mortality rates and lower incidence of respiratory problems associated with greater street tree density also carry significant associated cost savings to the healthcare industry (Wolf et al. 2020).
- **Improved clinical outcomes:** Simply having a view of trees out the window or having regular access to trees was found to have positive outcomes for people recovering from major depression disorder, exhaustion disorder, post-surgical recovery and cancer. Overall they recovered faster, experienced lower remission rates, and reported improved mood and a greater sense of restoration (Wolf et al. 2020).
- **Healthier immune systems and reduced inflammation:** Exposure to natural environments has been found to increase the numbers and activity levels of white blood cells that control tumours and microbial infections, potentially due to the high concentrations of phytoncides released by trees (Wolf et al. 2020). These effects were found to last more than seven days in some test subjects. Exposure to trees also decreased the severity of asthma and atopic dermatitis in children and reduced inflammation and promoted healthier immune systems in all participants (Wolf et al. 2020).
- **Improved birth outcomes:** A 10% increase in tree canopy within 50m of the house reduced the number of small for gestational age births by 1.42 per 1,000 births (Donovan et al. 2010). Although a link between tree cover and improved birth outcomes has been found in a handful of studies, the underlying cause for these improvements are unknown and the available research is limited (Wolf et al. 2020). It is theorised that improvements to the mother's health are what lead to improved neonatal health outcomes.
- **Improved cognition and attention restoration:** In a study based in Chicago, adult residents with nearby treed areas and lawn - versus residents with only paved outdoor areas - were found to have better attention functioning and more effective life management with reported lower incidences of household aggression and violence (Wolf et al. 2020). The role of nature and natural environments on improving cognition and attention restoration has been researched for decades and has been found to improve results on attentional tests in adults and children (Wolf et al. 2020).
- **Emotional benefits:** There has been shown to be very rapid improvement in psychological wellbeing from even very limited exposure to nature, such as seeing a tree outside a window (Shanahan et al. 2015). The presence of trees has been shown to lower levels of the stress hormone cortisol in participants (Donovan 2016). Glimpses of nature through windows improved feelings of life satisfaction and wellbeing, improved self-esteem and improved feelings of restoration (Shanahan et al. 2015).
- **Improved mental health:** Exposure to trees and natural environments has been repeatedly found to reduce stress and increase relaxation, reduce feelings of anger and fatigue and enhance feelings of liveliness, vigour and vitality (Wolf et al. 2020). It is considered that greater species richness and biodiversity may have a greater positive effect on mental health than natural environments low in biodiversity (Wolf et al. 2020).

- **Improved sense of connectedness, belonging, trust and social cohesion:** It can be challenging to measure the extent of urban trees on unquantifiable and conceptual contributors to human happiness such as connectedness, belonging, trust and social cohesion. However, many residents form deep emotional attachments to urban trees and view them as living beings and friends (Pearce, Davison & Kirkpatrick 2015). Urban trees can also act as members of the community by generating neighbour interaction via starting conversation, sharing botanical interest, swapping cuttings or produce and by acting as reference points to places. Throughout human history, trees have been known to play an important role as vessels of meaning, metaphor, symbology, tradition and place-making (Pearce, Davison & Kirkpatrick 2015). One study found that participants who stared at a tree, when compared to those who stared at large buildings, were significantly more likely to engage in prosocial helping behaviours (Wolf et al. 2020). Increased access to green space has also been shown to reduce feelings of loneliness and increase connectedness within communities (Donovan 2016). Overall, high densities of urban trees help create more socially cohesive and connected communities that members are proud to be a part of (Wolf et al. 2020).
- **Sense of identity:** Urban trees have been found to give cities and towns a sense of identity, improve positive attitudes of citizens, elicit reverence and create a more socially cohesive community (Kirkpatrick, Davison & Daniels 2013).
- **Increased public safety:** Urban street trees have been found to reduce the incidence of violent crimes such as murder, rape and assault as well as property crime such as burglary, theft and arson (Wolf et al. 2020). Overall, large urban trees had greater positive outcomes on crime rates than small, view-obstructing urban trees or shrubs, which in some cases were even associated with an increase in crime (Wolf et al. 2020). Urban trees also act as a visual and physical barrier between motorists and pedestrians and have been found to reduce incidences of speeding (Mullaney, Lucke & Trueman 2015).
- **Reduction in crime rates:** The presence of urban street trees had a 40% greater crime reduction rate when compared to properties with no urban street trees but the presence of private property trees in Baltimore U.S. (Wolf et al. 2020). The presence of street trees was also associated with reduced gun assaults in Philadelphia, U.S., particularly in low-income urban areas (Wolf et al. 2020).
- **Aesthetic value:** In a survey conducted in Melbourne, Adelaide, Brisbane, Hobart, Sydney and Townsville that elicited 736 responses, by far the most common response was that street trees added to the beauty of a city and 'the more trees the better' in city environments (Kirkpatrick, Davison & Daniels 2013). Interestingly, the most common reason for private tree removal by Australian residents was aesthetic preferences for garden and house style (Clark, Ordonez & Livesley 2020). It is considered that rules and regulations alone will not be enough to protect trees on private property. Implementing programs and other ways to engage people in stewardship of private trees and educating private landowners about the value of trees in a cooperative approach would be a more effective way of preserving private tree populations (Clark, Ordonez & Livesley 2020). People who had planted a tree before were also found to be more positive in their attitude towards trees and place more value in the worth trees (Kirkpatrick, Davison & Daniels 2013). Due to this, engaging in stewardship or other tree-care activities could have a positive impact on how residents view trees as a whole and the urban trees within their neighbourhood.
- **Provide wind breaks:** Urban trees as windbreaks can act as insulation in winter, reducing the costs of heating, and create more beneficial conditions for people, plants, soil and wildlife (Mullaney, Lucke & Trueman 2015).
- **Reduce noise:** Urban street trees can have a significant dampening effect on noise by acting as physical barriers to sound waves (Donovan 2016). Strategic placement of urban trees in high-noise areas such as along freeways can provide the greatest benefit to noise reduction efforts (Donovan 2016).

Challenges of Successful Urban Trees

Properly functioning and sufficiently large street trees help pave the way in urban environments for other vegetation to thrive and increase plant survival rates (Czaja, Kolton & Muras 2020). However, trees face a number of stress factors within urban environments. This includes soil compaction, limited access to sunlight, limited space for root growth, limited space for canopy growth, air pollution, soil pollution, high soil pH, the urban heat-island effect, surface runoff, degradation of soil structure, sun reflection from infrastructure, heat radiation from infrastructure, extreme soil temperatures, nutrient deficiencies in soil and artificial light pollution (Czaja, Kolton & Muras 2020).

Smaller trees, with less canopy than large trees, don't provide the same level of shade and so have limited cooling capacity and do not deliver as many ecological, social and health benefits. For example, large trees can remove between 60 and 70 times more air pollution than smaller trees (McPherson, Nowak & Rowantree 1994). The largest tree for the space available should be preferred over smaller tree species alternatives.

What do Ararat Residents Think About Urban Street Trees?

In February 2022, a survey was distributed to residents of Ararat to assess their knowledge and understanding of urban trees. The survey received 97 responses, the majority of which were from Ararat residents (70%), a few from surrounding farms (9%), a few from other, unspecified regional towns in the area (15%), and some from Stawell (6%).
The data collected gave a snapshot of Ararat resident's knowledge and attitudes towards urban trees.

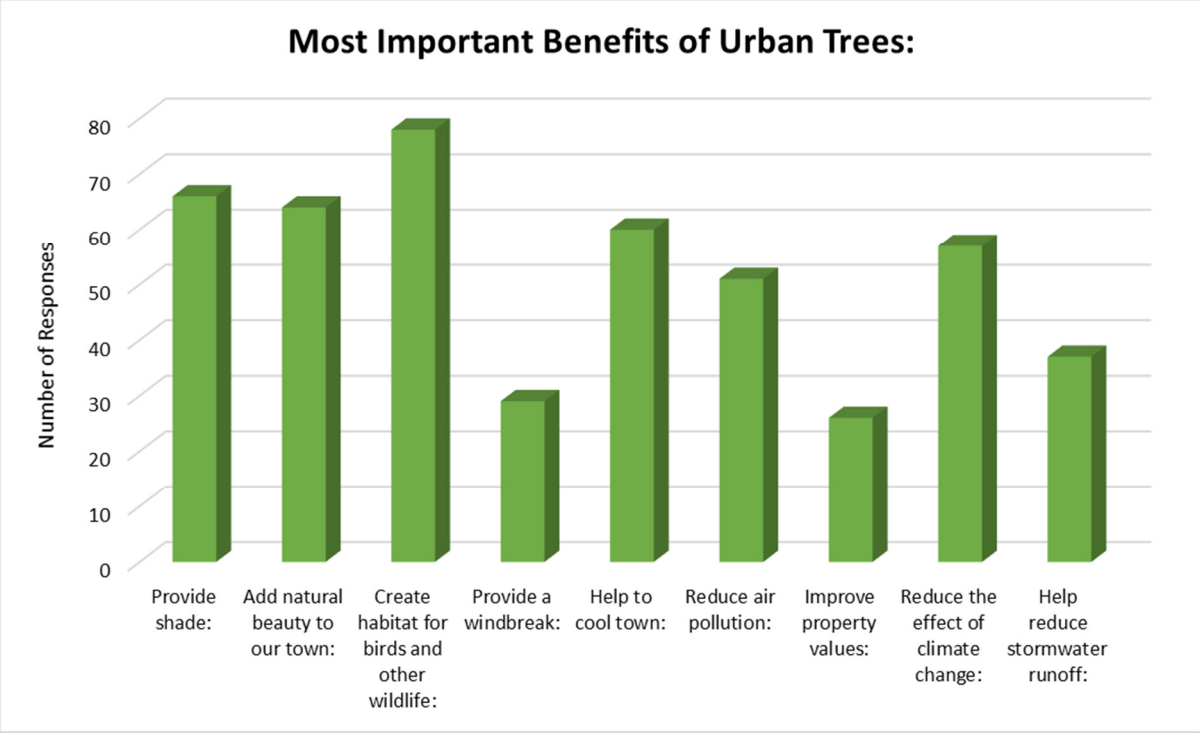


Figure 1: Number of votes for various urban tree benefits deemed to be most important by Ararat residents

Ararat residents were asked to vote for the most important urban tree benefits from a set list. From the survey results, residents thought that creating habitat for wildlife was the most important benefit of urban trees, followed closely by shade provision and adding natural beauty to Ararat's streets.

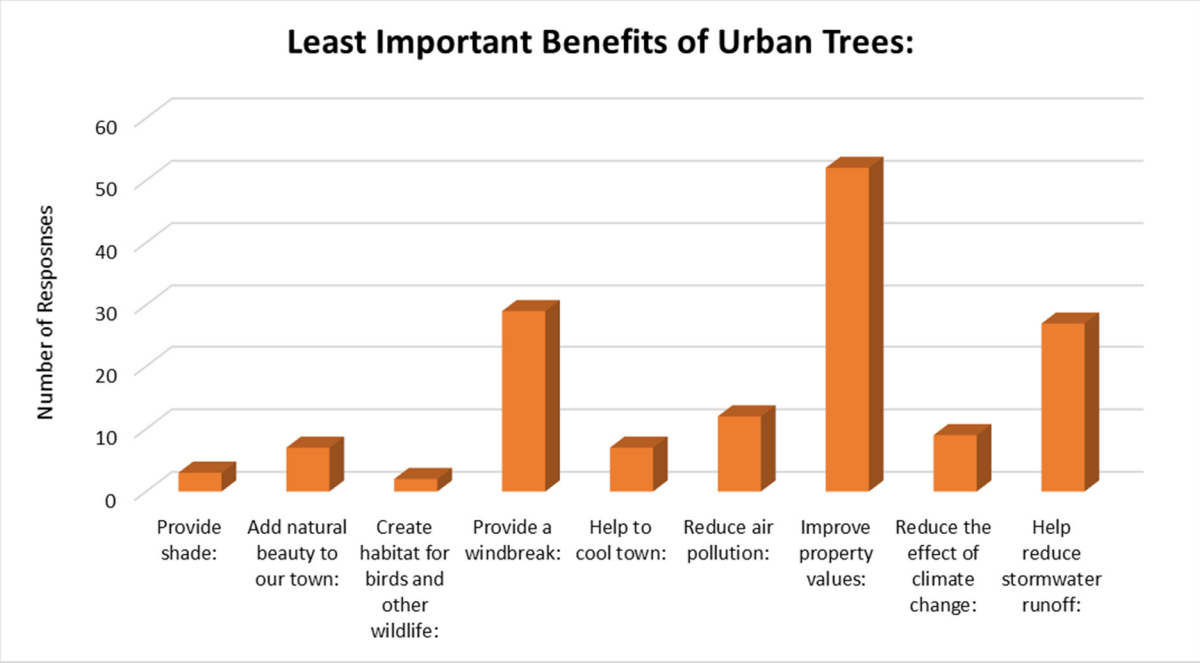


Figure 2: Number of votes for various urban tree benefits deemed to be of least importance by Ararat residents

Ararat residents were asked to vote for the least important urban tree benefits from a set list. From the survey results residents found improving property values to be the least important urban tree benefit.

82% of responders believed Ararat did not have enough street trees and they wanted more planted, some thought there was the right amount of street trees in their town (14%) and a few were not sure (4%).
The vast majority of respondents indicated at least some concerns about climate change in the region (92%). The most common response being that residents were greatly concerned about climate change (55%), some somewhat concerned (37%), a few not sure (4%) and a few not at all concerned (4%).
From responses there was a clear preference for the use of native and evergreen trees in Ararat's urban forests (79%). This is in line with the responses that creating habitat for wildlife was the most important benefit provided by street trees.
46% of responders believed urban street tree species chosen should be natives, with many also advocating for evergreen species (33%), and only some desiring deciduous trees (21%).
Most respondents (71%) indicated that they did not need help choosing tree species for use in their private gardens, with only some indicating they may need help (16%), and a few indicating they did want help (13%). Tree species selection for use in private gardens is often a matter of personal preference, and the inclusion of any form of tree in home gardens provides shading and cooling benefits. As there was no way for respondents to give a reason as to why they didn't need help selecting species it is unclear whether they already had established gardens, were already knowledgeable in species selection, had no desire for trees in their garden, were set in their personal preferences for their garden or did not desire help for some other reason.

Figure 3: Identification of challenges posed by urban street trees generated independently by Ararat residents

Residents were asked to identify challenges of growing trees in urban areas. The most common challenges identified by residents were falling leaves and falling branches. Amongst Australian residents, studies have shown that the general public fear of urban trees far outweighs the actual risk posed by urban trees (Clark, Ordonez & Livesley 2020). Educating residents on the risks posed by urban trees and the likelihood of such risks occurring can help the public to form a more realistic view of the dangers associated with trees in urban areas. Proper urban tree management can also help reduce and effectively manage a number of the risks identified by residents.

Overall the survey received 97 responses. Although this is a satisfactory number of responses, it is important to remember that the results may not be a true reflection of the opinions of Ararat residents. For example only residents with a strong love or hatred for urban trees may have bothered to respond to the survey, skewing the results. A more in-depth and extensive survey may be useful if a clearer picture of Ararat residents' views on urban trees was desired. However, other more interactive and educational community engagement initiatives may be a more beneficial use of resources to better understand the community's attitudes towards urban trees.

Important Management Points

Growing trees in an urban environment doesn't come without challenges. However, by employing a proactive management style, a number of risk factors of growing trees in urban environments are mitigated and the lifespans of urban trees are often prolonged. This improves the health of urban trees, maximises the benefits provided to urban areas and decreases maintenance costs by pre-emptively addressing future risks before they become costly and problematic.
In order to provide the greatest benefit, urban street trees should be healthy and thriving, not just surviving. As extreme climate conditions increase - including more frequent and prolonged heat waves - it is important to care for urban trees in a proactive rather than a reactive manner (Esperon-Rodriguez et al. 2021). This increases individual tree resilience and maximises the benefits provided. It is also critical to encourage the maintenance of existing remnant vegetation in the urban environment and continue to build on it through preferential planting of native species where possible. This has significant positive impacts on native fauna, particularly bird and pollinator species, and can greatly increase the ability of urban environments to act as wildlife conservation areas (Van Helden et al. 2020).

Existing Tree Regulations and Controls

There are several State and Local laws and regulations that control the removal and pruning of both native and exotic vegetation on private and public land. The policies and procedures for urban street tree management are in support of these laws and regulations and should be viewed as an addition to them.
It is the responsibility of all persons to ensure they do not do anything that is in breach of any existing laws and regulations. The applicable laws and regulations have been listed below to assist any person in determining the correct course of action for a given situation. Laws and regulations are subject to change over time.

State Government:

State Government Acts exist that control what may be done with vegetation including the Planning and Environment Act 1987. More information on this and also the Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Management Framework (NVMF) can be found at www.delwp.vic.gov.au/planning

Local Government:

The Ararat Rural City Council has a variety of planning scheme overlays and local laws that specify what may or may not be undertaken with certain types of vegetation. Some of the overlays include:

- Environmental Significance Overlay
- Vegetation Protection Overlay
- Significant Landscape Overlay
- Heritage Overlay
- Public Acquisition Overlay
- Restructure Overlay

Further details can be found at:
https://planning-schemes.app.planning.vic.gov.au/Ararat/ordinance/4876584

The Ararat Rural City Council 'Local Law Guidelines 2013x' and 'General Local Law 2012 inc amend s32 CM2019 06 25' both detail some conditions relating to private and public trees and vegetation. More details can be found at: https://www.ararat.vic.gov.au/council/council-documents/local-law

Town Planning Approvals

Urban street trees should be considered as a valuable asset and a permanent fixture in the community. No tree should be considered for removal until all other options have been explored. Refer to 'Tree removal' for further information.

Liability

Urban street trees should be the sole responsibility of Council and as such all costs related to urban street trees should be borne by Council. Any claims for damages or health and safety risks posed by Council trees will be reviewed and managed by Council.

Staff

Urban street trees should be solely managed by Council. This includes Council officers, parks and gardens staff, and independent arborists or other professionals deemed necessary that have been approved and engaged by Council. Ararat residents or other non-Council members should not prune, remove or otherwise vandalise or tamper with urban street trees.

Unauthorised Actions

Council has the power to prosecute any person who prunes or removes Council trees, unless they are an approved Council staff member or Council engaged contractors acting under Council's authorization. In addition to pruning or removing Council trees, unauthorised persons can also be prosecuted for other destructive acts to Council trees, including affixing signs or other infrastructure, or in some way disfiguring, damaging or killing trees.

Risk Identification and Mitigation

Urban trees are associated with a number of risks that must be appropriately managed.

Risks that may arise from street trees include:

- Tree root incursion
- Power line clearance
- Falling branches or dead wood that may cause injury or property damage
- Falling leaves, fruit, flowers and other plant parts that may create a slipping hazard
- Health impacts from allergenic or irritating plant parts
- Sight distance issues particularly in relation to traffic
- Impact on public and private infrastructure

These risks should be managed on a most-to-least harm basis as resources allow. All community requests relating to risk identification and mitigation should be evaluated in a timely manner and appropriate actions taken to manage the risk when deemed necessary.

Risk mitigation strategies should begin before street trees are even placed in the ground through appropriate site selection, formative pruning, root management strategies implemented at time of planting, adequate watering and continued care and maintenance throughout life. All these activities should also be supplemented with routine tree inspections every 2-5 years.

Infrastructure Protection

The growth of tree roots pose the greatest and most common risk to infrastructure. The most effective method of combating this issue is by choosing species appropriate for the available root space and species without invasive root systems.

Aside from species selection there are a number of engineering solutions that can be applied to minimise infrastructure damage including:

- Permeable paving
- Porous asphalt
- Rubber footpaths
- Water sensitive urban design
- Structural cells
- Structural soils
- Passively irrigated kerb outstands

Steps can be taken to help mitigate the risk of root intrusion on nearby infrastructure including footpaths, roads, drains, sewerage and buildings prior to, during or after planting.
Designing and constructing infrastructure that can withstand impacts from tree roots is also an excellent option. There are ongoing opportunities for design improvements as infrastructure may be replaced or changed several times throughout the lifetime of surrounding trees.

Power Lines

The Ararat Rural City Council has a statutory obligation under the Electrical Safety Act 1998 and the Electrical Safety (Electric Line Clearance) Regulations 2020 (Vic) to maintain the clearance of public vegetation around overhead electric lines to reduce the risks of fire, disruption of power or other risks to the community within the 'Declared Area'.
All electric line clearance work within the 'Declared Area' should be undertaken by a suitably qualified person engaged by Council and working in accordance with the Ararat Rural City Council Electric Line Clearance Management Plan and amenity tree pruning standards. Refer to Ararat Rural City Council Electric Line Clearance Management Plan for more information on how vegetation should be managed and 'Declared Area' maps.
Outside of the 'Declared Area,' maintaining overhead powerline clearance is the responsibility of Powercor. Although electric line clearance responsibilities do not lie with the Ararat Rural City Council outside the 'Declared Area,' Council should still ensure amenity tree pruning standards are upheld and impacts on trees are minimised.
Undergrounding of power lines is very expensive and not always feasible. Council could significantly reduce undergrounding costs by seizing opportunities presented during road reconstruction, subdivisions and capital works projects. Wherever possible Council should encourage underground power.
Consideration of tree size and location for new street tree plantings under electric lines can also help minimise risks by reducing the likelihood that the mature tree will trespass into the minimum electric line clearance area.

Data Collection and Inventory

Tree inventories compile all relevant information in one place and are the only way to get a complete picture of Ararat's urban forest and effectively track and manage it into the future.
Creating a comprehensive tree inventory can have many advantages. Adopting urban forestry principles to help mitigate the effects of climate change and reap the many benefits of urban trees should go hand-in-hand with compiling an extensive tree inventory.
Tree inventories are often stored in a fit-for-purpose Tree Asset Management System which should be nominated by Council. There are several tree management systems available commercially including Vegetation Group Australia, which works through GIS Cloud.
Tree Asset Management Systems store all relevant data in the one place as well as containing canopy mapping and tree location functions. They can also help manage urban trees' risk profile, place monetary value on street trees as an appreciating asset, and adequately budget for their sustainable management.

At a minimum Council should commit to a basic tree inventory that includes:

- Species of tree
- Tree location
- Tree age
- Predicted useful life expectancy if the tree
- Tree size (height, trunk width, canopy width)
- Tree condition
- Any notes deemed relevant during every tree inspection conducted
- Works or Tree Protection Plans/Tree Protection Management Plans that affect the tree
- Locations of vacant sites identified for future street tree plantings; particularly priority sites

Records of species and ages of trees should be used to help Council work towards best practice tree population composition. This safeguards urban forests against large-scale tree death events which would leave urban areas vulnerable to the effects of climate change with expected disastrous effects. Best practice tree population composition recommends that a single tree species make up no more than 5% the whole tree population, a single genera make up no more than 10%, and a single family no more than 20%. It is also recommended that juvenile trees represent 40% of the overall urban tree population, semi-mature represent 30%, mature 20% and over-mature or senescent 10%. This is further explained in the 'Biodiversity Considerations' and 'Tree Age' sections of this document respectively.

Space for Tree

When choosing an appropriate tree species for a site the amount of room available for the tree should always be taken into consideration. The largest tree size for the space available should be given preference over smaller options as large street trees provide the greatest range of benefits to urban environments.

Some things that may limit the available room for an urban tree include:

- Nearby private or public infrastructure
- The presence of impermeable footpaths or roads nearby
- The presence and location of drainage and sewers
- The presence and location of overhead power lines

Engineering solutions to allow surrounding infrastructure to withstand root intrusion and soil preparation techniques such as structural cells, structural soils and other root training techniques all make it possible for infrastructure and urban trees to exist in the same vicinity without issue.

Tree Selection

Please refer to the proposed Ararat Rural City Council Street Tree Guide for lists of appropriate species and for a more detailed explanation of species selection criteria. This guide can continue to be updated over time as tree species may be trialled and found to be suitable or unsuitable for the changing climate and conditions in Ararat Rural City Council.
Appropriate species selection using the Ararat Rural City Council Street Tree Guide as a reliable tool, creating diverse plantings and employing best practice planting techniques should be solely the responsibility of Council.

When selecting the appropriate species for a site, a number of factors need to be taken into consideration including:

- Size of site (the largest tree possible for the site size limitations should be given preference where possible as larger trees provide the greatest range of benefits)
- Surrounding infrastructure and the possibility of, and mitigation strategies for, root intrusion
- Other nearby species choices to ensure aesthetic and biodiversity values are met
- What percentage of the urban tree population is already represented by that species (a single species should make up no more than 5% of the overall urban forest population)
- Habitat value for the area and how it may impact species selection
- If the species being considered is classed as an environmental weed in Victoria

Biodiversity Considerations

Urban trees worldwide have limited species and genetic diversity (Lohr, Kendall & Dobbs 2016). Creating an urban forest with a wide range of tree species helps increase the resilience of the forest by mitigating the potential impact of changes in climate, new pest or disease incursions and minimising the likelihood of mass tree death events. Best practice tree population composition recommends that a single tree species make up no more than 5% the whole tree population, a single genera make up no more than 10%, and a single family no more than 20%.
In addition to safeguarding the urban forest, a diverse assemblage of species also provides a wide range of habitat values for local fauna and insect species. This is particularly true of indigenous plant species. Large, old native trees are recognised as keystone species within urban environments as they provide vital habitat, shelter, food, nesting and roosting sites and in many cases hollows for local fauna. Tree hollows are a precious habitat commodity which can in some cases lead to dead, hollow-bearing trees being retained in streetscapes for their habitat value.
Increasing structural diversity by creating canopy, understory and groundcover layers can also help mitigate some of the stress factors associated with the urban environment by different plants shielding each other from strong winds, re-radiated heat, ultraviolet radiation and protecting against soil compaction as well as reducing water loss in times of drought. Groundcover layers are of particular importance to water conservation efforts.
Artificial hollows can and should also be installed within urban streetscapes, particularly within native trees, to maximise and retain a diverse assemblage of local fauna.

Tree Size

A larger canopy cover of urban street trees provides more benefits. In terms of climate mitigation and cooling properties, 80% of a tree's cooling abilities comes from production of shade. The more shade a tree is able to create and the denser its canopy, the greater the cooling benefits of the tree.
Preference should always be given to planting taller trees with larger canopies. Canopy cover is by far the most important contributing factor to the cooling effect of urban trees.
Any vegetation is better than none for providing benefits to increase the liveability of urban areas, including cooling benefits, but trees outweigh all other vegetation in the amount of benefits provided for the number of individual plants and are the most economical way of achieving said benefits.

Useful Life Expectancy

The average useful life expectancy of urban street trees is over 40 years, which is the expected number of years a tree will be able to remain in the landscape before requiring removal and/or management for decline due to environmental stresses. The useful life expectancy of a tree often correlates with the natural death of a tree or tree decline due to environmental stress factors, which are more common in an urban environment than a natural one.
Due to the major percentage of all urban forests still being in the infancy of their useful life expectancy, many Councils will not need to invest heavily in tree renewal of declining trees for decades to come. This should be considered in budgeting predictions and urban forests should be viewed as long-term and appreciating assets.

Tree Planting

Many streets and parklands contain fewer trees than their capacity or that desired by the community. Most urban streetscapes have many potential sites for more street tree plantings. Ideally, Council should encourage residents to nominate streets, street sections and parks to be included in Council's annual planting programs. The size of the planting program will be determined by existing budgets. These budgets will require yearly revision as the program evolves and maintenance costs increase with the expansion of Ararat's urban forest.
Opportunities should be made readily available and easily accessible for community residents to lodge their requests for additional street planting; for example via Council's website, through digital or written forms or by calling directly. This helps spread community awareness of the program and ensures community cooperation and support for the program which has been shown to boost newly planted street trees survival rates.

Priority areas for street tree planting should be given to:

- Areas that lack trees
- Areas requested by the community
- High profile and high use areas
- Areas often used and conducive to recreational purposes
- Areas where there is a high percentage of old aged trees, low species diversity, and/or trees are in poor condition
- Sites where trees have been removed

Within a single street, it is important to maintain good age diversity, ensuring trees' expected natural death occurs at varying times separated by years so entire street tree populations don't die at once. It

is also important to maintain species diversity, with a suggested minimum of two species within a single street and for a single genera to make up no more than 10% of the whole tree population, so pests, diseases or other unpredicted events cannot wipe out the entire population. It is also important to provide a mixture of vegetation of different sizes, with preference given to large, shady trees, as these provide the most benefits and the greatest cooling effect. Mixtures of diverse species, sizes and ages achieve long term stability of urban tree populations and help combat stress factors for the trees associated with urban environments.

Tree species should be selected from the proposed Ararat Rural City Council Street Tree Guide and planted in accordance with the industry best-practice planting techniques outlined in 'Tree Maintenance' in this document. Correct planting techniques, species selection, quality tree stock and follow-up maintenance are all essential for successful tree establishment and avoiding costly interventions at a later date. To ensure quality tree stock and obtaining the desired species, it is often necessary to pre-plan what tree stock will be required so trees can be grown to order.

Keeping an up to date record of potential street tree planting sites helps to assist in planning ahead for species selection, annual selection of sites where new trees will be established and budget constraints.

Tree Inspections

Urban trees should be routinely inspected as part of their continued maintenance. Trees in high risk or high use areas, such as parks and playgrounds, should be inspected approximately once annually or every 2 years depending on Council's judgement. Trees in lower risk areas can be routinely inspected approximately every 4-5 years. Any defects should be electronically recorded and linked to the correct tree within the tree inventory or similar database.

Trees can also be inspected more often, if deemed necessary, for reasons such as:

- Tree risk assessments
- Tree planting requests
- Customer service requests
- Tree health assessments
- Change in tree condition
- After extreme weather events
- As part of an incident related to an insurance claim

All tree inspections should be conducted by a qualified arborist engaged by Council.

Formative Pruning

Formative pruning helps create structurally sound and strong trees. To be most effective, formative pruning should be carried out whilst trees are still young as this significantly decreases costs and the amount of stress placed on the tree.

Formative pruning is a complex process that varies between species and should only be carried out by qualified professionals that have been engaged by Council engaged because they are knowledgeable in the requirements of the species represented within the Council's urban forest.

Formative pruning whilst trees are young has been shown to save hundreds of dollars per tree in structural corrections when the tree matures and significantly lengthens the lifespan of the tree.

Pruning

Pruning trees, excluding formative pruning, should be done as a last resort as pruning can intervene on the tree's self-management and can have health ramifications for the tree.
During the planting stage trees should already have been situated in a location where minimal pruning will be required based on surrounding structures and predicted tree size.

In some instances pruning is required for reasons such as:

- To ensure healthy tree growth through formative pruning to repair physical damage and maintain shape
- Tree poses unacceptable risk to human health or safety that can be corrected by pruning
- Tree poses unacceptable risk to private and/or public infrastructure that can be corrected by pruning
- To ensure suitable clearances are maintained around power lines and other power services
- Obscured views that have been identified and verified as a traffic safety concern
- To provide safe access for both pedestrians and vehicles, depending on location
- To control epidemic pest/disease outbreaks

Refer to 'Tree removal' for further information on when tree intervention is warranted.

Root Pruning

If infrastructure redesign is not a feasible option for fixing existing infrastructure damage, selective root pruning may be required. Root pruning may also be required due to new development proposals where root bypass is not viable, or sewer, pipe and drain works or damage when no other option is available.
Roots should only be pruned by a qualified arborist under the authorisation and engagement of Council. Root pruning can be quite detrimental to tree health and so should only occur when other options have been exhausted or when the pruning required is minimally invasive. Root pruning should always be given preference over tree removal when the root pruning is not predicted to result in tree death. Refer to 'Tree removal' for further information.
To avoid root pruning, all planting sites selected should also provide adequate underground growing space for tree roots to allow for healthy trees and effective soil moisture retention.

Tree Maintenance

Tree maintenance begins in the earliest stages of developing an urban forest including appropriate species selection for the site, using best practice planting techniques outlined below and ensuring a diverse range of species are planted both within streets and between streets.

Best practise planting techniques:

1. Dig the hole for the plant 2-3 times the width of the root ball, giving the hole sloping sides. Excavate the hole to the depth of the root ball.
2. Set the root ball firmly into the hole, ensuring that the soil underneath is firmly packed and the top of the root ball sits flush with the soil horizon around the hole.
3. Backfill the hole with the original excavated soil ensuring it is flush with the top of the root ball and firming it around the root ball with your hands.

4. Add a watering method for the tree such as a length of Agi-pipe buried next to the root ball, a water well or another acceptable watering method.
5. Mulch to a depth of 75mm over the planting hole and slightly beyond to overlap with the surrounding undisturbed soil. Keep mulch 25-50mm away from the trunk of the plant to deter rot.
6. Stake the tree and use two opposing soft, flexible ties to stabilise the tree whilst it establishes. Place a tree guard around smaller trees for protection if required.

Accurate and extensive data collection should include information about relevant site conditions and surrounding vegetation to guide species selection decisions.
After initial planting, a number of ongoing maintenance tasks will need to be carried out every year that will also be managed by Council. The number of trees requiring maintenance will continue to rise over the years as Ararat's urban forest grows so the number of employees, time allotted and budgets will need to be adjusted over time to meet the growing maintenance requirements.

Ongoing maintenance tasks are outlined below:

- **Pruning around power lines:** All trees within the 'Declared Area' should have electrical line clearance maintained in accordance with the Ararat Rural City Council Electric Line Clearance Management Plan and amenity tree pruning standards

- **Pruning to maintain safe lines of site for traffic:** This will be managed through community requests that are deemed reasonable and through regular tree inspections as outlined in 'Tree Inspections'
- **Formative pruning:** Formatively pruning young and developing trees correctly can reduce future risks and costs associated with the tree as outlined in 'Formative Pruning'
- **Leaf litter or tree debris pick up service:** Should be managed in conjunction with a formal composting service or area for composting designated by Council
- **Watering:** Watering of young and developing trees to aid in their establishment and maintain healthy urban street trees
- **Maintaining best practice techniques:** Continually staying up to date with new and emerging techniques and technology to ensure maintenance techniques and tree planting techniques are run to an appropriate standard. Staying up to date and employing infrastructure techniques that help improve success rates of site sharing by infrastructure and trees. This may require formal updates to relevant documents.
- **Data collection and inventory:** Ararat's urban tree inventory should continue to grow over time until every tree and possible planting site is included in the inventory. It will also require continual updating to ensure the information is accurate and reflects the current condition and number of urban street trees
- **Continual management of tree assets:** As part of data collection, Council should aim towards including the monetary assets of urban trees within the budget and use the data to guide budget decisions. The budget associated with the urban forests establishment and maintenance will also need continual management and updating as the urban forest grows and evolves

All tasks associated with the maintenance of the urban forest should be the sole responsibility of Council. This includes Council officers, parks and gardens staff, and independent arborists or other professionals deemed necessary that have been approved and engaged by Council. All works requiring expert knowledge should only be undertaken by qualified persons engaged and acting under the authorisation of Council.
Watering and leaf litter and tree debris maintenance tasks are an excellent opportunity for community engagement. Wherever possible, residents should be encouraged to assist in managing tree debris and should have access to a composting service or composting site to dispose of the tree litter. Residents should also be encouraged to provide watering to young or developing Council trees - particularly those in front of their home - to assist in the establishment and continued health of urban trees. Encouraging tree stewardship actions like these by residents helps residents to better value street trees, garners support for urban forest initiatives, creates more resilient and better connected communities and results in greater survival rates of urban trees and healthier urban forests.

Water Management

Water is crucial for urban tree health and survival. However, traditional streetscape drainage systems have been designed to divert stormwater away from urban areas as quickly as possible. Urban trees without enough water become vulnerable to pests and disease and are less able to deliver a full range of social, economic and environmental benefits. Thriving - as opposed to surviving - urban trees contribute maximum benefits to an urban landscape and have higher survival rates and longer lifespans.
For all urban street trees under Council's management, it is important to meet the water requirements of those trees. This can be sustainably achieved through recycled, grey water, and storm water use. Additionally, encouraging residents to water the trees in front of their property in times of water and heat stress can encourage stewardship and connection with urban trees and increase survival rates of urban trees. Thriving street trees that are watered appropriately are healthier, more resilient and deliver a greater range of benefits than street trees which are stressed and struggling to survive.

Integrating water sensitive urban designs features into the urban environment delivers significant economic, social and environmental benefits and is an excellent way to sustainably manage stormwater.

Water sensitive urban design features include:

- Urban vegetation irrigation through storm water capture and storage, grey water use, or other sustainable water sources
- Passive stormwater capture
- Bioretention systems such as rain gardens, tree pits, bio-filters, bio-pods and bio-filtration systems
- Swales
- Sedimentation basins
- Constructed wetlands
- Flood retarding basins

All of these water sensitive urban design features provide urban trees with adequate water sources and reduce stormwater runoff, reduce erosion, decrease flood risks and passively filter stormwater, reducing the need for costly and hard-to-install stormwater treatment systems.
Planting trees over impervious surfaces, such as along streets, was shown to have the biggest impact on stormwater runoff rates as roads have the highest runoff rate of all groundcovers in urban areas.
Water sensitive urban design also has immense environmental benefits for nearby wetlands and water bodies by decreasing water pollution rates and reducing turbulence.
Irrigation and passive stormwater capture reduces the need for urban tree watering, freeing up Council staff and resources.
Additionally, urban trees should be selected from the proposed Ararat Rural City Council Street Tree Guide as all the species within will have proven to be resilient, heat tolerant and drought tolerant.

Pest and Disease Management

Trees are subject to a range of pests and diseases and eradication is not practical in most cases as pests generally exist as part of the natural system.
Biodiversity is a key tool in avoiding widespread tree loss and in some cases in preventing the spread of the pests or disease. Biodiversity within streets and among streets helps safeguard urban trees against pests and diseases. Tree species that are known to be particularly susceptible to specific pests or diseases should be avoided and should be excluded from the Ararat Rural City Council Street Tree Guide. As the climate changes it is unclear how this will influence and impact tree pests and diseases, further highlighting the need for diverse urban forest populations.
As pests and diseases are inevitable and impractical to treat, harm minimization should be adopted as the best approach. Council should intervene when pests or diseases threaten the immediate or long term survival of urban trees or in cases of life-threatening outbreaks or epidemics.

Infectious Material

If a street tree is removed due to pests or diseases or carrying a pest or disease all waste products of that tree, including wood chips, logs, branches and other debris, that was infected or could have been infected should be disposed of in a manner that will prevent the spread of infection. All equipment, vehicles and personal items that came into contact or potentially came into contact with infected items should be disinfected by approved methods prior to being returned to service.

Termites

Termites are a native species that play an important role in ecosystem function. There are hundreds of different species of termites in Australia but only a dozen are known to cause damage to property. Trees that contain termites should not be assumed to be compromised as termites feed on the dead heartwood of trees and not the living tissue required for growth and stability. Removal of trees with termites may increase the chance of damage to property as their original home and food source would be removed, forcing the termites to seek a new place to live. Due to this the presence of termites in urban trees should not be a reason for the removal of any Council tree.

Council should not allow:

- The drilling or boring of urban trees to ascertain the presence of termites
- The chemical treatment of urban trees against termites
- The removal of urban trees as a preventative measure against termites

Tree Health

Street trees should be routinely inspected to ensure they are in good health, are being well maintained, and do not pose any risks to surrounding infrastructure or public health and safety. Those in poor health that do not seem likely to recover and those that are dead should be recorded and replaced in a timely manner.

Tree Value

Street trees provide a number of social, economic and environmental benefits as outlined in this document. No single study has placed a monetary value on the amount of money saved from each benefit, but it is unanimously considered that urban trees pay for themselves many times over.
A number of localities have attempted to place values on their urban forests using a US based valuation tool i-Tree Eco. i-Tree Eco provides estimates of tree value based on eight urban tree benefits, as well as taking into account the costs of tree planting, maintenance and species composition. The estimates are conservative estimates of the true value of urban street trees.

Annual value of urban forests for selected regional towns and metropolitan centres:

- Ballarat (120,000 trees): AU$387m
- Geelong (120,000 trees): AU$350m
- Dandenong (55,276 trees): AU$182m
- Dubbo (38,000 trees): AU$211m
- Moreland (129,000 trees): AU$270m

It isn't possible to place a value on Ararat's street trees at this time as there is not enough data available. However street trees would clearly add value to the city and save on a number of costs.

Significant Trees

Significant trees are any tree that has cultural, historical, horticultural, scientific, aesthetic, amenity, social, ecological or contextual significance. The term "significant tree" can also pertain to trees that have large trunk diameters or form part of a canopy.
Significant trees should be required to be formally identified and assessed for significance. Approved trees should be registered within an Ararat Rural City Council Significant Tree Register.
Where possible the community should be encouraged to nominate trees for inclusion on the register and registered trees should be clearly identified and promoted.

Habitat Trees

Hollows occur in large, old trees and provide critical habitat for many native wildlife species. Hollows take decades, and in some cases over a century, to form and as such hollow bearing dead trees are a precious asset. Living trees that bear hollows should be vigilantly protected and dead hollow-bearing trees should be assessed for risk and, if suitable, have their main trunk, branches and hollows preserved.

Tree Age

Urban trees are generally classified into four separate age categories: juvenile (including newly planted trees), semi-mature trees (that are still actively growing and yet to achieve their expected size), mature trees, and over mature or senescent trees.
According to best practice it is recommended that juvenile trees represent 40% of the overall urban tree population, semi-mature represent 30%, mature 20% and over-mature or senescent 10%.
Over-mature or senescent trees should, where possible, be afforded extra care to prolong their presence in the landscape as they reach the end of their natural life.

Intervention techniques such as those listed below can assist in this endeavour:

- Mulching
- Soil aeration
- Irrigation and fertilisation
- Increased frequency of inspection
- Bracing or cabling of weak branches and stems
- Landscape design interventions to remove possible targets and create a more favourable growing environment

Senescent trees should also be inspected for tree hollows and, if any are found, assessed for suitability as standing, dead, hollow-bearing trees. After tree death, trees which do not bear hollows should be removed and replaced in a timely manner.

Tree Protection

Tree protection is of vital importance to ensure urban street trees are healthy and functioning. Urban trees take years and significant funds to establish and it is important that adequate protection measures are put in place to safeguard tree assets. Protecting all urban trees, above and below ground, should

always be at the forefront of any decisions made by Council, including construction and maintenance activities, changes to land-use and public requests. Tree protection is important from as early in the process as selecting appropriate species and selecting appropriate tree planting sites.
In cases of construction and works activities, a Tree Protection Zone can be established around impacted trees that protect trees from damage, pruning, severing roots, soil compaction, stockpiling of building materials, debris or soil, wash down and cleaning of equipment, chemical, cement products or fuel spills, trenching, tree canopy scorching and temporary or permanent installation of utilities and signs.
If any pruning or root pruning is required for the works, these tasks should be undertaken by a Council engaged arborist and should not be permitted without authorization from Council.
Tree Protection Plans (TPP) or Tree Protection Management Plans (TPMP) forms can be created and approved by Council and required for any work that will be done near an urban tree to ensure trees will be protected. TPPs and TPMPs must be finalised and approved prior to works commencing. Failure to do so could result in fines. Adopting incentives and penalties such as tree protection Bonds at the time of TPP or TPMP approval can help ensure urban street trees are not damaged.
If acts of vandalism occur it is important that this is addressed swiftly.

In order to address and prevent acts of vandalism Council could consider:

- Community education programs to improve public perceptions of trees
- Encouraging people to report acts of vandalism and vandals
- When urban trees are suspected of vandalism erect signs to inform the public of what happened and reinforce Council's commitment to trees
- Replace vandalised trees as soon as possible if required
- Encourage community stewardship of public trees through programs such as 'Adopt a Tree'
- Retain strong relationship with local environmental and friends of groups to advocate for urban forests
- Adopt community engagement and community awareness programs such as poetry or message forums for street trees where people can write to their favourite tree
- Remind people it is against the law to vandalise Council trees

Tree Removal

Encouraging robust protection regulations around street tree removal is important for the persistence, health and sustainability of any urban forest. Deciding upon these guidelines that will later inform if and when trees are removed is a vital part of street tree management plans.
A key component in informing street tree removal is valuing the tree being removed. It should always be assumed when assessing individual trees for removal that every tree, no matter how insignificant they may appear, is valued by somebody. Mature, healthy street trees in particular are universally acknowledged as invaluable and irreplaceable, as any new tree planted will take years to reach a similar size. Careful planning and thought must be put in before removing mature, healthy street trees and they should only ever be removed as a last resort.
A review of 10 sound, existing urban tree guidelines in Victoria explored the following reasons to consider urban tree removal:

Trees <u>will not</u> be formally considered for removal based on the following reasons:

- Reduce or eliminate leaf litter or other debris
- Difficulty establishing plants or grass under tree
- The presence or presumed presence of termites within the tree
- To reduce the impact of bird/bat/animal/insect waste or noise
- For superficial bush fire risk mitigation
- Pollen
- Minor allergies or irritant responses

- Increase number of car parks or to facilitate parking on nature strip
- To reduce overshadowing of solar panels or for solar access
- Tree is blocking light or creating shade
- Preserve lines of sight to advertising boards
- Interference with television or satellite dish reception
- Obscuring views or vistas unless there is a traffic safety concern
- For unjustified property or infrastructure damage claims
- Aesthetic concerns or personal dislike
- Tree is considered too large by the complainant

Tree removal may be required for the following reasons:

- Tree poses unacceptable risk to human health or safety that cannot be corrected by pruning, transplanting, or other arboriculture treatment
- Tree poses unacceptable risk to private and/or public infrastructure that cannot be corrected by pruning, transplanting, or other arboriculture treatment
- To facilitate Council-approved developments, once all practical design solutions to retain the tree have been exhausted
- In the case of an emergency such as a burst water main where removal is deemed necessary
- Obscured views that have been identified and verified as a traffic safety concern
- To control epidemic pest/disease outbreaks
- If the tree is dead or in severe decline
- To eliminate trees identified as environmental weed species
- Non-indigenous trees that occur in natural or bushlands reserves and are incompatible with the conservation values of the reserve
- The tree has been recognized to produce severe allergic response or toxic responses

Urban street trees should not be removed until all possible interventions and practical design solutions to retain the tree have been exhausted if they are:

- Listed as a significant tree
- Provide an important biodiversity function
- Healthy and structurally sound indigenous or non-weedy species
- In some cases dead, large, native trees may be retained for habitat value for native wildlife based on case-by-case evaluation

All urban street tree removal works including pruning and assessments should be conducted by an appropriately trained Council staff member or an independent arborist engaged by Council. The Council should bear the responsibility and costs associated with the management, removal and replacement of all Council trees.

Community Engagement

Community engagement is an important factor in ensuring that there is community support for urban trees and helps increase the incidence of tree stewardship and decrease the incidence of tree vandalism.

There are many education opportunities for the community that can be provided by Council including:

- Community outreach projects educating the community on the value and benefits of urban trees such as Council newsletters, informative websites, flyers, videos, signage on site, newspaper articles, booklets, Q&A sessions etc
- Information on Council's objectives for its urban trees
- Public access to Suitable Trees species lists and Urban Tree Management Plan documents

- Community activities centred around urban trees
- A contactable and responsive Council in regards to urban tree requests
- Information about Council's proactive urban tree inspection and pruning programs
- Consultation with residents adjacent to tree planting works in regards to urban tree selection, staying within the parameters of Suitable Tree species lists and biodiversity guidelines
- Information and consultation with the community regarding major projects involving tree planting, tree removal and other specialised projects that involve urban trees
- Encouraging community stewardship of public trees through programs such as 'Adopt a Tree'
- Retaining strong relationship with local environmental and friends of groups to advocate for urban forests
- Adopting community engagement and community awareness programs such as poetry or message forums for street trees where people can write to their favourite tree
- Dispelling urban street tree myths that commonly result in community concern such as limb dropping and root damage to infrastructure

In addition to this, the community can effectively monitor urban trees because they are generally on site more often than Council staff. Encouraging the wider community to be aware of tree issues and to contact Council for information or when matters of concern arise can provide an excellent opportunity for cooperative urban tree monitoring. Monitoring their local urban trees can also encourage tree stewardship by residents and increase voluntary urban tree watering and leaf litter collection. This is of great benefit to the survival rates of urban trees and the overall health of an urban forest.

Education

Community awareness programs and education programs are important to ensure the community understands the value of street trees and to foster caring and responsible attitudes towards trees and tree management. These education programs can also lead to better informed tree selection and tree stewardship on private land, and an increase in the amount of trees on private land. Community awareness programs are also important for ensuring positive and supportive attitudes towards urban trees and urban greening strategies proposed and undertaken by Council.
Subject to funding and resource constraints, Council should endeavour to provide education and spread community awareness around appropriate ways to care for, manage and value trees.

Recommendations

Many cities are working towards 25%-40% canopy coverage by 2025-2030. It would greatly benefit Ararat and Ararat residents to adopt similar initiatives.

In order to best manage the urban heat-island effect and create a more sustainable and liveable city moving forwards it is recommended that the Ararat Rural City Council:

- Commit to diverse plantings with no more than 5% of a single species, no more than 10% of a single genera and no more than 20% of a single family to make up the whole tree population.
- Commit to working towards a canopy cover of 30-40%.
- Commit to extensive data collection that accurately reflects the current makeup and state of Ararat's urban forest, including an inventory of every potential tree planting site that will then be planted in a priority based fashion.
- Collate an inventory of Significant trees that will be recognised and given protections higher than the general protections granted to all urban street trees.
- Employ community engagement initiatives to make the general public aware of the project and to encourage street tree appreciation and stewardship amongst the community. Community engagement activities should include educating the general public about the benefits of street trees and urban gardens.
- Preferentially plant native tree species instead of exotic species wherever possible, particularly in parks, reserves and riparian zones for habitat benefits.
- Ensure all species planted are not classed as environmental weeds in Victoria
- Actively protect and value urban trees, using the monetised value of street trees to help inform on budget allocations.

Creating an urban forest in Ararat helps future-proof the city and boasts myriad benefits including a number of health benefits for citizens, financial benefits for the city and environmental benefits for all life in the area. Urban trees are now being considered as an appreciating asset that all Australian cities should be investing in.

References

- Akbari, H Pomerantz, M Taha, H 2001, 'Cool surfaces and shade trees to reduce energy use and improve air quality', *Solar Energy*, vol. 70, no. 3, pp. 295-310, doi: https://doi.org/10.1016/S0038-092X(00)00089-X
- Barth, B FitzGibbon, S Wilson, R 2014, 'New urban developments that retain more remnant trees have greater bird diversity', *Landscape and Urban Planning*, vol. 136, pp. 122-129, doi: https://doi.org/10.1016/j.landurbplan.2014.11.003
- Cappiella, K Schueler, T Wright, T 2005, '*Urban Watershed Forestry Manual Part 1: Method of increasing forest cover in a watershed'*, United States Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry, Pennsylvania.
- Carlyle-Moses, D Livesley, S Baptista, M Thom, J Szota, C 2020, *Forest-Water Interactions: Urban trees as green infrastructure for stormwater mitigation and use,* vol. 240, Springer, Cham
- Clark, C Ordonez, C Livesley, S 2020, 'Private tree removal, public loss: valuing and enforcing existing tree protection mechanisms is the key to retaining urban trees on private land', *Landscape and Urban Planning*, vol. 203, doi: https://doi.org/10.1016/j.landurbplan.2020.103899
- Clem, C Held, D 2018, 'Associational interactions between urban trees: are native neighbours better than non-natives', *Environmental Entomology*, vol. 47, no. 4, pp. 881-889, doi: https://doi.org/10.1093/ee/nvy071
- Czaja, M Kolton, A Muras, P 2020, 'The complex issue of urban trees- stress factor accumulation and ecological service possibilities', *Forests*, vol. 11, no. 9, pp. 932, doi: https://doi.org/10.3390/f11090932
- Doick, K Hutchings, T 2013, *Air temperature regulation by urban trees and green infrastructure*, *Forest Research,* vol. 12, Forestry Commission, Edinburgh
- Donovan, G 2016, 'Including public-health benefits of trees in urban-forestry decision making', *Urban Forestry & Urban Greening*, vol. 22, pp. 120-123, doi: https://doi.org/10.1016/j.ufug.2017.02.010
- Donovan, G Butry, D 2009, 'The value of shade: Estimating the effect of urban trees on summertime electricity use', *Energy and buildings*, vol. 41, no. 6, pp. 662-668, doi: https://doi.org/10.1016/j.enbuild.2009.01.002
- Donovan, G Michael, Y Butry, D Sullivan, A Chase, J 2010, 'Urban trees and the risk of poor birth outcomes', *Health & Place,* vol. 17, no. 1, pp. 390-393, doi: https://doi.org/10.1016/j.healthplace.2010.11.004
- Dwyer, J McPherson, E Schroeder, H Rowntree, R 1992, 'Assessing the benefits and costs of the urban forest', *Journal of Arboriculture*, vol. 18, no. 5, pp. 227-234, url: https://www.fs.usda.gov/treesearch/pubs/61733
- Esperon-Rodriguez, M Power, S Tjoelker, M Marchin, R Rymer, P 2021, 'Contrasting heat tolerance of urban trees to extreme temperatures during heatwaves', *Urban Forestry & Urban Greening*, vol. 66, doi: https://doi.org/10.016/j.ufug.2021.127387
- Fisher, P 2007, 'Why we need the urban forest', *Urban Ecosystems*, pp.12-13.
- Gilbert, M Brack, C 2006, 'Changes in public requests to remove significant urban trees after severe bushfires in Canberra, Australia', *Urban Forestry & Urban Greening*, vol. 6, no. 1, pp. 41-48, doi: http://doi.org/10.1016/j.ufug.2006.10.001
- Gkiatas, G Kasapidis, I Koutalakis, P Iakovoglou, V Savvoppoulou, A, Germantzidis, I Zaimes, G 2021, 'Enhancing urban and sub-urban riparian areas through ecosystem services and ecotourism activities', *Water supply*, vol. 21, no. 6, pp. 2974-2988, doi: https://doi.org/10.2166/ws.2021.114
- Killicoat, P Puzio, E and Stringer, R 2002, 'The economic value of trees in urban areas: estimating the benefits of Adelaide's street trees', *Proceedings Treenet Symposium*, vol. 94, pp. 106.
- Kirkpatrick, J Davison, A Daniels, G 2013, 'Sinners, scapegoats or fashion victims? Understanding the deaths of trees in the green city', *Geoforum*, vol. 48, pp. 165-176, doi: https://doi.org/10.1016/j.geoforum.2013.04.018

- Leuzinger, S Vogt, R Korner, C 2010, 'Tree surface temperature in an urban environment', *Agricultural and Forest Meteorology,* vol. 150, pp. 56-62, doi: 10.1016/j.agrformet.2009.08.006
- Lohr, V Kendall, D Dobbs, C 2016, 'Urban trees worldwide have low species and genetic diversity, posing high risks of tree loss as stresses from climate change increase', *Acta Hortic,* pp. 263-270, doi: 10.17660/ActaHortic.2016.1108.34
- McPherson, G Nowak, D Rowntree, R 1994, *Chicago's Urban Forest Ecosystem: Energy-Saving Potential of Trees in Chicago,* General Technical Report NE-186, U.S. Department of Agriculture, Forest Service, Northern Forest Experiment Station, Pennsylvania.
- Moore, G 2009, 'Urban trees: worth more than they cost', *Proc. 10th National Street Tree Symp.,* pp. 7-14, url: https://treenet.org/resource/urban-trees-worth-more-than-they-cost/
- Mullaney, J Lucke, T Trueman, S 2015, 'A review of benefits and challenges in growing street trees in paved urban environments', *Landscape and Urban Planning*, vol. 134, pp. 157-166, doi: https://doi.org/10.1016/j.landurbplan.2014.10.013
- Palmer, G Bennett, A 2006, 'Riparian zones provide for distinct bird assemblages in forest mosaics of south-east Australia', *Biological Conservation,* vol. 130, no. 3, pp. 447-457, doi: https://doi.org/10.1016/j.biocon.2006.01.006
- Pandit, R Polyakov, M Tapsuwan, S Moran, T 2012, 'The effect of street trees on property value in Perth, Western Australia', *Landscape and Urban Planning,* vol. 110, pp. 134-142, doi: http://doi.org/10.1016/j.landurbplan.2012.11.001
- Pearce, L Davison, A Kirkpatrick, J 2015, 'Personal encounters with trees: The lived significance of the private urban forest,' *Urban Forestry & Urban Greening*, vol. 14, no. 1, pp. 1-7, doi: https://doi.org/10.1016/j.ufug.2014.11.003
- Plant, L Sipe, N 2016, 'Adapting and applying evidence gathering techniques for planning and investment in street trees: a case study from Brisbane, Australia', *Urban Forestry & Urban Greening*, vol. 19, pp. 79-87, doi: https://doi.org/10.1016/j.ufug.2016.07.005
- Rathinasabapathi, B Ferguson, J Gal, M 2005, 'Evaluation of allelopathic potential of wood chips for weed suppression in horticultural production systems', *HortScience,* vol. 40, no. 3, pp. 711-713, doi: http://doi.org/10.21273/HORTSCI.40.3.711
- Rhodes, M Wardell-Johnson, G Rhodes, M P Raymond, B 2006, 'Applying network analysis to the conservation of habitat trees in urban environments: a case study from Brisbane, Australia', *Conservation Biology*, vol. 20, no. 3, pp. 861-870, doi: http://doi.org/10.1111/j.1523-1739.2006.00415.x
- Seitz, J Escobedo, F 2011 'Urban forests in Florida: Trees control stormwater runoff and improve water quality', *School of Forest Resources and Conservation*, no. 268, pp. 1-5, url: https://respository.urosario.edu.co/handle/10336/28325
- Shanahan, D Fuller, R Bush, R Lin, B Gaston, K 2015, 'The health benefits of urban nature: How much do we need?', *BioScience*, vol. 65, no. 5, pp. 476-485, doi: https://doi.org/10.1093/biosci/biv032
- Shashua-Bar, L Pearlmutter, D Erell, E 2009, 'The cooling efficiency of urban landscape strategies in a hot dry climate', *Landscape and Urban Planning*, vol. 92, no. 3-4, pp. 179-186, doi: https://doi.org/10.1016/j.landurbplan.2009.04.005
- Stagoll, K Lindenmayer, D Knight, E Fischer, J Manning, A 2012, 'Large trees are keystone structures in urban parks', *Conservation Letters*, vol. 5, no. 2, pp. 115-122, doi: https://doi.org/10.1111/j.1755-263X.2011.00216.x
- Symes, P Connellan, G 2013, 'Water management strategies for urban trees in dry environments: lessons for the future', *Arboriculture & Urban Forestry*, vol. 39, no. 3, pp. 116-124, url: https://www.researchgate.net/profile/Peter-Symes/publication/284033257_Symes_P_and_Connellan_G_2013_Water_Management_Strategies_for_Urban_Trees_in_Dry_Environments_Lessons_for_the_Future_Arboriculture_Urban_Forestry_2013_393_116-124/links/5aa3104745851543e63d5040/Symes-P-and-Connellan-G-2013-Water-Management-Strategies-for-Urban-Trees-in-Dry-Environments-Lessons-for-the-Future-Arboriculture-Urban-Forestry-2013-393-116-124.pdf

- Van Helden, B Close, P Stewart, B Speldewinde, P Comer, S 2020, 'An underrated habitat: Residential gardens support similar mammal assemblages to urban remnant vegetation', *Biological Conservation*, vol. 250, pp. 108760, doi: https://doi.org/10.1016/j.biocon.2020.108760
- White, J Antos, M Fitzsimons, J Palmer, G 2004, 'Non-uniform bird assemblages in urban environments: the influence of streetscape vegetation', *Landscape and Urban Planning*, vol. 71, no. 2-4, pp. 123-135, doi: https://doi.org/10.1016/j.landurbplan.2004.02.006
- Wolf, K 2005, 'Trees in the small city retail business district: Comparing resident and visitor perceptions', *Journal of Forestry*, vol. 103, no. 8, pp. 390-395, doi: https://doi.org/10.1093/jof/103.8.390
- Wolf, K Lam, S McKeen, J Richardson, G Van den Bosch, M Bardekjian, A 2020, 'Urban Trees and Human Health: A Scoping Review', *International Journal of Environmental Research and Public Health*, vol. 17, no. 12, pp. 4371, doi: http://doi.org/10.3390/ijerph17124371

Appendix

Ararat Rural City Council Street Tree Guide

Green boxes = native species.
Pink boxes = exotic species.
Organised alphabetically and by size.
All listed species have moderate to high drought tolerance and are predicted to do well in Ararat's climate now and into the future.
This table is subject to change as real world data is collected on the species selected and new species are trialled. Species with high mortality rates and/or weediness potential to invade surrounding bushland should be discounted from the list.

When selecting the appropriate species for a site, a number of factors need to be taken into consideration including:

- Size of site (the largest tree possible for the site size limitations should be given preference where possible as larger trees provide the greatest range of benefits)
- Surrounding infrastructure and the possibility of, and mitigation strategies for, root intrusion
- Other nearby species choices to ensure aesthetic and biodiversity values are met
- What percentage of the urban tree population is already represented by that species (a single species should make up no more than 5% of the overall urban forest population)
- Habitat value for the area and how it may impact species selection
- If the species being considered is classed as an environmental weed in Victoria

Small Trees: 1-5m tall

Scientific Name:	Common Name:	Tree Size:	Notes:
Acacia boormannii	Snowy River Wattle	H: 4m W: 3m	
Acacia stricta	Hop Wattle	H: 2-5m W: 2-4m	
Acacia verniciflua	Varnish Wattle	H: 3-5m W: 3-5m	
Allocasuarina grampiana	Grampians Sheoak	H: 1-4m W: 1-3m	
Banksia ericifolia	Heath Banksia	H: 3-6m W: 2-4m	
Banksia marginata	Silver Banksia	H: 2-12m W: 1-4m	Typically only 2-4m in height.
Banksia praemorsa	Cut Leaf Banksia	H: 2-5m W: 2-3m	
Banksia saxicola	Grampians Banksia	H: 2-6m W: 2-4m	
Callistemon 'Harkness'	Callistemon Harkness	H: 3-6m W: 2-3m	

Callistemon 'Kings Park Special'	Callistemon Kings Park Special	H: 4m W: 2-3m	
Callistemon citrinus	Crimson Bottlebrush	H: 3-4m W: 2-3m	
Callistemon pallidus	Lemon Bottlebrush	H: 4-6m W: 2-5m	
Callistemon rugulosus	Scarlet Bottlebrush	H: 4m W: 3-4m	
Callitris canescens	Scrubby Cypress Pine	H: 5-6m W: 1-2m	
Dodonaea viscosa	Sticky Hop Bush	H: 2-3m W: 1-2m	
Eremophila bignoniiflora	Bignonia Emu Bush	H: 3-7m W: 2-5m	Frost hardy, but may struggle over winter.
Eremophila oppositefolia	Weeooka	H: 2-5m W: 2-4m	Frost hardy, but may struggle over winter.
Eremophila youngii	Emu bush	H: 2-3m W: 2m	Frost hardy, but may struggle over winter.
Eremophila santalina	Sandalwood Emu Bush	H: 2-5m W: 2-4m	Frost hardy, but may struggle over winter.
Eucalyptus cosmophylla	Cup Gum	H: 3-8m W: 6m	Typically 5m.
Eucalyptus dolichorhyncha	Fuchsia Gum	H: 3-8m W: 3-5m	Typically 5m.
Eucalyptus forrestiana	Fuchsia Gum	H: 4-7m W: 3-4m	
Eucalyptus gregsoniana pauciflora	Dwarf Snow Gum	H: 4-6m W: 3-5m	
Eucalyptus macrandra	Long-flowered Marlock	H: 3-7m W: 3-6m	
Eucalyptus orbifolia	Round Leaf Mallee	H: 3-8m W: 3-6m	Typically 5m.
Eucalyptus pachyphylla	Red Bud Mallee	H: 2-5m W: 2-5m	
Eucalyptus serraensis	Grampians Stringybark	H: 5m W: 4m	
Hakea bucculenta	Red Pokers	H: 3-4m W: 3m	
Hakea francisiana	Emu Tree	H: 4m W: 2-4m	
Hakea multilineata	Grass-leaved Hakea	H: 3-5m W: 2-4m	
Leptospermum laevigatum	Coastal Tea Tree	H: 2-5m W: 2-5m	
Leptospermum petersonii	Lemon Scented Tea Tree	H: 3-5m W: 1-2m	
Melaleuca coccinea	Goldfields Bottlebrush	H: 2m	

		W: 2m	
Myoporum insulare	Boobialla	H: 4m W: 4m	Variable form, can grow as groundcover.
Ozothamnus ferrugineus	Tree Everlasting	H: 2-5m W: 1-3m	
Syzygium australe	Brush Cherry	H: 4-5m W: 2-3m	
Feijoa sellowiana	Pineapple Guava	H: 3-6m W: 2-3m	
Prunus 'Shimidsu Sakura'	Japanese Cherry	H: 3-4m W: 3-4m	Only grow this cultivar as it is sterile.

Medium Trees: 5-12m tall

Scientific Name:	Common Name:	Tree Size:	Notes:
Acacia dealbata	Silver Wattle	H: 6m-30m W: 5-10m	
Acacia howittii	Sticky Wattle	H: 5-9m W: 3-5m	
Acacia implexa	Hickory Wattle	H: 5-15m W: 4-7m	
Acacia maidenii	Maiden's Wattle	H: 5-15m W: 5m	
Acacia mucronata	Narrow Leaf Wattle	H: 5-9m W: 3-5m	
Acacia pendula	Weeping Myall	H: 6-12m W: 4-6m	
Acacia pravissima	Ovens Wattle	H: 4-8m W: 3-7m	
Acacia provincialis	Swamp Wattle	H: 6-10m W: 3-7m	
Acacia pycnantha	Golden Wattle	H: 4-8m W: 2-5m	
Acacia salicina	Willow Wattle	H: 5-13m W: 3-6m	
Allocasuarina inophloia	Woolly Oak	H: 3-10m W: 2-6m	
Allocasuarina littoralis	Black Sheoak	H: 8-12m W: 4-7m	
Allocasuarina verticillata	Drooping Sheoak	H: 4-10m W:	
Angophora hispida	Dwarf Apple Gum	H: 5-7m W: 3-5m	
Bursaria spinosa	Sweet Bursaria	H: 3-8m W: 2-3m	
Callistemon salignus	Willow Bottlebrush	H: 3-9m	

		W: 2-5m	
Callistemon viminalis	Weeping Bottlebrush	H: 6-9m W: 4-5m	
Callitris endlicheri	Black Cypress Pine	H: 9-12m W: 4-6m	
Callitris rhomboidea	Oyster Bay Pine	H: 8-15m W: 2-4m	
Corymbia ficifolia	Red Flowering Gum	H: 4-12m W: 2-5m	
Elaeocarpus reticulatus	Blueberry Ash	H: 8-10m W: 3-5m	
Eucalyptus arenacea	Desert Stringybark	H: 3-10m W: 3-6m	
Eucalyptus behriana	Bull Mallee	H: 8-12m W: 6-8m	
Eucalyptus campaspe	Silver Gimlet	H: 4-11m W: 5m	
Eucalyptus cladocalyx nana	Dwarf Sugar Gum	H: 8-10m W: 4-5m	
Eucalyptus conferruminata	Bald Island Marlock	H: 4-8m W: 3-5m	
Eucalyptus diversifolia	Coastal White Mallee	H: 5-8m W: 4-6m	
Eucalyptus erythrocorys	Illyarrie	H: 3-9m W: 2-6m	
Eucalyptus falciformis	Grampians Peppermint	H: 5-14m W: 4-8m	
Eucalyptus leucoxylon subsp. megalocarpa	Large-fruited Yellow Gum	H: 8-15m W: 5-10m	
Eucalyptus megacornuta	Warted Yate	H: 4-12m W: 6m	
Eucalyptus newbeyi	Beaufort Inlet Mallee	H: 8-10m W: 5-7m	
Eucalyptus pauciflora subsp. parvifructa	Snow Gum	H: 8-10m W: 6-8m	
Eucalyptus platypus	Moort	H: 4-8m W: 3-6m	
Eucalyptus porosa	Mallee Box	H: 5-12m W: 4-10m	
Eucalyptus saxatilis	Suggan Buggan Mallee	H: 8-10m W: 5-8m	
Eucalyptus scoparia	Wallangarra White Gum	H: 8-12m W: 5-10m	
Eucalyptus torquata	Coral Gum	H: 6-8m W: 4-5m	
Eucalyptus willisii	Shining Peppermint	H: 10m W: 4-8m	

Exocarpos cupressiformis	Cherry Ballart	H: 3-8m W: 3-6m	
Flindersia australis	Crows Ash	H: 10-40m W: 5-8m	Generally only 10-12m high in cultivation.
Geijera parviflora	Wilga	H: 6-10m W: 5-8m	
Glochidion ferdinandi	Cheese Tree	H: 8-20m W: 5-10m	Commonly only reaches 8-10m.
Melaleuca halmaturorum	Salt Paperbark	H: 6-8m W: 2-3m	
Melaleuca lanceolata	Moonah	H: 7-10m W: 3-5m	
Melaleuca styphelioides	Prickly Paperbark	H: 6-15m W: 3-8m	
Melia azedarach	White Cedar	H: 7-12m W: 6-8m	Must be a fruitless variety.
Pittosporum angustifolium	Weeping Pittosporum	H: 4-8m W: 3-5m	
Pomaderris apetala	Dogwood	H: 6-12m W: 3-5m	
Prostanthera lasianthos var. subcoriacea	Victorian Christmas Bush	H: 2-10m W: 2-5m	Highly variable in height and appearance.
Syzygium luehmannii	Small Leaved Lilly Pilly	H: 6-10m W: 3-5m	
Syzygium smithii	Lilly Pilly	H: 5-15m W: 2-8m	Variety of cultivated sizes.
Tristaniopsis laurina	Kanooka	H: 5-15m W: 3-6m	
Acer buergerianum	Trident Maple	H: 6-10m W: 6m	
Acer campestre	Field Maple	H: 10-12m W: 6-8m	
Acer rubrum	Red Maple	H: 10-12m W: 7-9m	
Ceratonia siliqua	Carob Tree	H: 10m W: 8-14m	
Cercis siliquastrum	Judas Tree	H: 10-12m W: 5-10m	
Lagerstroemia indica	Crepe Myrtle	H: 3-8m W: 3-5m	
Magnolia virginiana	Sweet bay Magnolia	H: 8-12m W: 3-8m	
Parrotia persica	Persian Ironwood	H: 7-10m W: 5m	

Large Trees: 12-20m tall

Scientific Name:	Common Name:	Tree Size:	Notes:
Acacia melanoxylon	Blackwood	H: 12-25m W: 6-10m	
Acacia obliquinervia	Mountain Hickory Wattle	H: 15m W: 8m	
Allocasuarina luehmannii	Buloke	H: 8-15m W: 4-6m	
Banksia integrifolia	Coastal Banksia	H: 6-18m W: 3-8m	
Brachychiton populneus	Kurrajong	H: 10-15m W: 5-8m	
Callitris columellaris	White Cypress Pine	H: 12-20m W: 5-8m	
Callitris glaucophylla	White Cypress Pine	H: 10-20m W: 5-8m	
Callitris gracilis	Southern Cypress Pine	H: 15-20m W: 8-12m	
Callitris preissii	Rottnest Island Pine	H: 10-20m W: 5-8m	
Corymbia aparrerinja	Ghost Gum	H: 15-20m W: 8-12m	Rarely known to reach up to 30m.
Eucalyptus aromaphloia	Scent Bark Gum	H: 18-20m W: 8-12m	
Eucalyptus baueriana	Blue Box	H: 12-20m W: 6-10m	
Eucalyptus cephalocarpa	Silver Stringybark Gum	H: 8-20m W: 5-15m	
Eucalyptus cinerea	Argyle Apple	H: 9-15m W: 6-12m	
Eucalyptus largiflorens	Black Box	H: 10-20m W: 8-15m	
Eucalyptus leucoxylon	Yellow Gum	H: 10-25m W: 6-12m	
Eucalyptus mannifera	Brittle Gum	H: 15-20m W: 8-10m	
Eucalyptus nicholii	Narrow-leaved Black Peppermint	H: 15-18m W: 8-12m	
Eucalyptus radiata	Narrow-leaved Peppermint	H: 15-20m W: 8-12m	
Eucalyptus sideroxylon	Red Ironbark	H: 15-20m W: 6-10m	
Eucalyptus yarraensis	Yarra Gum	H: 15-20m W: 8-15m	

Grevillea robusta	Silky Oak	H: 10-30m W: 5-20m	
Waterhousea floribunda	Weeping Lilly Pilly	H: 10-30m W: 5-10m	
Acer freemanii	Freeman Maple	H: 12-20m W: 9-10m	
Liquidambar styraciflua	Liquidambar	H: 15-25m W: 6-12m	
Tilia cordata	Small-leaved Linden	H: 15-20m W: 5-9m	
Tilia tomentosa	Silver Linden	H: 15-25m W: 9-15m	

Giant Trees: 20+m tall

Scientific Name:	Common Name:	Tree Size:	Notes:
Angophora floribunda	Rough-barked Apple	H: 20-30m W: 10-20m	
Eucalyptus albens	White Box	H: 20-25m W: 10-15m	
Eucalyptus camaldulensis	River Red Gum	H: 20-40m W: 10-12m	
Eucalyptus cladocalyx	Sugar Gum	H: 25-30m W: 7-12m	
Eucalyptus cornuta	Yate	H: 10-25m W: 8-12m	
Eucalyptus globulus subsp. pseudoglobulus	Victorian Eurabbie	H: 30-45m W: 10-20m	
Eucalyptus melliodora	Yellow Box	H: 10-30m W: 8-20m	
Eucalyptus microcarpa	Grey Box	H: 25m W: 8-12m	
Eucalyptus obliqua	Messmate Stringybark	H: 15-70m W: 10-20m	
Eucalyptus occidentalis	Flat Topped Yate	H: 10-25m W: 8-15m	
Eucalyptus ovata	Swamp Gum	H: 15-25m W: 8-15m	
Eucalyptus pauciflora	Snow Gum	H: 5-30m W: 5-20m	
Eucalyptus polyanthemos	Red Box	H: 10-20m W: 5-15m	
Eucalyptus rubida	Candlebark	H: 15-25m W: 10-20m	
Eucalyptus tricarpa	Red Ironbark	H: 25-35m W: 7-12m	

Ficus macrophylla	Moreton Bay Fig	H: 30-40m W: 20-40m	
Ginkgo biloba	Maidenhair Tree	H: 15-25m W: 9-12	