Urban Forest Strategy 2021 – 28

Prepared by Strategic, Design and Sustainability Planning

Contents

Mayor's Forward

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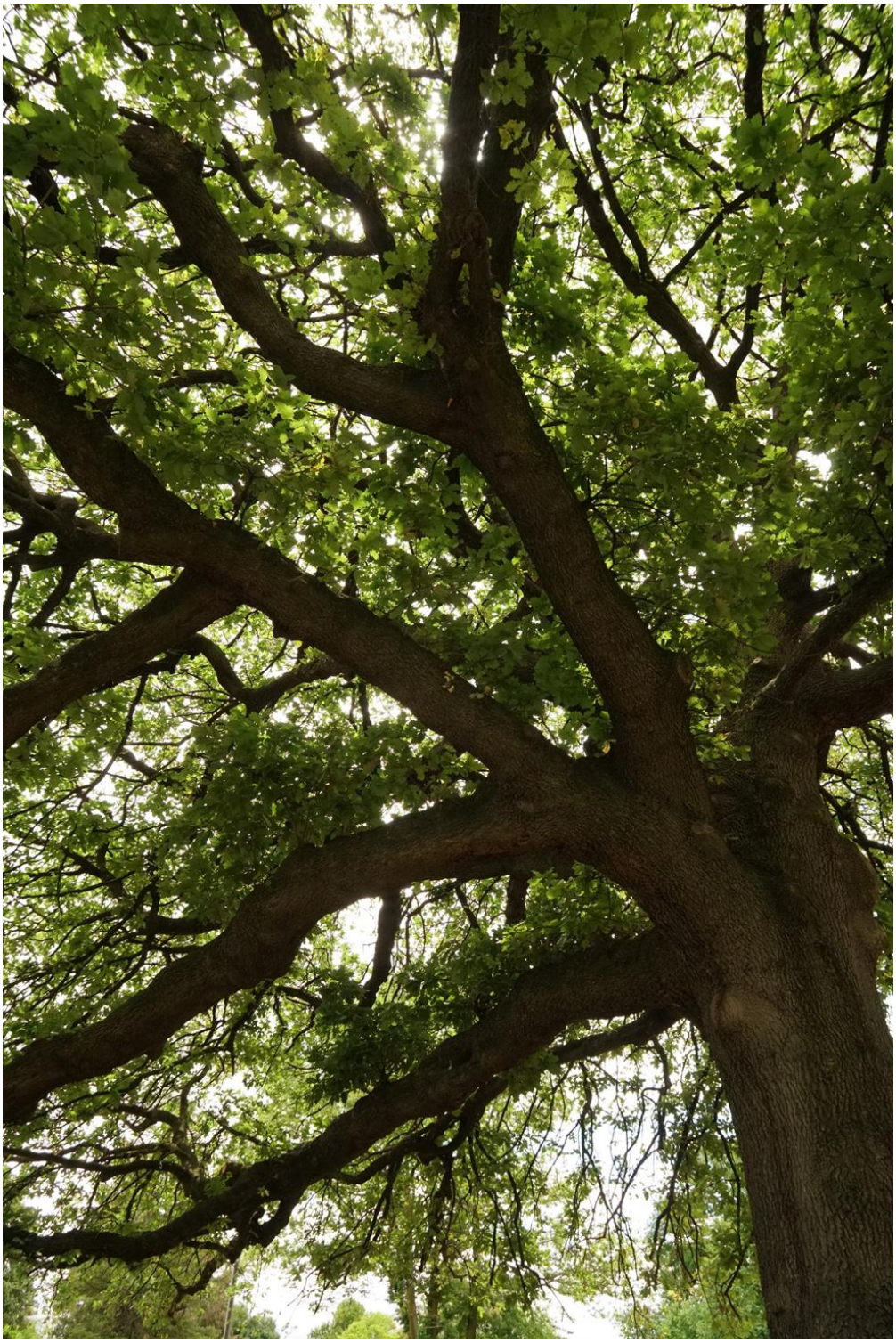
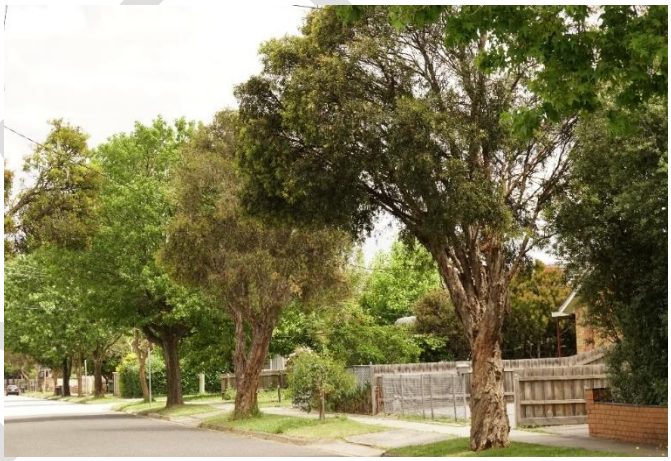


Executive Summary

The City of Greater Dandenong's *Urban Forest Strategy* provides a holistic approach to delivering a healthy, green and resilient urban forest. The City of Greater Dandenong's urban forest includes all vegetation, big and small growing on private and public land. Vegetation, particularly canopy trees deliver immense economic, social and environmental benefits including shade, streetscape amenity, air pollution reduction, habitat for wildlife and help tackle and respond to climate change.

Climate change is already impacting our municipality through increased average daily temperatures, less rainfall and increased intensity of storm and fire events. On average, Melbourne's urban areas are over 8°C hotter than non-urban areas, and our changing climate will only increase the risks (Department of Environment, Land, Water and Planning (DELWP), 2019). Therefore, it is critical that we take action to increase tree cover in urban areas.



On 28 January 2020 Greater Dandenong City Council declared a 'Climate and Ecological Emergency' committing Council to emergency action on climate change. Enhancing our urban forest will play a significant role in mitigating against the impacts of climate change by helping to:

- drawdown carbon emissions
- cool our urban environment
- reduce our community's risk to climate change.

The City of Greater Dandenong will be impacted to a greater extent by climate change's effects on our local urban heat island than our greener, neighbouring suburbs due to our very low canopy cover (9.9 per cent). Unless we can increase canopy cover in the City of Greater Dandenong this will further impact our community, already recognised as the most disadvantaged municipality in metropolitan Melbourne. This is because vulnerable people, such as the elderly, children and those from low socio-economic backgrounds are at an even greater risk to extreme heat events and a changing climate.

The City of Greater Dandenong's *Urban Forest Strategy* is the overarching document to:

- *Greening Our City: Urban Tree Strategy 2018-28* which considers the current status, issues and opportunities for Council managed trees
- *Greening Our Neighbourhoods 2021-28* which considers the current issues and opportunities for trees on privately owned land.

The *Urban Forest Strategy* has set a vision for:

> A healthy, green and resilient urban forest that is well managed, protected and provides benefits to the community.

The key objectives that Council aims to work towards are:

1. *Provide a framework for managing and enhancing our urban forest*
2. *Improve the City of Greater Dandenong's resilience to the unavoidable impacts of climate change*
3. *Cool through greening our city*
4. *Improve the health and wellbeing of our community*
5. *Engage and educate our community about the importance of trees.*

Council aims to increase its canopy cover to 15 per cent by 2028, by strategically planting more trees on publicly owned land in locations of greatest need and advocating for higher quality landscaping and canopy trees on privately-owned land.

1. Introduction

The *Urban Forest Strategy 2021-28* is viewed as a direct response to climate change and a way in which Council can significantly help drawdown carbon levels and improve the community's resilience to the unavoidable effects of a changing climate. The City of Greater Dandenong currently has a very low tree canopy cover of 9.9 per cent. This is the lowest of all metropolitan Melbourne municipalities on the eastern side of Melbourne. Low canopy cover has contributed to more severe urban heat island impacts with our municipality identified as the 7th hottest metropolitan municipality in Melbourne.

Based on the findings of the 2016 Census, the 2016 Index of Relative Socio-economic Disadvantage ranked the City of Greater Dandenong as the most disadvantaged municipality in metropolitan Melbourne.

The municipality's existing low level of canopy cover puts the City of Greater Dandenong community at an even greater risk to the impacts of climate change, including heat-related illnesses and stress. An urban forest includes all types of vegetation and ecosystems. It is made up of trees, shrubs, grasslands, and increasingly rooftop gardens and green walls growing on public and private land. Growing our urban forest is essential to playing our part in reducing carbon emissions and improving the community's resilience.

The *Urban Forest Strategy 2021-28* is the strategic document that provides the overarching support to the *Greening Our City: Urban Tree Strategy 2018-28* and the *Greening Our Neighbourhoods Strategy 2021-28*. Together these three strategies will help Council manage and enhance the urban forest and provide a roadmap to create a cooler greener city that benefits our community's health and wellbeing. The target is to increase the City of Greater Dandenong's canopy cover to 15 per cent by 2028.

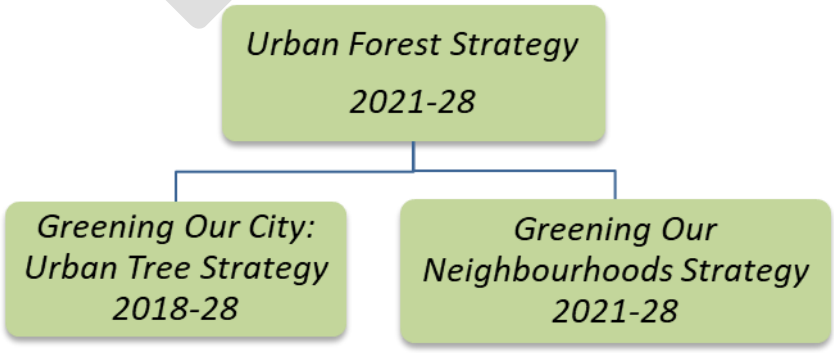


Figure 1 Structure of Urban Forest suite of strategies

1.1 Policy context

The *Urban Forest Strategy*, encompassing *Greening Our City* and *Greening Our Neighbourhoods* will help deliver Council's strategic objective *'A healthy, liveable and sustainable city'* by planting more trees in our streets and parks, engaging with the community to increase their awareness of the environment and enhancing the ecological value of all land within the municipality. The Urban Forest Strategy also directly responds to Objective 1.5 of Council's existing *Community Wellbeing Plan* by preparing *'for climate change and its impact on the health and wellbeing of the community'.*

Figure 2 demonstrates the relationship between the *Urban Forest Strategy* and it's two parts, as well as with other relevant Council documents.

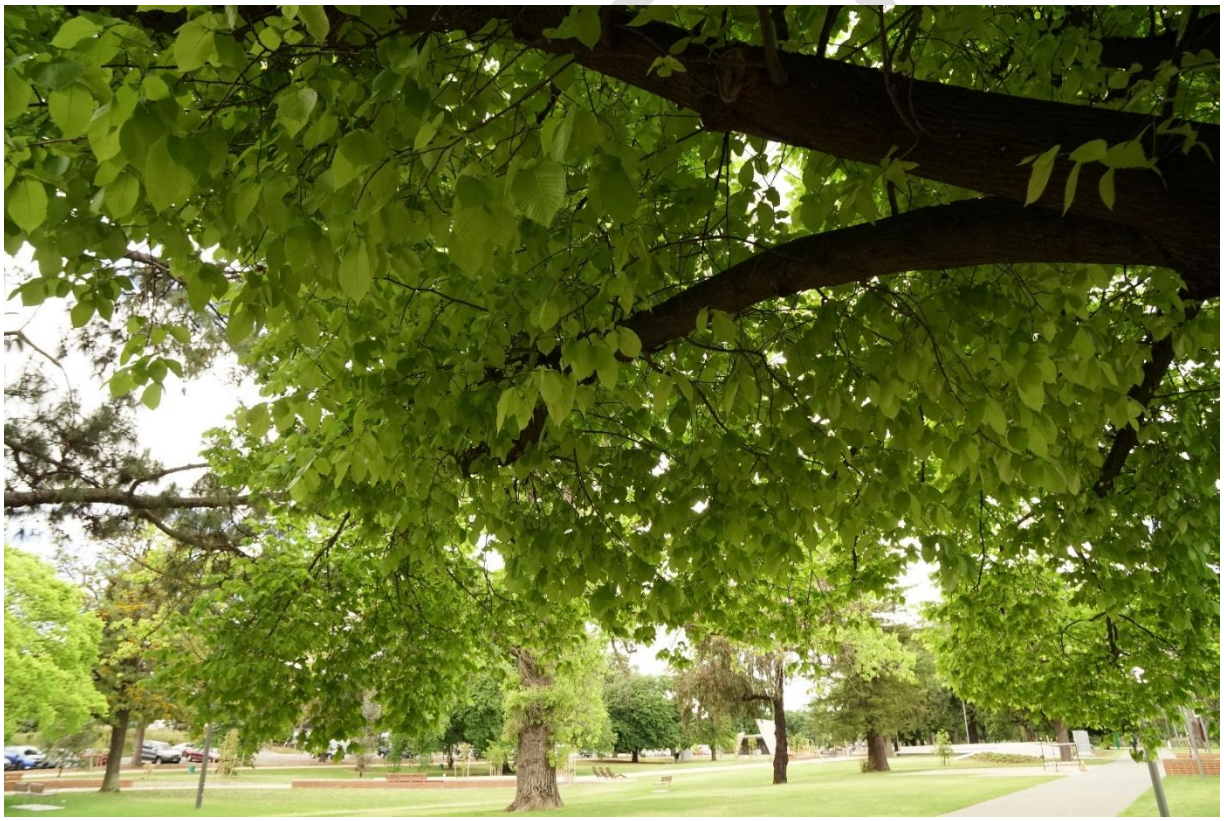
Figure 2 Policy Context and Hierarchy of Urban Forest Strategy and relevant Council documents

The *Urban Forest Strategy* is informed by multiple state strategic documents including the *Local Government Act 2020*, the *Climate Change Act 2017* and the Victorian Government's *2017 Climate Change Adaptation Plan* which all identify Council's vital role and obligation to mitigate and plan for climate change risks in areas such as land-use planning, infrastructure, health, emergency management, community services and environmental management.

In addition to these, the *Urban Forest Strategy* has considered *Plan Melbourne 2017-2050* and *Living Melbourne: Our Metropolitan Urban Forest Strategy (2019)* which recognise an urgent need for Melbourne to adapt to climate change and increase canopy cover, particularly on privately-owned land, to respond to and mitigate the impacts of the urban heat island. *Plan Melbourne* also recognises that green wedges are vital to long-term food security due to their proximity to markets, quality soils and access to infrastructure and labour.

Council's 2018 *Greening Our City* identified the City of Greater Dandenong has a low canopy cover of 9.9%, the lowest for a municipality on the eastern side of Melbourne, as a key issue facing the municipality. To address this issue *Greening Our City* sets out an action plan to increase the canopy cover across public and private land to 15 per cent by 2028. In response to the community feedback received during consultation, *Greening Our City* also identifies the need to protect and increase vegetation on private land. The *Urban Forest Strategy* is in direct response to these considerations and will ensure a holistic approach to managing and enhancing our urban forest.

Additionally, Council has a suite of strategies (shown in Figure 2) which set clear objectives to deliver '*a healthy, liveable and sustainable city*' and commits to responding to climate change through mitigation and adaptation, including increasing canopy cover, working with key stakeholders and increasing biodiversity.



1.2 What is an urban forest?

While the term may conjure up images of giant gum trees, an 'urban forest' includes all the vegetation (trees, shrubs, groundcovers, grasses), big and small growing on private and public land. The expansive grassland of the Green Wedge, the River Red Gums which line our parks, the vines which grow over patios and the fruit trees and vegetable gardens which fill our backyards are all part of the City of Greater Dandenong's urban forest. As well as providing a greener cooler city, urban forests also help provide habitat for our local biodiversity.

For Greater Dandenong Council, the urban forest is as much about greening our streets, buildings, car parks and industrial precincts as it is about greening our gardens and our homes.







**Images on this page are placeholders and have not been finalised.*

1.3 What is the urban heat island?

The term "urban heat island" refers to the temperature difference between urban and non-urban areas. Figure 3 demonstrates an urban heat island with hotter temperatures associated with built up areas and cooler temperatures with parks and rural land. There is significant evidence that the urban heat island is a major issue facing all Australian cities and is likely to worsen with more extreme weather events if no action is taken. The urban heat island is having devastating impacts on human health and on vulnerable communities who are more susceptible to extreme heat and its effects. As the occurrence and intensity of extreme heat events increase with climate change, the risk of adverse impacts on human health is increasing. As well as the pressure on health services, including those that local governments provide (Climate Council, 2016).

Urban heat islands are worsened by a lack of shade trees and higher proportion of hard and dark surfaces which retain and radiate heat. For the Greater Dandenong municipality, this is a key issue which must be addressed.

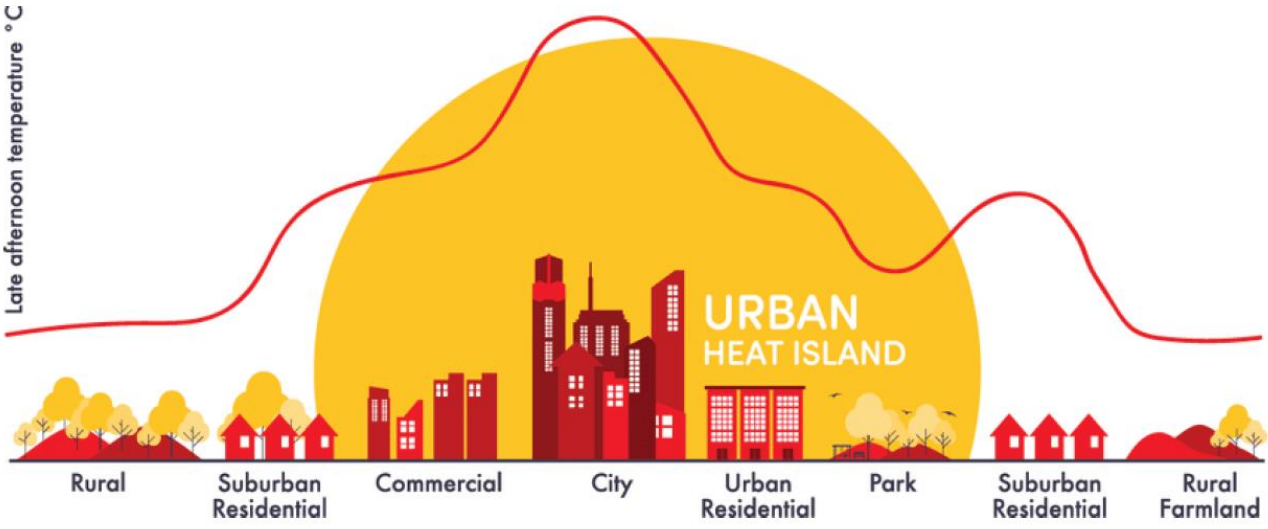


Figure 3 Western Sydney Regional Organisation of Councils 2018, Turn Down the Heat Strategy and Action Plan

1.4 Background

On 23 July 2018 Council adopted *Greening Our City: Urban Tree Strategy 2018-28*. *Greening Our City* considers the current status, issues and opportunities for Council managed trees (street and park trees of Greater Dandenong) and sets a canopy cover target of 15 per cent by 2028 across the entire municipality.

Greening our City identified that the City of Greater Dandenong has a very low canopy cover of 9.9 per cent and hence, the strategy set a series of actions and targets for Council's ongoing tree planting programs until 2028. By strategically planting more trees in locations of greatest need, Council aims to increase canopy cover on publicly owned land.

Greening our City also recognised the need to protect and enhance trees on privately-owned land to help achieve the targeted canopy cover. To address this, the strategy proposed the development of an Urban Forest Strategy which provides a holistic context for the management of the urban forest.

The second part of the *Urban Forest Strategy*, *Greening our Neighbourhoods Strategy 2021-28* responds to this need and presents the current challenges and opportunities to increasing canopy cover on privately-owned land. The *Urban Forest Strategy* aims to understand how Council and the community can enhance and manage the urban tree canopy on both public and privately-owned land.

1.5 Climate change and our community

Greater Dandenong City Council, on 28 January 2020 declared a 'Climate and Ecological Emergency' and on 24 August 2020 Council adopted the *Climate Emergency Strategy 2020-2030* and Action Plan committing Council to emergency action on climate change. The urban forest plays a significant role in mitigating against climate change by cooling our urban environment.

As part of the community consultation undertaken to inform the *Climate Emergency Strategy 2020-2030,* Council found that 92 per cent of respondents were worried about climate change, and 94 per cent believed it was important that Greater Dandenong City Council take action.

Climate change is already affecting our environment, our society and our economy. The key challenges facing our municipality include an increased average daily temperature, higher maximum temperatures, less rainfall and increased intensity of storm events and fire weather.

The City of Greater Dandenong is the most disadvantaged municipality in metropolitan Melbourne which is further compounded by very lower canopy cover of 9.9 per cent. Vulnerable people, such as the elderly, children, people living with a disability and those from low socio-economic backgrounds are at an even greater risk to extreme heat events, increased financial pressures and a changing climate.

It is clear climate change will worsen heatwave events, increasingly affecting the health and wellbeing of our community. Local governments have a key role in facilitating their municipalities to be cooler and greener as part of their response to climate change, to deliver the best outcomes for their community. For Greater Dandenong City Council, the need to respond is even greater, as many members of our community lack the resources to either prepare for or respond to the impacts of heat waves and other climate change related risks. This is due to some living in old, poorly insulated housing which heat up quickly or being unable to afford to turn on the air conditioner to cool the home.

Evidence shows that planting canopy trees is a strong and effective response to these effects. Not only do trees significantly cool our urban environment, they also provide a sense of calmness and improved aesthetic values for our streets and gardens. Being connected with nature through access to fresh air, shade and pleasant spaces to move through, relax and recreate in is vital to our mental and physical wellbeing.

The *Urban Forest Strategy* will help respond and reduce the effects of climate change, build resilience in our community and create a more visually appealing municipality.

2. Vision

A healthy, green and resilient urban forest that is well managed, protected and provides benefits to the community.

3. Objectives

Council has set five objectives to guide the management and enhancement of its urban forest:

1. *Provide a framework for managing and enhancing our urban forest*
   To assist Council and the community in making informed decisions about tree canopy on public and private land within the municipality in line with the 15-year tree planting program.

2. *Improve the City of Greater Dandenong's resilience to the unavoidable impacts of climate change*
   Proactively mitigate against climate change and drawdown carbon emissions by increasing canopy cover in streets, public open spaces and on privately-owned land and transitioning towards more suitable species to improve the health and diversity of our urban forest and our resiliency to climate change.

3. *Cool through greening our city*
   Fill all vacant street tree sites and encourage private landowners to protect and enhance landscaping to cool our city, promote integrated water management to support our urban forest and increase canopy cover across the municipality to 15 per cent by 2028.

4. *Improve the health and wellbeing of our community*
   Cool the urban environment to improve access to nature and reduce the risk of heat related illness to improve the health and wellbeing of our community.

5. *Engage and educate the community about the importance of trees*
   Deliver community educational programs to develop the knowledge of landowners and residents on vegetation selection and maintenance, and to improve perceptions of trees by demonstrating their importance in the urban environment.

4. Benefits

**the list of benefits will be graphically designed*

Our climate is becoming hotter and drier, with more extreme weather events which we need to mitigate and adapt to. Growing our urban forest is one of the most effective ways to tackle urban heat island impacts and mitigate against climate change. Trees and vegetation directly help reduce urban heat island effects by shading buildings and other hard surfaces, deflecting radiation from the sun and releasing moisture into the atmosphere. More broadly, the wide range of benefits for our municipality include:

Environmental

- Canopy trees help cool urban environments and can reduce daytime surface temperatures by between 5-20°C
- Through photosynthesis a tree can capture and store up to 150kg of CO^2 per annum, this is known as carbon sequestration
- Trees support a healthy and diverse ecosystem by providing habitat and wildlife corridors for local and migratory wildlife
- Trees can help regulate stormwater runoff, reducing demand on drainage infrastructure, reducing intensity of localised flood and assisting in the improvement of water quality. For every 5 per cent of tree cover added to a landscape, storm water runoff is reduced by approximately 2 per cent
- Trees filter airborne pollutants and there is up to a 60 per cent reduction in street level particulates where trees are present
- Trees act as wind buffers on agricultural land minimising the loss of topsoil and providing shelter to grazing animals.

Economic

- Tree-lined streets attract more foot traffic and can lead to increased spending and investment. Trees incorporated into commercial and retail precincts can increase business income by 20 per cent[1]
- Residential land values can increase in streets with street trees, compared to nearby streets with no street trees[2]
- Office workers with a view of nature are more productive, report fewer illnesses and have higher job satisfaction.

[1] (Georgia Urban Forestry Publication, 2004; Mullaney, Lucke, & Trueman, 2015)
[2] (Pandita, Polyakovb, Tapsuwanc, & Morand, 2013; Mullaney, Lucke, & Trueman, 2015; Pandit, Polyakov, & Sadler, 2012; Moore, 2020)

- Appropriately placed trees can realise financial savings up to 50 per cent on daytime air conditioning for businesses[3]
- Shade trees can assist in prolonging the life of infrastructure[4]
- The presence of nature, access to clean air and cooler environments improves human health by reducing stress and blood pressure thus reducing demand on health systems
- Vegetation, such as fruit trees or vines and vegetable gardens, contribute to local food production which can lead to reduced grocery costs and healthier communities

Social

- Reduce daytime air temperatures by 1-2°C during extreme heat events, which can significantly reduce heat mortality rates for elderly and vulnerable people
- Reduced heat-related illnesses including heat exhaustion, damage to medications and stress
- Removes pollution in the air, mitigating and alleviating respiratory problems such as asthma and other chronic lung conditions[5]
- Reduced vulnerability to extreme heat events
- Leafy areas can provide a comfortable outdoor place to gather with loved ones and build community networks
- Help strengthen communities by promoting contact, encouraging physical activity, reducing stress and stimulating social cohesion
- Contribute to a safer neighbourhood through appropriate design responses
- Provide protection against skin cancer by reducing UV-B exposure (the most damaging type of solar radiation) by approximately 50%
- Children function better than usual after activities in green settings, and 'greener' play areas can lead to less severe attention deficit symptoms[6]
- Spending time near trees improves physical and mental health by increasing energy levels, reducing stress and decreasing blood pressure
- Treed landscapes foster active and passive recreation aiding in increased physical and mental health
- Exposure to nature while young can influence a person's lifelong attitude to environmental protection
- Trees promote positive perceptions and connections with nature

[3] (Georgia Urban Forestry Publication, 2004; Mullaney, Lucke, & Trueman, 2015; Moore, 2020)
[4] (Moore, 2020)
[5] (Georgia Urban Forestry Publication, 2004; Moore, 2020)
[6] (Taylor, Kuo, & Sullivan, 2001)

Amenity

- Trees enhance our neighbourhoods and are considered the most important indicator of attractiveness in a community
- Vegetation contributes to the character of a neighbourhood
- Trees absorb sound waves, reducing urban noise
- Trees frame and screen views, and soften the built environment
- Variety in the shape, texture and colour of trees and vegetation contributes to visual amenity and interest
- Natural barrier to wind

5. Mapping of Greater Dandenong's canopy coverage

5.1 Canopy cover

To inform *Greening Our City: Urban Tree Strategy 2018-28,* Council measured the municipality's canopy cover using a point sampling tool called i-Tree Canopy (www.canopy.itreetools.org) in 2017 and determined that canopy cover for Greater Dandenong was 9.9 per cent.

To further inform our knowledge of canopy cover across Melbourne, in 2019, the Department of Environment, Land, Water and Planning released canopy mapping using Lidar technology which allows for greater analysis of canopy cover and urban heat on both public and private land. This methodology (using Lidar technology) has been used to gain a deeper understanding of the City of Greater Dandenong's vulnerability to the urban heat island and an understanding of how we can work to increase our overall canopy cover and in turn reduce our risk to climate change. The Lidar mapping method has been used to inform the following land use and canopy discussion.

By using both i-Tree and Lidar methodologies Council can provide a detailed analysis of canopy cover according to specific land uses (i.e. public or private, residential or industrial) (Lidar) and ensure consistency for monitoring and reporting against the adopted target of 15 per cent (i-Tree) across the urban forest suite of strategies.

Table 1 Based on Hurley et al., 2018

Tree Canopy Cover (Metropolitan Melbourne Councils)	
1	Yarra Ranges (S)
2	Nillumbik (S)
3	Manningham (C)
4	Maroondah (C)
5	Boroondara (C)
6	Mornington Peninsula (S)
7	Banyule (C)
8	Whitehorse (C)
9	Stonnington (C)
10	Frankston (C)
11	Knox (C)
12	Bayside (C)
13	Monash (C)
14	Yarra (C)
15	Glen Eira (C)
16	Port Phillip (C)
17	Cardinia (S)
18	Darebin (C)
19	Casey (C)
20	Melbourne (C)
21	Moreland (C)
22	Kingston (C)
23	Moonee Valley (C)
24	Maribyrnong (C)
25	Whittlesea (C)
26	Greater Dandenong (C)
27	Brimbank (C)
28	Hume (C)
29	Hobsons Bay (C)
30	Wyndham (C)
31	Melton (C)

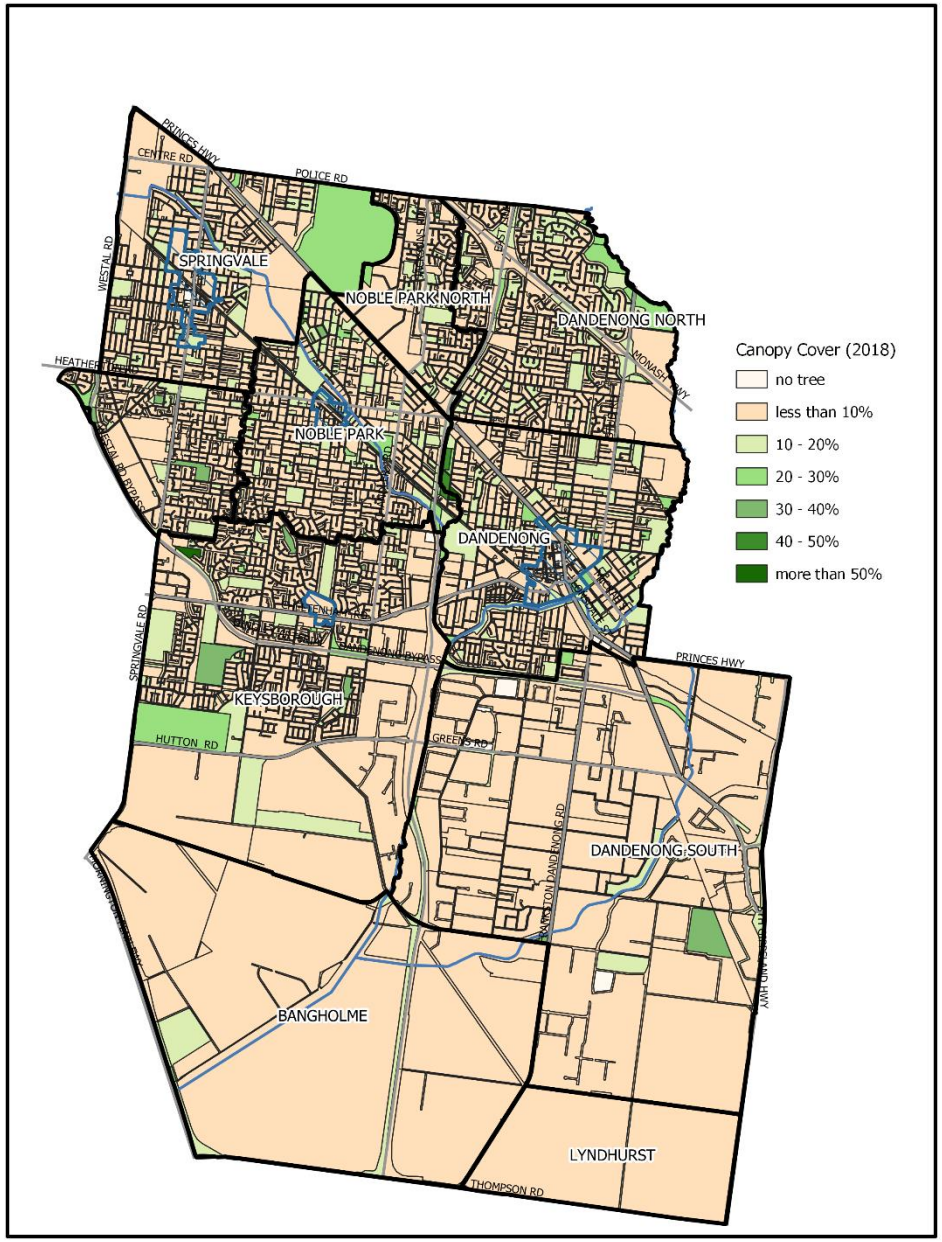


Figure 4 Map of Municipality showing canopy cover (Lidar, 2018)

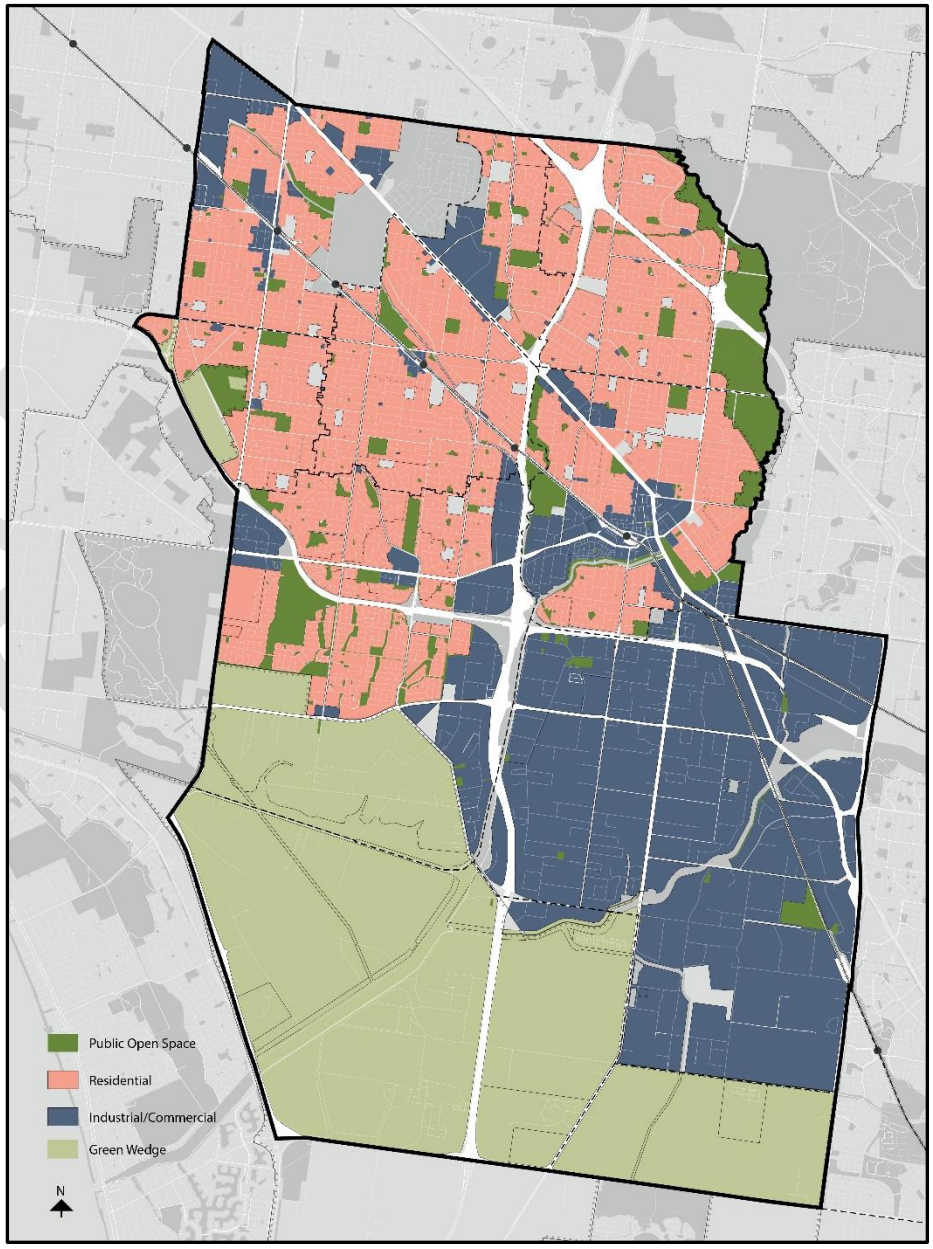


Figure 5 Map of Municipality showing basic land use in Greater Dandenong

5.2 Land use assessment

The research[7] on land use and canopy cover conducted in 2018 by the Centre for Urban Research at RMIT University identified that residential land provides the largest contribution to tree canopy cover across metropolitan Melbourne. However, due to a combination of urban re-development, landowner land-management practices and climatic effects, vegetation cover on residential land is decreasing.

In the City of Greater Dandenong 73 per cent of land is privately-owned, including residential, industrial, commercial and rural zones (i.e. the Green Wedge). The remainder (27 per cent) is publicly owned and includes parks, urban and civic spaces, footpaths, road reserves and Council buildings and its associated land. Figures 4 and 5 demonstrates that the majority of land within the City of Greater Dandenong is privately-owned and has less than 10 per cent canopy cover.

Privately-owned land, which includes residential, industrial, commercial, rural land and all land not owned by Council or the Crown, has a canopy cover of 5.6 per cent.

Publicly owned land which includes Council owned land, public open space, roads and Crown land has a canopy cover of 9.1 per cent.

Low canopy cover greatly contributes to the urban heat island impacts and the liveability of our urban environment. To ensure these effects are mitigated it is vital canopy cover is increased, particularly on privately-owned land which accounts for 73 per cent of the municipality.

The following maps provide examples of canopy cover seen across the Greater Dandenong municipality.

[7] (Hurley, et al., 2019) based on Lidar technology

Figure 6 Canopy Cover Percentages (Lidar) - Fotheringham Reserve, Dandenong

Fotheringham Reserve in Dandenong has a canopy cover of over 40 per cent. This is attributed to its creek environs, dense bushland and walking trails. Industrial areas have typically less than 10 per cent canopy cover due to large site coverage requirements (for building footprints and car parking).

Figure 7 Canopy cover percentages for residential areas and road reserves (Lidar) – Greater Dandenong

Council is working to increase the number of street trees through the *Greening Our City* Strategy, as currently there is generally between 10-20 per cent canopy cover in road reserves. Typically, most privately-owned residential areas support less than 10 per cent canopy cover.

Figure 8 Palm Plaza (outlined in red) and Lonsdale Street, Dandenong

The mature trees in Palm Plaza and Lonsdale Street Dandenong, provide significant greening and cooling benefits to the Dandenong Metropolitan Activity Centre (10-20 per cent canopy cover ((Hurley, et al., 2019), based on Lidar technology) The mature canopy trees ensure this public space is walkable and pleasant to visit, as well as assisting in reducing the radiant heat from the pavement, adjoining buildings, rooftops and carparks. Placemaking data collected since 2015 has reported that Palm Plaza is the busiest outdoor public space in central Dandenong.

Palm Plaza, Dandenong

Lonsdale Street, Dandenong

6. Urban heat

The impact of climate change is one of the most significant drivers to grow our urban forest. Climate change is expected to intensify the urban heat island (UHI) which presents substantial challenges to all facets of our lives at a social, environmental and economic level.

The UHI refers to the temperature difference between urban and non-urban areas. There is significant evidence that the UHI is a major issue facing all Australian cities and is likely to worsen with more extreme weather events if no action is taken. The UHI is having devastating impacts on human health and on vulnerable communities who are more susceptible to extreme heat and its effects.

Research has shown that canopy trees can reduce daytime surface temperatures by between 5-20°C. Canopy trees are one of the most effective mechanisms for reducing the UHI effect by removing carbon dioxide from the air, and cooling through evapotranspiration and shading hard or dark surfaces.

Due to the lack of canopy trees and the large extent of hard surfaces which absorb and radiate heat across the municipality, the City of Greater Dandenong has been identified as the 7th hottest municipality in metropolitan Melbourne (refer to Figure 9).

Whilst the Greater Dandenong municipality does have a very large industrial area with large amounts of hard surfaces, our residential area is also contributing to the intensity of the UHI. Industrial and residential land in the City of Greater Dandenong have 3.4 and 7.8 per cent canopy cover respectively[8].

The lack of trees, high level of reflective concrete in private gardens and dark surfaces all contribute to the City of Greater Dandenong having a high urban heat index.

[8] (Hurley, et al., 2019) based on Lidar technology

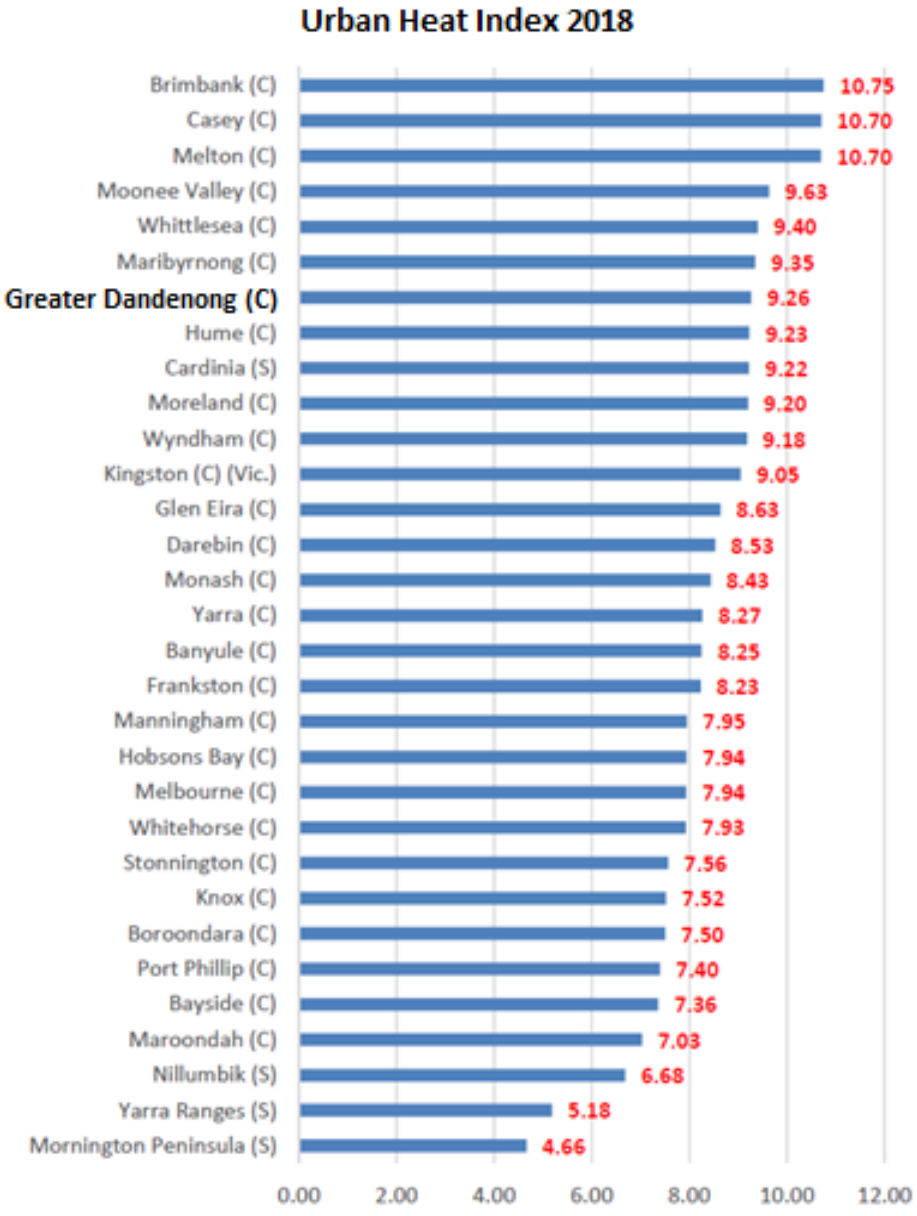


Figure 9 The average difference (°C) in Land Surface Temperature (LST) to baseline LST (°C) between LGAs (Sun, et al., 2019). Based on Lidar technology.

7. Social vulnerability and health

"Unless we start to deal with the urban heat issue … it seems likely that, particularly for vulnerable groups, our cities are going to become quite unliveable"

Associate Professor Andrew Butt, Sustainability and Urban Planning at RMIT

Climate change, and in turn the UHI pose a significant threat to our environment, people and businesses. In 2016 the City of Greater Dandenong was ranked the most disadvantaged municipality in metropolitan Melbourne. Our community's vulnerability is further compounded by our very low canopy cover of 9.9 per cent. Vulnerable people, such as the elderly, children, people living with a disability and those from low socio-economic backgrounds are at an even greater risk to extreme heat events and a changing climate. Communities that suffer from heat stress are more likely to experience:

- social isolation due to increased barriers to exercise or movement
- heat related illnesses, particularly in the sick and elderly
- financial struggles due to a higher reliance on air conditioning (due to poorly designed housing including lack of air circulation, poor insulation or a lack of environmentally sustainable design principles implemented).

As detailed previously, the City of Greater Dandenong is the 7th hottest municipality in metropolitan Melbourne (Figure 10). To measure our community's vulnerability to heat, Council has used the Heat Vulnerability Index (2018) prepared by the Centre for Urban Research at RMIT University in partnership with DELWP and Clear Air and Urban Landscapes Hub (CAULH). The Heat Vulnerability Index (HVI) measures heat exposure, sensitivity to heat and adaptive capability to determine populations that are most vulnerable to heat.

Figure 10 shows the City of Greater Dandenong's vulnerability in comparison to other Melbourne municipalities and demonstrates most of the residential portion of the Greater Dandenong municipality has a HVI of 5. This indicates the health and wellbeing of our community is at serious risk to the impacts of urban heat islands. This image also demonstrates the City of Greater Dandenong is one of the most vulnerable municipalities in the Melbourne metropolitan region.

If not managed, the increased daytime temperatures and reduced ability of land and homes to cool during the evening contribute to respiratory difficulty, heat exhaustion, heat stroke and heat-related mortality. Urban heat islands also exacerbates the impact of heat waves which put vulnerable people at greater risk due to their limited ability to adapt.

The ability of people to adapt is heavily influenced by their health, financial position and access to support and services. A person's health can severely deteriorate during an extreme heat event or heat wave. This is compounded by the financial strain caused by cooling the home with air conditioning units and the ability for the person to access support services and cool environments if they are reliant on motor vehicles or walking in a hot environment.

We all have a responsibility and can play a role in addressing the urban heat island impacts in order to reduce the City of Greater Dandenong community's vulnerability to heat. To do this we must cool and green our urban environment by planting trees.

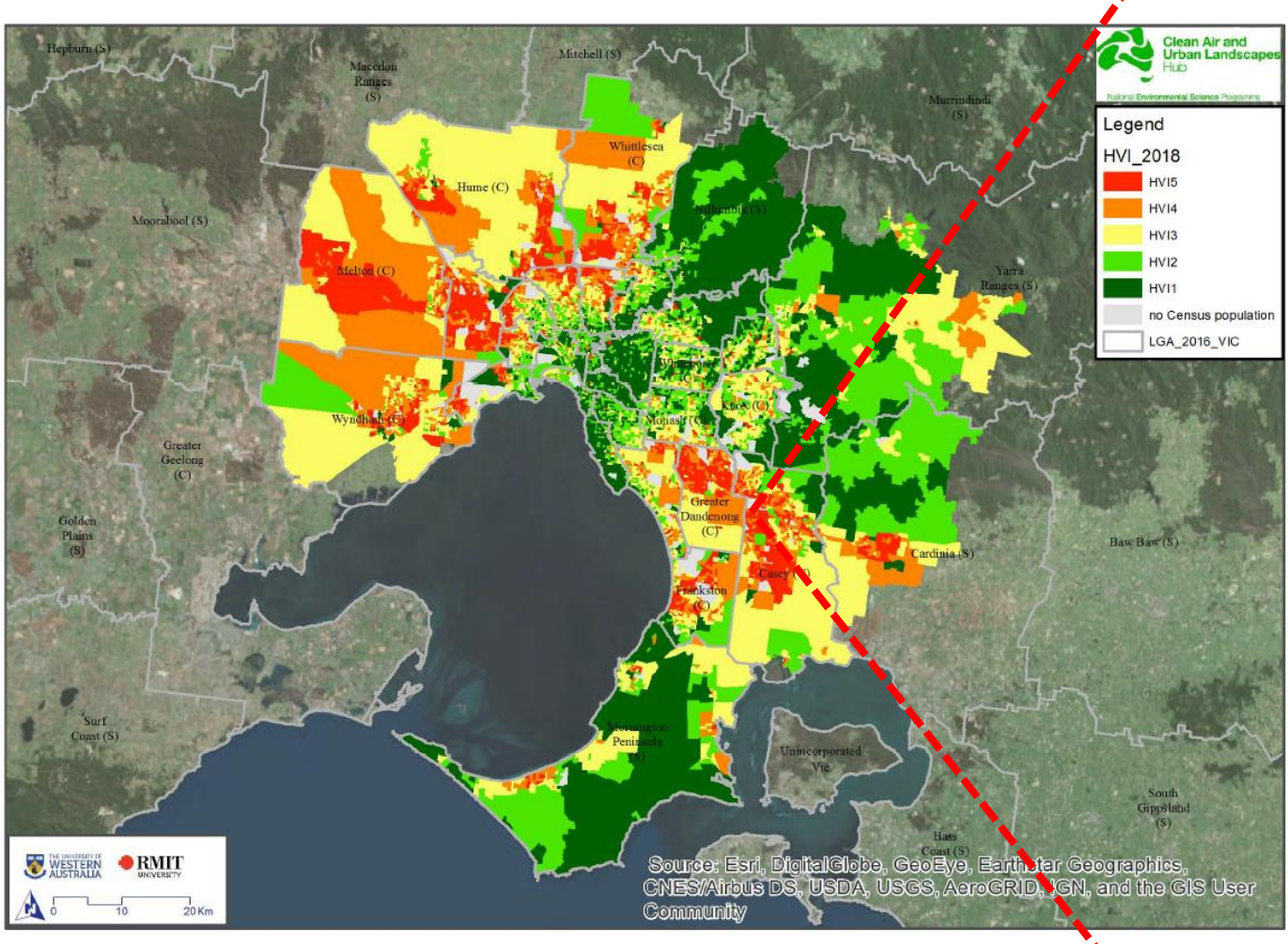


Figure 10 Heat Vulnerability Index for Metropolitan Melbourne and Greater Dandenong

**Image to be designed side-by-side with enlarged map of the City of Greater Dandenong with north point and scale visible*

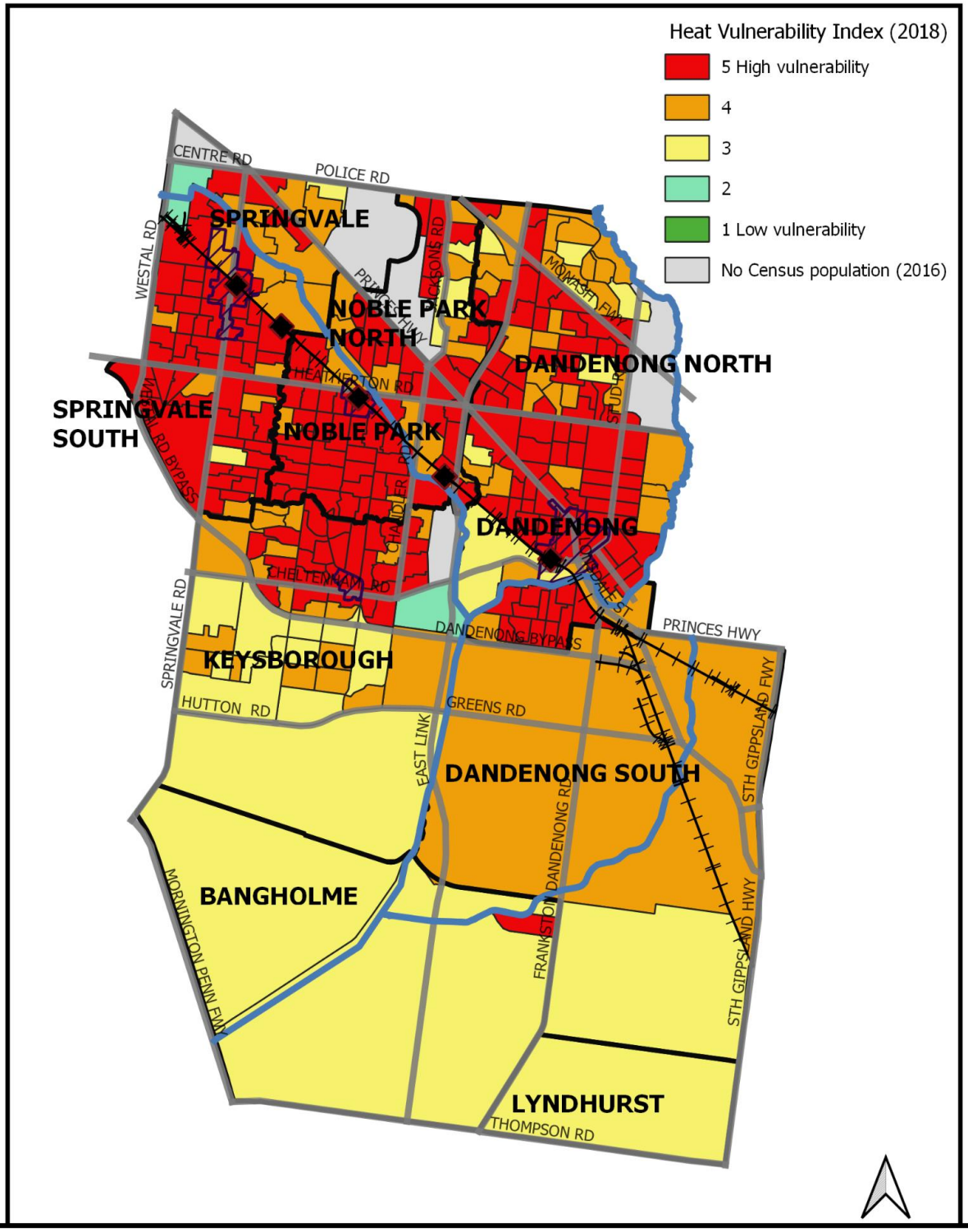


Figure 10 The Heat Vulnerability Index (HVI) identifies which populations are most vulnerable to heat. It consists of three indicators: heat exposure, sensitivity to heat, and adaptive capability. This has been measured at the 2016 Census mesh-block level. Vulnerability ratings range from 1 (low vulnerability) to 5 (high vulnerability). This map demonstrates the City of Greater Dandenong community is highly vulnerable to urban heat due to high heat exposure (lack of shade), sensitivity to heat and low adaptive capability (low socio-economic demographic, people living with disabilities, the elderly and children). The areas denoted light green have low population numbers but are still prone to heat exposure and areas denoted grey had no census population recorded in 2016.

Further information on this can be found in *'Urban Vegetation, Urban Heat Islands and Heat Vulnerability Assessment in Melbourne, 2018*' (Sun, et al., 2019).

8. Defining the action plans

The *Urban Forest Strategy* acts as the parent document to the *Greening Our City* and *Greening Our Neighbourhoods* Strategies. It is a high-level strategy which provides the overarching framework for how Greater Dandenong City Council manages its urban forest.

Greening Our City and *Greening Our Neighbourhoods* will have separate, individual Action Plans which will provide a series of short- and longer-term actions to cool and green the municipality, whilst engaging with the community and advocating for improved vegetation cover and landscaping.

9. Monitoring and review

This *Urban Forest Strategy* has a timeframe of seven years to align with the existing *Greening Our City Strategy*. The *Urban Forest Strategy* along with *Greening Our City* and *Greening Our Neighbourhoods* will be fully reviewed in 2028.

Regular desktop reviews will be required to monitor our progress on the urban forest and to ensure *Greening Our City* and *Greening Our Neighbourhoods* are guided by up to date urban forest and climate data research, resource allocations and community expectations.

Every two years:	Desktop review of *Greening Our City* and *Greening Our Neighbourhoods* strategy actions, progress towards targets and technical guidelines.
In seven years (2028):	The Strategies (UFS encompassing *Greening Our City* and *Greening Our Neighbourhoods*) will be reviewed and proposed to be combined into one strategic document. At this 7-year milestone Council will also review the canopy cover, reaudit its tree inventory and measure the achievement of its targets in readiness for an updated Strategy.

Glossary

Canopy cover: the measure of the area of tree canopy when viewed from above and is recorded as a percentage of total land area.

Canopy Tree: is defined as any tree above 3m.

CAULH: Clear Air and Urban Landscapes Hub (part of the National Environmental Science Program by the Australian Government).

DELWP: Department of Environment, Land, Water and Planning

Evapotranspiration: the release of water from leaves of vegetation to the surrounding air by the process of evaporation and transpiration. This cools the plant whilst cooling the air around the plant.

Heat Vulnerability Index (HVI): The HVI identifies which populations are most vulnerable to heat. It consists of three indicators: heat exposure, sensitivity to heat, and adaptive capability. Vulnerability ratings are determined by the sum of the aggregated indicators and are scaled from 1 to 5 (1 = low vulnerability, 5 = high vulnerability).

Heat Waves: defined as three or more days of high maximum and minimum temperatures that are unusual for that location (Bureau of Meteorology, 2020).

i-Tree Canopy: a point sampling tool used to measure the area of tree canopy when viewed from above. This method was used to determine the City of Greater Dandenong's canopy cover in 2017 for the *Greening our City: Urban Tree Strategy 2018-28.* Council has based the canopy cover percentage (9.9 per cent) on previously obtained data from *Greening our City* to ensure consistency with the adopted target (15 per cent).

Land Use: a term describing a use or activity in relation to land (i.e. residential, commercial, industrial).

Lidar: this method of tree canopy measurement was used by RMIT and DELWP in 2018. The method provides a 3D representation of the distribution of vegetation at 20cm resolution. This method (using Lidar technology) has been used for the Land Use Assessment in *Greening Our Neighbourhoods* to better understand where our canopy is located as a snapshot in time.

Private land or privately-owned land: land owned by a private entity or individual (includes land owned by private and government agencies i.e. Melbourne Water, Department of Education or Department of Human and Health Services). This does not include Crown land or land owned by Council.

RMIT University: Royal Melbourne Institute of Technology University

Urban heat island: when urban areas are warmer than surrounding rural areas due to heat retention in hard surfaces. These occur due to the increased hard surfaces that absorb and radiate heat, limited vegetation to shade and cool, heat production from machines and activities and air pollution creating local greenhouse effects. The analysis has demonstrated the City of Greater Dandenong is already experiencing these effects with the most serious effects being experienced in major activity centres such as Dandenong, Springvale or Noble Park. The most cost effective and efficient mitigation tool is an increase in tree canopy cover.

Bibliography

Australian Bureau of Statistics (ABS). (2016, March 19). *SEIFA 2016 by Local Government Area (LGA).* Melbourne: ABS. Retrieved March 19, 2020, from http://stat.data.abs.gov.au/Index.aspx?DataSetCode=ABS_SEIFA_LGA

Bureau of Meteorology. (2020). *Understanding heatwaves*. Retrieved December 02, 2020, from Bureau of Meteorology: http://www.bom.gov.au/australia/heatwave/knowledge-centre/understanding.shtml

Chawla, L. (1998). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *Environmental Education Research, 4*, 369-382.

Cities4Forests. (2020, May). *Inner Forests: We need more trees in our cities*. Retrieved from Cities4Forests: https://cities4forests.com/forests/inner/

Climate Council. (2016). *The Silent Killer: Climate Change and the Health Impacts of Extreme Heat.* Climate Council of Australia.

Department of Environment, Land, Water and Planning (DELWP). (2019, November 25). *Trees for Cooler and Greener Streetscapes: Guidelines for Streetscape Planning and Design*. Retrieved from Policies and Initiatives: Cooling and Greening Melbourne: https://www.planning.vic.gov.au/policy-and-strategy/planning-for-melbourne/plan-melbourne/cooling-greening-melbourne/trees-for-cooler-and-greener-streetscapes

Georgia Urban Forestry Publication. (2004). *Shade-Healthy Trees, Healthy Cities, Healthy People.* Georgia Urban Forest Council. Illinois: University of Illinois at Urbana Champaign. Retrieved from www.cucf.com

Greater Dandenong City Council. (2010). *Imagine 2030: Community Plan.* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2016). *Greater Dandenong Sustainability Strategy 2016-2030.* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2017). *Greater Dandenong Council Plan 2017-2021.* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2017). *Green Wedge Management Plan (Revised 2017).* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2018). *Greening Our City: Urban Tree Strategy 2018-2028.* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2020). *Climate Emergency Strategy 2020 - 2030.* Melbourne, Australia: Greater Dandenong City Council.

Greater Dandenong City Council. (2020, January 28). Notice of Motion No. 75 - Climate Emergency. *Minutes Ordinary Council Meeting* . Melbourne, Victoria, Australia.

Greater Dandenong City Council. (2020). *Open Space Strategy 2020.* Melbourne, Australia: Greater Dandenong City Council.

Hurley, J., Saunders, A., Amati, M., Boruff, B., Both, A., Sun, C., Duncan, J. (2018). *Urban Vegetation Cover Analysis, Melbourne Metropolitan Region 2018.* Department of Environment, Land, Water and Planning. Melbourne, Australia: Unpublished Report.

Hurley, J., Saunders, A., Both, A., Sun, C., Boruff, B., Duncan, J., Caccetta, P. (2019). *Urban Vegetation Cover in Melbourne 2014-2018 .* Melbourne, Australia: Centre for Urban Research, RMIT University.

International Society of Arboriculture. (n.d.). Tree Care Bulletin. *Benefits of Trees*.

Kjellstrom, T., & Weaver, H. J. (2009). Climate change and health: impacts, vulnerability, adaptation and mitigation. *NSW Public Health Bulletin, 20*(1-2), 5-9. doi:10.1071/NB08053

Kuo, F. E. (2001). Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behaviour, 33*, 343-367. Retrieved from www.herluiuc.edu

Kuo, F. E. (2003). The role of arboriculture in healthy social ecology. *Journal of Arboriculture, 29*, 148-155.

Moore, G. (2020). *Economic Value of Trees*. Retrieved from Sustainable Gardening Australia: https://www.sgaonline.org.au/economic-value-of-trees/

Mullaney, J., Lucke, T., & Trueman, S. J. (2015). A review of benefits and challenges in growing streets trees in paved urban environments. *Landscape and Urban Planning, 134*, 157-166.

Pandit, R., Polyakov, M., & Sadler, R. (2012, February 7-10). The importance of tree cover and neighbourhood parks in determining urban property values. *Australia Agricultural & Resource Economics Society (AARES)*.

Pandita, R., Polyakovb, M., Tapsuwanc, S., & Morand, T. (2013). The effect of street trees on property value in Perth, Western Australia. *Landscape and Urban Planning, 110*, 134-142.

Resilient Melbourne. (2019). *Living Melbourne: Our Metropolitan Urban Forest Strategy (2019) .* Melbourne.

Sun, C., Hurley , J., Amarti, M., Arundel , J., Saunders, A., Boruff, B., & Caccetta, P. (2019). *Urban Vegetation, Urban Heat Islands and Heat Vulnerability Assessment in Melbourne, 2018.* Melbourne, Australia: Clean Air and Urban Landscapes Hub.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2001). Coping with ADD: The Surprising Connection to Green Play Settings. *Environment and Behaviour, 33*(1), 54-77.

The Nature Conservancy and Resilient Melbourne. (2019). *Living Melbourne: Our Metropolitan Urban Forest.* Melbourne: The Nature Conservancy and Resilient Melbourne.

Tyrväinen, L., Pauleit, S., Seeland, K., & de Vries, S. (2005). Benefits and Uses of Urban Forests and Trees. (C. C. Konjinendijk, K. Nilsson, T. B. Randrup, & J. Schipperjin, Eds.) *Urban Forests and Trees*, 81-114.

United States Department of Agriculture (USDA) Forest Service. (2000). *A guide: Developing a street and park tree management plan.* Northeast Centre for Urban & Community Forestry Holdsworth Natural Resource Centre. Amherst, MA: University of Massachusetts. Retrieved from http://www.na.fs.fed.us/urban/inforesources/mgmtplanguide/mgtplanguide.pdf

Van Dillen, S. M., De Vries, S., Groenewegen, P. P., & Spreeuwenberg, P. (2012). Greenspace in urban neighbourhoods and residents health: Adding quality to quantity. *Journal of Epidemiology and Community Health, 66*(8).

Victorian Government DELWP. (2019). *Trees for Cooler and Greener Streetscapes: Guidelines for Streetscape Planning and Design.* Department of Environment, Land, Water and Planning. Melbourne: E2Designlab.

Victorian State Government. (2016). *Victoria's Climate Change Adaptation Plan 2017-2020.* Melbourne: Department of Environment, Land, Water and Planning.

Western Sydney Regional Organisation of Councils. (2018). Turn Down the Heat Strategy and Action Plan.

Whiting, A. (2018, December 4). Cities are planting more trees to fight climate change and improve healthy living. World Economic Forum; The Thomson Reuters Foundation. Retrieved from https://www.weforum.org/agenda/2018/12/cities-are-planting-more-trees-to-curb-wild-weather-and-boost-healthy-living-ec92b137-4610-4871-a341-

0c10ea1b3954?utm_source=Facebook%20Videos&utm_medium=Facebook%20Videos&utm_campaign=Facebook%20Video%20Blogs

Wolf, K. L. (2005). Trees in small city retail business district: comparing resident and visitor perceptions. *Journal of Forestry, 103*, 390-395.