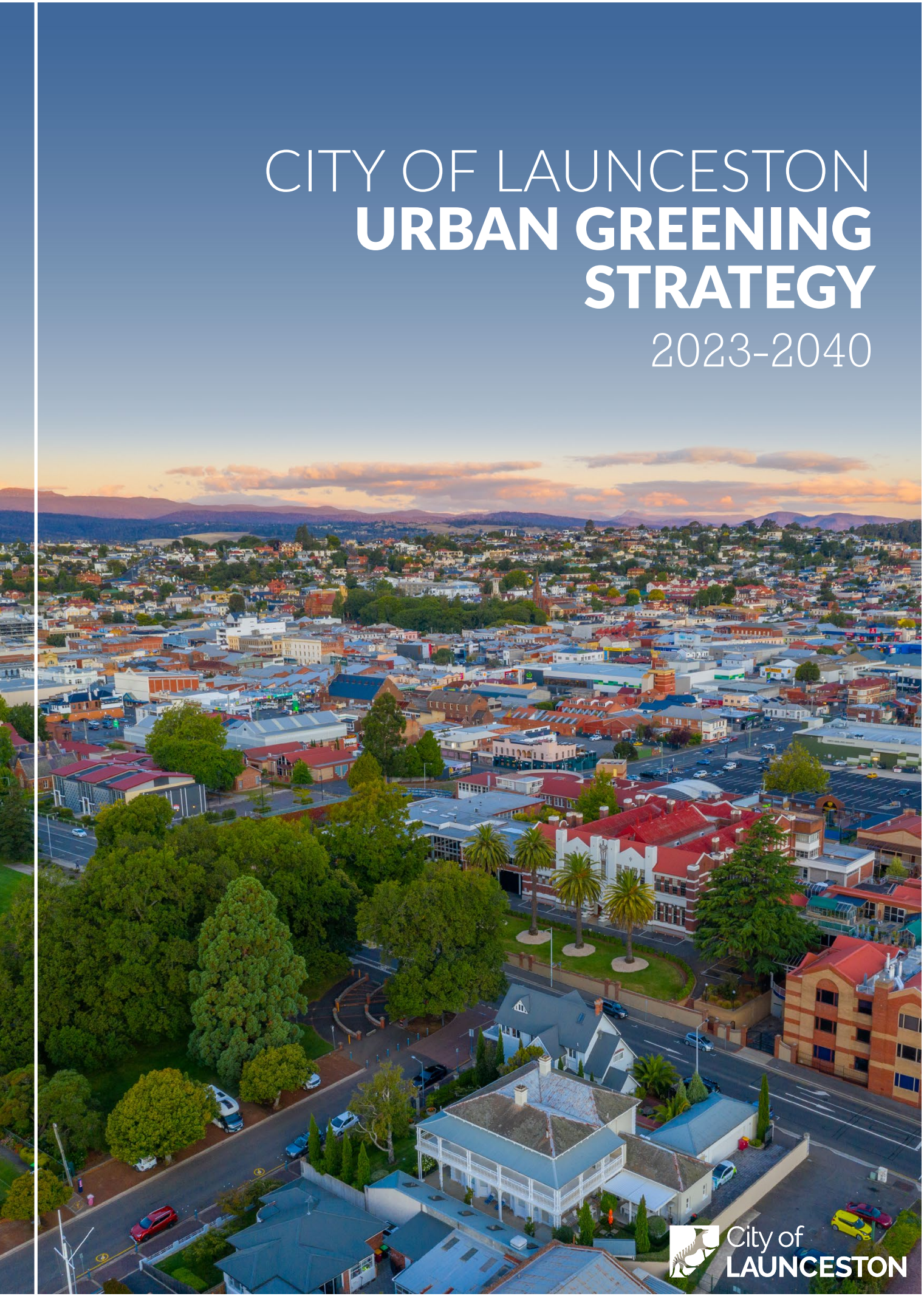
CITY OF LAUNCESTON
URBAN GREENING STRATEGY
2023-2040



Acknowledgment of Country

The City of Launceston acknowledges the Tasmanian Aboriginal people as the traditional custodians of this land on which the city and its surrounds are located, and pays respect to the Elders – past, present and future. Their legacy is evident in the natural and cultural values of this special place, and it speaks to us of the duty we have to preserve these values for future generations.

Cover image: iStock

City of LAUNCESTON

CITY OF LAUNCESTON

URBAN GREENING STRATEGY

2023-2040

Image: City of Launceston

Foreword

Mayor's Message

The Vision for the City of Launceston in the Greater Launceston Plan is for a compact, highly accessible green city with robust sustainable communities and a vibrant diverse inner city core.

Launceston's spectacular Cataract Gorge and City Park exist due to those that have gone before us. Our Council recognises that while these places delight tourists and residents, it's the rich tapestry of greenery in private gardens, along streets and waterways, and in a multitude of our parks and recreational areas that enhance the visual amenity of our City, create a strong sense of identity in a location, enhance biodiversity in the urban environment and mitigate the impacts of climate change, particularly reducing the effects of heat.

I am proud of the recent investments by our Council in Civic Square. We have transformed the space into a wonderful green oasis for the community to enjoy. Most days you can find people sitting in the shelter of the trees having their lunch, reading a book, sharing a chat and a cuppa, or watching their children play in the interactive water feature outside the library. The space also includes an edible garden and provides a wonderful location for events and community gatherings adding to a vibrant and inclusive city centre.

While some parts of our community have good canopy cover, many parts still do not. As a community we can do better for today and for future generations.

Over the past year Council staff have been working with the Launceston Chamber of Commerce on a shared commitment to the protection and enhancement of green infrastructure in the City. In an MOU signed in May 2022, both organisations committed to develop an urban greening strategy and implementation plan that builds on recent and current projects and establishes priority actions and timelines to enhance the greening of Launceston.

I am pleased to present Launceston's Urban Greening Strategy that sets out a bold target aimed at more than doubling the canopy cover in our urban area by 2040.

This is a shared strategy built from valuable community input and informed by robust analysis on where and how we need to enhance our canopy cover.

From Newnham in the north to Relbia in the south, and from Waverley in the east to Summerhill in the west, Council will work with the Launceston Chamber of Commerce and the broader community to protect our current trees, plant new street trees, enhance our parks and recreational areas, and encourage residents and businesses to continue to green their properties. Everyone in the City can play a vital role in bringing the strategy to life. By working together we have the opportunity to transform the urban landscape and create a vibrant, liveable city.

I encourage you to participate in actions that will help to reach the goal of 40% canopy cover by 2040.

This is our opportunity to invest in the City's future and add to the greening legacy for generations to come.

Danny Gibson
Mayor

CEO's Message

Council is committed to playing an important leadership role in the greening of Launceston. A target that will more than double the canopy cover in the next 17 years is bold and will require Council, businesses, community groups and individuals to work together to achieve it.

Over the past 12 months, Council has commissioned Geoneon Pty Ltd and the University of Tasmania to help lay the foundation for the development of the Urban Greening Strategy. Geoneon Pty Ltd used 2021 satellite imagery and sophisticated artificial intelligence software to undertake a comprehensive analysis of the extent of the current canopy cover, identify key actions, and create a baseline to assist in measuring changes over time.

The analysis tells us that the current canopy cover in the Launceston urban footprint at 19%. While this is well below the national best practice benchmark of 39% we are not alone. The most recent assessment of canopy cover in comparison cities across Australia is: City of Hobart (16.7%), Melbourne (22%), Sydney (15.5%); we all have more work to do. Brisbane is the standout performer in this area with a canopy cover of 44% which offers us many lessons.

In addition, Council worked with the University of Tasmania to seek input from the community including workshops with key stakeholder groups to identify values, beliefs, perceptions, preferences, and concerns regarding the greening of the city. This feedback has been instrumental in the development of the strategy.

Armed with this background analysis and input, Council has embarked on a two stage planning process. This strategy establishes the broad themes, objectives, and targets to 2040.

The Urban Greening Strategy has five key themes and targets:

1. **Retain and Increase Canopy Cover**

   Target: Achieve a 40% Canopy Cover in the Launceston Urban Area by 2040 (Currently 19.49%)

2. **Improve Urban Forest Diversity and Resilience**

   Target: To have no more than 5% of any tree species, no more than 10% of any genus and no more than 20% of any family in Launceston's urban forest.

3. **Support Biodiversity and Conservation of the Urban Forest**

   Target: Develop a biodiversity health check and implement a vegetation condition assessment to ensure improvement of urban biodiversity.

4. **Develop Integrated Infrastructure to support the Urban Forest and Liveability**

   Target: Increase numbers of street trees by planting 18,000 new street trees by 2040, this is equivalent to the increase of tree canopy cover to 40%

5. **Increase Community Knowledge and Participation**

   Target: Benchmark and improve community reported engagement and satisfaction through Tomorrow Together.

Under each of these themes sit a number of objectives that provide direction for the second stage of more detailed implementation planning. The implementation plan will outline the actions required to reach the targets in this strategy. Progress to implement the plan will be reviewed each year with a full review of the strategy every five years.

The Urban Greening Strategy focuses on the forest in Launceston but it also draws on and supports many other strategic objectives of the community and Council. For example, increased canopy cover encourages more people to walk, cycle and to use public transportation so they are less car reliant and enhances community health and supports our commitment to reducing greenhouse gas emissions.

Given its importance in shaping our community into the future, I encourage you to review the draft strategy and provide your feedback.

Council looks forward to working with you to create an accessible green city with robust sustainable communities and a vibrant diverse inner city core.

Michael Stretton

Chief Executive Officer

Image: City of Launceston

Image: istock

Organisational Vision, Mission, Values

Greater Launceston Plan Community Vision Statement

Sustainable prosperity for greater Launceston will be achieved by consolidating and building nationally and internationally recognised strategic advantage for the region through a focus on creativity and innovation, maintaining exceptional environmental and liveability qualities and ensuring a diverse, connected and inclusive region.

Our Vision

Inspired people, working together to create the best outcomes for our community.

Our Purpose

We are a progressive organisation, working with our community to create a positive future for Launceston.

Our Values

Our people matter

- We value clear and open communication
- We support and encourage each other
- We respect diversity
- We recognise individual needs, experience and strengths

We care about our community

- We take pride in our work and pursue a standard of excellence
- We genuinely listen, and value collaborative relationships
- We strive towards the best outcome for our community
- We make responsible and sustainable decisions

We bring an open mind

- We actively seek opportunities to continuously improve
- We respect and explore different ideas and perspectives
- We embrace change that leads to positive outcomes
- We value innovation and creativity.

We go home safe and well

- We show care for people and look out for one another
- We speak up and support others to be healthy and safe
- We take personal responsibility for our own health and wellbeing
- We value work-life fit

Executive summary

This is the City of Launceston's first Urban Greening Strategy and sets out the City's vision for a resilient, connected and diverse urban forest that will contribute to the health and wellbeing of our community and to the creation of a vibrant, liveable and sustainable city.

It is the product of a collaborative process, developed with many stakeholders including local academics, businesses, interest groups and the broader community.

This Strategy has been developed within the framework of the Greater Launceston Plan and the Launceston's Strategic Plan, and alongside the *City of Launceston Sustainability Strategy and Transport Strategy*.

The City of Launceston's Urban Greening Strategy replaces the *Street Tree Strategy* and shifts a focus from managing trees on an individual basis towards delivering a whole-of-forest approach, which encompasses trees and all other forms of vegetation, recognising that urban forests have economic, social and cultural benefits whilst conserving biodiversity, maintaining soil and water values and mitigating against heat impact and climate change.

Whilst Launceston is known for its leafy parks and significant trees, the urban forest that people enjoy today only covers around 19% of the urban area and lacks species diversity. This is below the national standard of 39%.

The Urban Greening Strategy sets out guiding principles that relate to urban greening that go beyond tree canopy and are as follows:

- mitigate and adapt to climate change
- reduce the urban heat island effect
- design a water sensitive city
- design for health and wellbeing
- design for liveability and sustainability
- create healthier ecosystems
- design for heritage sensitivity

This strategy also delivers five key themes and targets (see figure 1) for development of an urban forest, which includes not only tree canopy in the public and private domain, but also other forms of urban greening.

An action plan for urban greening will be further developed through an implementation plan and subordinate documents. It is also intended to indirectly guide other aspects of council operations, such as specifications and policies relating to green infrastructure, as well as development assessment and open space management, over time.

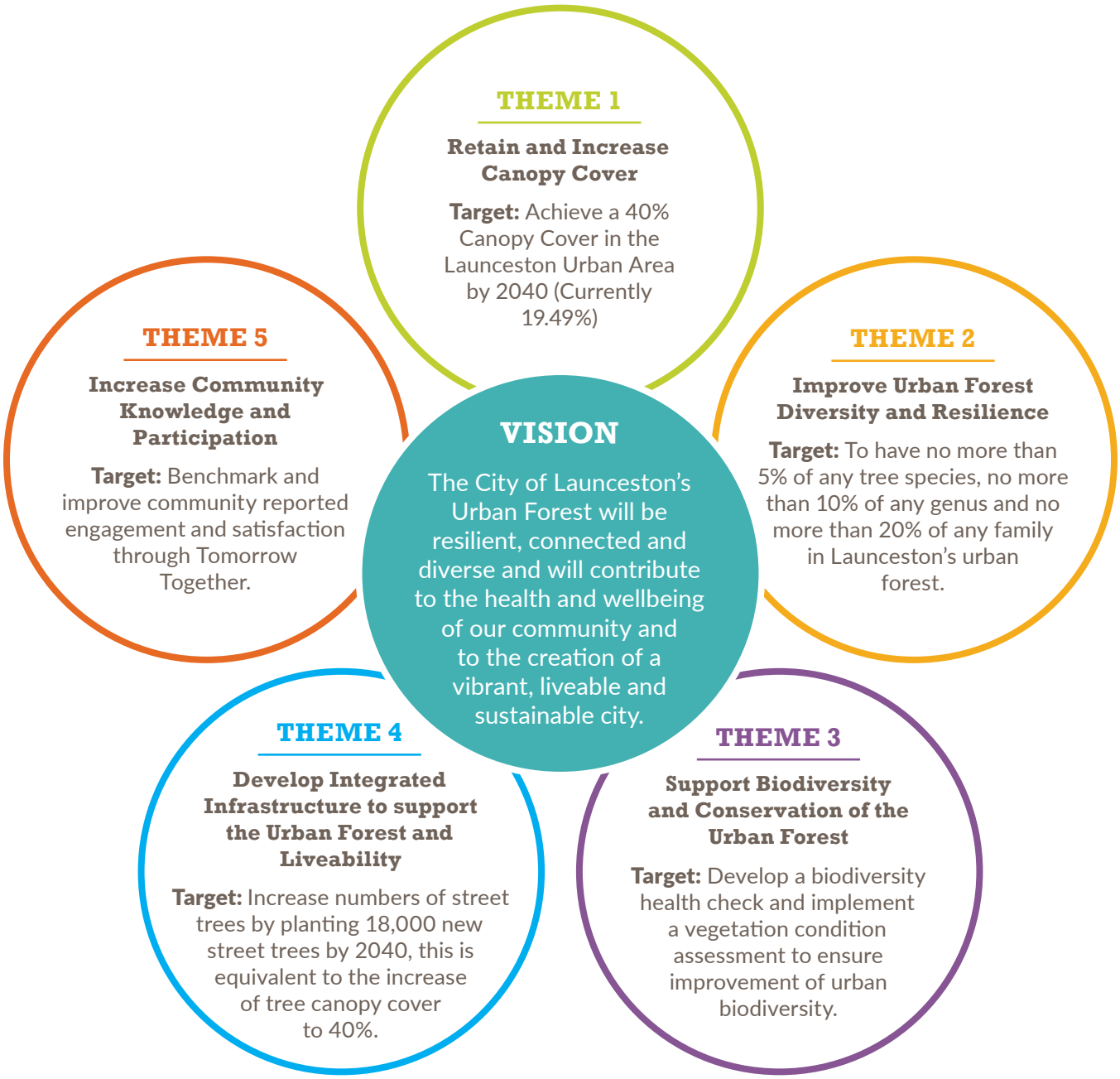


Figure 1: Launceston's Urban Forest Vision, Key Themes and Targets

1 Background and Context

Image: City of Launceston

1.1 Context for the Urban Greening Strategy

Launceston is Tasmania's largest city and is the economic, social and cultural hub of Northern Tasmania home to 15 per cent of the state's population. Its position at the junctions of the North Esk and South Esk rivers and kanamaluka/ Tamar estuary has long made it a key settlement and transport hub. It is also a major tourist destination, welcoming a third of Tasmania's visitors. As a growing region, the Greater Launceston population is expected to increase from 66,800 to 75,800 under a high-growth scenario (exclusive of associated urban growth in neighbouring LGAs). These people live, work and study in Launceston and also welcome over half a million visitors a year to the city (2018).

Demographic Context

Launceston residents have a median age of 39 (2021) which is slightly younger than Tasmania as a whole, and comparable to Australia generally, and this age has reduced slightly since 2016, despite falling numbers of children, indicating a growing young working age population. It also has a comparable older population (19.8% that are 65+ years old) with the rest of Tasmania (20.9%), although Launceston's population tends to be older than the national average (17.2%).

Census data also shows that of those of working age residents, 89 per cent work full or part-time, a rise since 2016 despite the COVID-19 pandemic. This figure is also comparable to the state and national employment levels. Most workers are in the household services sector, followed by goods related and business services. The household services sector includes health, education, hospitality, and art and recreation, and is increasingly important to Launceston's local economy, growing in proportion from 36 per cent in 2010 to 43 per cent in 2019. This growth suggests that meeting the local population's needs is largely driving Launceston's economy. Having a connected, diverse and healthy green city is vital for future liveability and sustainability.

Median Age: **39**
(▼ from 2016)

Worked (full or part time):
89%
(▲ from 2016)

Children 0 – 14 years:
17.1%
(▼ from 2016)

People 65 and over:
19.8%
(▲ from 2016)

Travel to work:

car **74.6%**

public transport **1.8%**

walking **4.1%**

cycling **0.6%**

worked at home **6%**

Top languages used at home (other than English):
Nepali (2.3%), **Mandarin (1.2%)**

The large working age population generally travels to work by car, although over 10% of workers either walk, cycle or work from home.

An Urban Greening Strategy has the potential to respond to this context by supporting:

- the natural setting of Launceston and the regional blue and green infrastructure of the kanamaluka/ Tamar estuary and Esk rivers
- tourism to the city through beautification and a greater sense of the natural setting within the city
- economic prosperity by creating inviting places to work, shop, and invest
- a reduction in greenhouse gas emissions by making streets more pleasant for workers who walk or cycle to work, or work from home, as well as supporting recreational walking, cycling and multi-modal transport
- population health by providing urban cooling to the more vulnerable, including older and very young residents and those living in less-well insulated homes.

Role of the Urban Greening Strategy

The City of Launceston's Urban Greening Strategy replaces the *Street Tree Strategy (2012)* and shifts a focus from managing trees on an individual basis towards delivering a whole-of-forest approach, which encompasses both trees and other forms of vegetation, recognising that urban forests have economic, social and cultural benefits whilst conserving biodiversity, maintaining soil and water values and mitigating against climate change.

Implementation of the Urban Greening Strategy will require coordination across the Council's operations and integration with a wide range of initiatives.

The diagram on the following page (figure 2) illustrates the relationship of the Urban Greening Strategy to City of Launceston's strategy and planning documents, which underpin and inform it, to complimentary documents that will support its implementation and to other strategies that the Urban Greening Strategy helps to deliver.

But, the Urban Greening Strategy cannot be delivered by Council alone. Implementation of actions to green our city will require the participation of many organisations, businesses, and individuals.

Image: City of Launceston

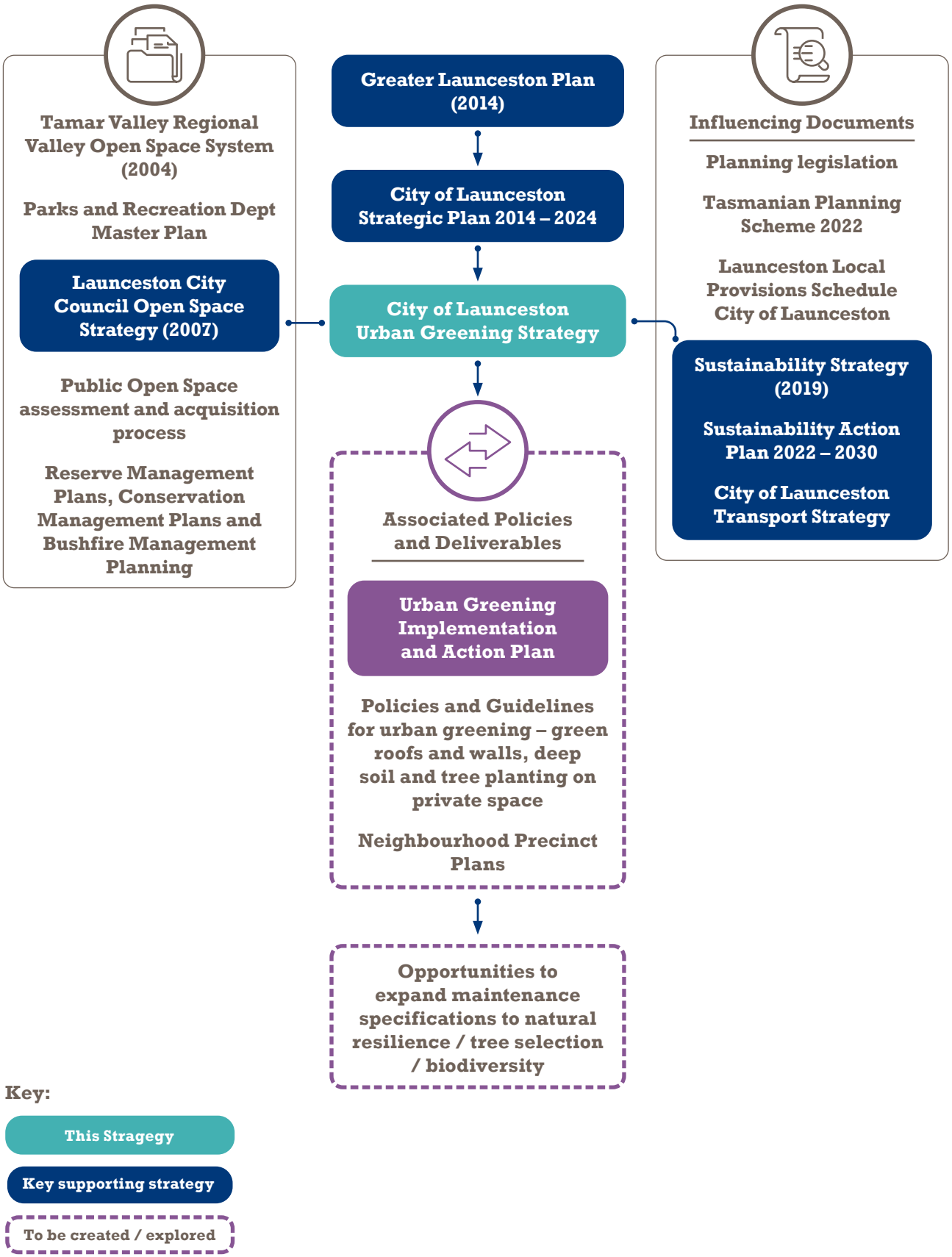


Figure 2: Relationship of Documents

Why not just a Street Tree Strategy?

The *Launceston Street Tree Strategy (2012)* defined the management of the City of Launceston's urban treescapes. The Street Tree Strategy emphasised connectivity within identified Central Activities Districts and other retail nodes driving a vision of a "liveable green network with attractive and usable tree-lined streets connecting areas of interest for all road and footpath users to safely experience and explore the city".

The *Street Tree Strategy* sought to address the imbalance between treed city parks and more sparsely planted streets within the city, as well as an absence of many notable tree avenues. The 2012 strategy prioritised long corridors for planting across the municipality. Since this time the City of Launceston had continued to plant trees, with significant achievements made in increasing the level of street tree planting overall.

However, a review of the *Street Tree Strategy* in 2020 found that the strategy's scope was insufficient to deliver a dense network of treed linkages that will realise the benefits of significant increase to urban forest canopy cover, nor did it address the creation of a green infrastructure network holistically. With the focus on longer treed corridors, the 2012 strategy also did not recognise or respond to equity issues with more recent development providing limited shading in suburban development areas. The review emphasises the need for a broader and stronger approach to the strategic management of Launceston's urban forest, with a stronger focus on trees and other vegetation in the total canopy distribution, including on private land and the use of alternative greening infrastructure such as arbours, green walls, and low plantings.

The urban forest's multifunctionality addresses some of the greatest sustainability issues facing cities. They enhance social equity and protect the most vulnerable people from urban heat island effects, they support active and public transportation corridors through shading and cooling, promote economic prosperity, and create places which support liveability, enhancing the health and wellbeing of current and future generations.

The Urban Greening Strategy applies to all the urban areas in the City of Launceston (as outlined in figure 3), including the Central Business District and roads, especially major arterial roads connecting with the city. It recognises the critical role it plays in social equity and focuses attention on those neighbourhood priority areas within surrounding suburbs, which are most affected when it comes to heat impact and vulnerability.

Image: City of Launceston

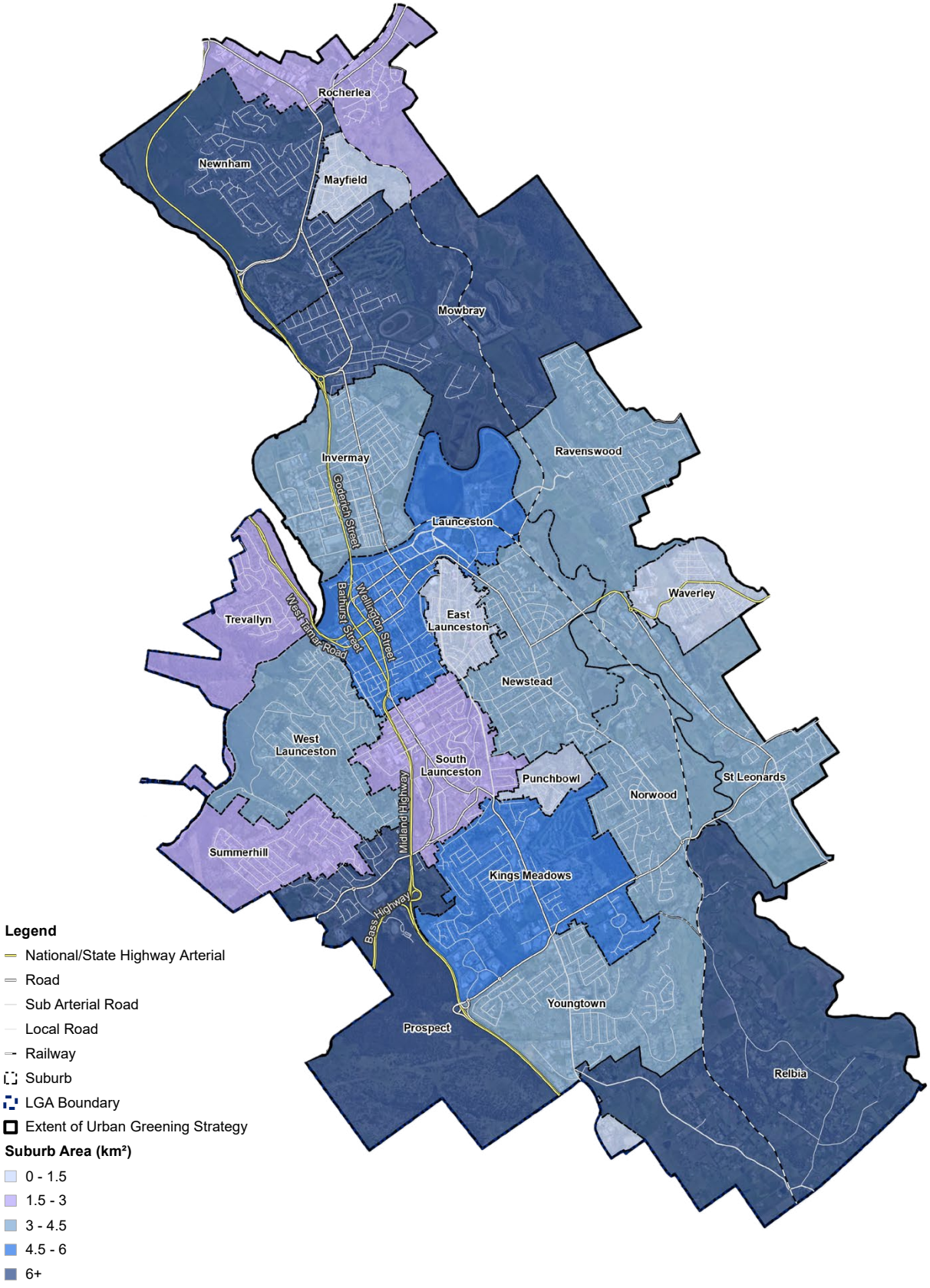


Figure 3: City of Launceston's Urban Areas

Image: istock

1.2 What is the Urban Forest?

The urban forest is made up of all the trees, shrubs, grassland and other vegetation, growing on public and private land within the city, and the soil and water that supports them.

This includes vegetation located in parks, private gardens, plazas, reserves, along main roads, local streets, in commercial areas, railways and waterways, and other green infrastructure such as balconies, walls and roofs.

The urban forest provides important ecosystem services such as air and water filtration, oxygen, shade, carbon sequestration, nutrient cycling and habitat for fauna. Whilst trees and shrubs are a critical element of urban forests, the Urban Greening Strategy encompasses a holistic approach to the cumulative benefits of all vegetation and associated ecosystems across the city and extends beyond the singular approach to tree management.

This strategy addresses the broader issues of climate change, urban heat island effects, urban densification and social equity, recognising that every part of the city, both public and private, contributes to and can be influenced by the urban forest.

The urban forest plays a significant role in enriching quality of life of its urban communities by supporting health and wellbeing, and making a city more liveable, attractive, sustainable and productive.

Image: City of Launceston

1.3 Benefits of the Urban Forest

Research has found that urban forests provide a wide range of important benefits for the community, environment and economy that extend beyond aesthetic and recreational values into an interconnected landscape, holistically feeding into the resilience, sustainability and prosperity of cities.

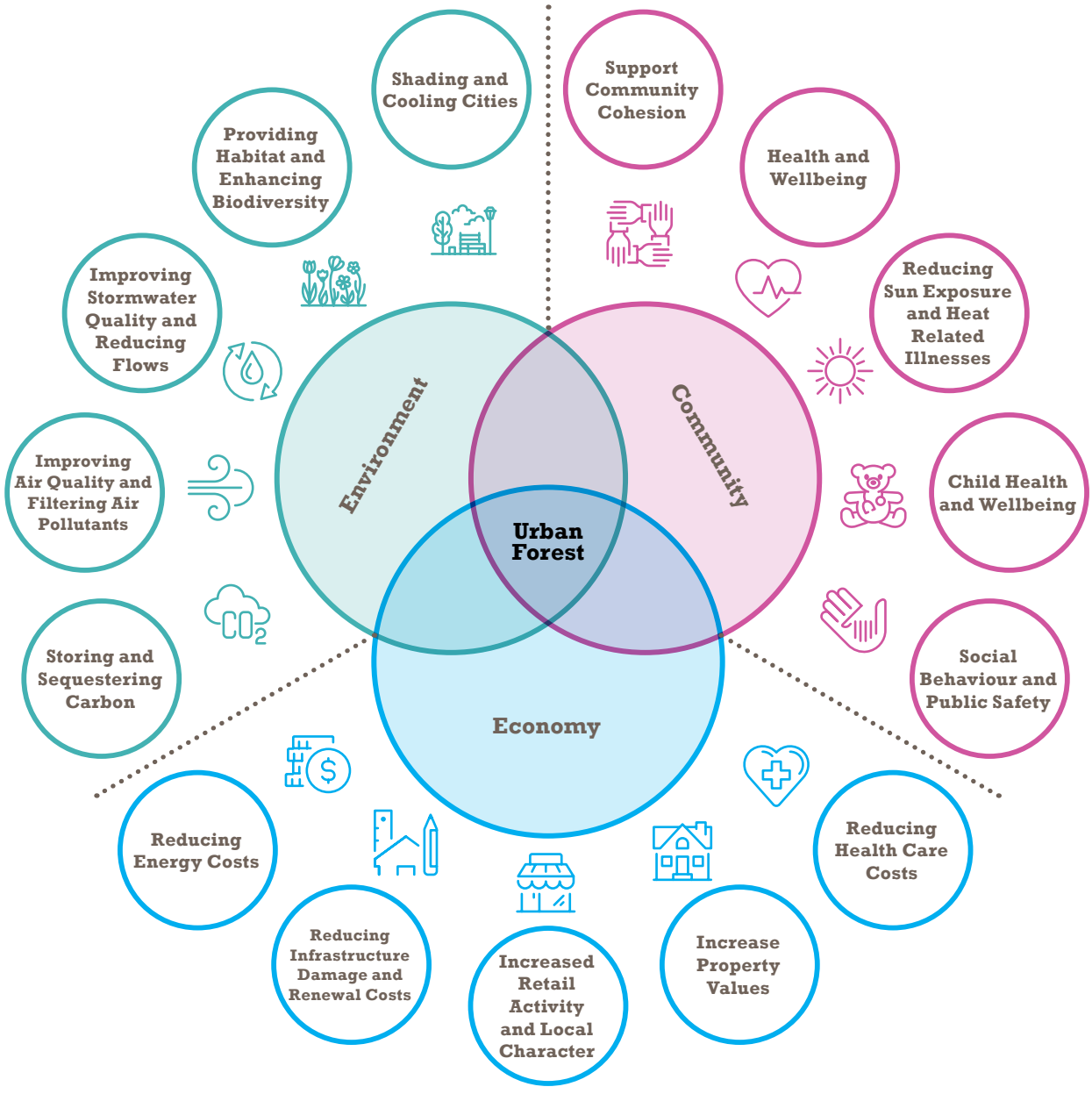


Figure 4: Urban Forest Benefits Diagram

1.3.1 COMMUNITY BENEFITS

Urban forests have many positive impacts for the community; they promote health and wellbeing, bolster social interaction, reduce incivility, and increase sense of place.

Some of the community benefits of the urban forest include:

Support Community Cohesion

Neighbours living in areas with more trees and green space are more likely to know each other and to help each other during times of crisis (Holtan et al., 2015). Green spaces are the setting for many everyday recreational opportunities such as sport, walking the dog or having a picnic, and provide spaces for events, festivals and entertainment throughout the city. These green spaces facilitate gatherings and interactions and play an important role in bringing diverse groups together within a public environment, supporting community cohesion and inclusion.

Health and Wellbeing

Neighbourhoods that are greener have also been found to have higher levels of happiness, social connectedness, and support, and better physical and mental health (Wolf et al., 2020). People living in such areas generally experience lower levels of stress and anxiety, lower levels of domestic violence and incivility, and higher levels of cooperation and overall sense of wellbeing.

Giving people access to green open spaces within the city encourages outdoor physical activity that can reduce people's risk of developing chronic heart disease, diabetes, dementia, obesity and some cancers.

Research shows that good tree canopy cover can increase the use of public transport and improve active transport and walkability in a neighbourhood, provided trees provide shade over bus stops, footpaths and cycle paths at the right time of the day, such as when children are walking home from school in the mid-afternoon (Langenheim et al., 2020).

Reducing Sun Exposure and Heat Related Illnesses

Sun exposure can have negative effects on physical and mental wellbeing. Trees provide shade from the potentially harmful effects of UV damage. Prolonged exposure to the sun can lead to skin cancer and heat related mortality for people over 65 years increases when temperatures exceed 30 degrees Celsius. Research indicates that quality shade from tree cover can reduce exposure to UV radiation by up to 75%. (Parsons et al., 1998)

Child Health and Wellbeing

Children attending schools with more greenery have been found to have higher test scores and better concentration (Kuo et al., 2018). Green spaces boost creativity, encourage exploration and adventure, promote physical activity and enable more experiential learning. These diverse benefits coagulate to have a significant impact on children's development and learning.

Social Behaviour and Public Safety

Access to nature can have a positive effect on the social behaviour of communities. There are generally lower levels of crime in neighbourhoods with more street trees (Lin et al., 2021).

1.3.2 ENVIRONMENTAL BENEFITS

Trees and other vegetation are good for the environment; they help cities adapt to climate change, provide habitats for a wide range of wildlife, reduce wind speed, can lower noise levels from traffic, lessening the chance of stormwater damage and improve management of water resources and can soak up carbon-dioxide, helping to lessen climate change (Roy et al., 2012). Urban forests make cities more liveable and should be core elements of a city's long-term planning (Riedman et al., 2022).

Some of the environmental benefits of the urban forest include:

Shading and Cooling Cities

The urban forest can mitigate the urban heat island effect by shading and cooling the built environment. Plant leaves reflect sunlight, absorb less heat than the built environment and protect hard surfaces from absorbing heat.

Through the process of transpiration trees draw up water from the soil and release it from their leaves into the atmosphere, cooling air temperatures by between 3°C and 11°C (Wong et al., 2021). The provision of shade to rooftops, streets and footpaths can reduce surface temperatures by up to 20 degrees Celsius, (Kovats et al., 2004; Cheng et al., 2019). This reduces day and night-time temperatures in summer and improves thermal comfort within the city, providing health and economic benefits. Shaded streets encourage more walking and riding, and shaded buildings reduce the need for air conditioning, mitigating insufficient insulation and reducing carbon dioxide emissions.

Trees in front of private dwellings that shade roofs and windows can also reduce heat stress on occupants, and when properly placed, trees can also funnel breezes.

Providing Habitat and Enhancing Biodiversity

Urban trees provide many benefits for other species. Where trees are planted in corridors alongside creeks and streams, connecting reserves and habitat patches to each other, they flourish with more insects, birds, and animals than in areas with fewer trees and provide critical movement corridors for wildlife, contributing to biodiversity conservation.

Studies have found that there are a greater diversity and number of birds, lizards and other small animals in cities with higher forest cover and where gardens have more trees and shrubs (Wood and Esain, 2020).

Improving Stormwater Quality and Reducing Flows

Trees and understory vegetation reduce the risk of flash flooding and slow flow rates during storm events by capturing heavy rainfall in their canopies, slowing flow with vegetation, and filtering stormwater with their root systems. This delays the time at which run off occurs, decreases stress on sewer systems, improves soil moisture and health, protects natural areas and reduces the nutrient load of nitrogen and phosphorus, sediment loads, and heavy metal content from entering waterways. (Webber et al., 2020)

Improving Air Quality and Filtering Air Pollutants

Trees and other vegetation trap, absorb and filter air pollution, capture greenhouse gases and improve air quality. Through the process of photosynthesis trees remove carbon dioxide, ozone, sulphur dioxide, carbon monoxide, nitrogen dioxide and particulate matter from the atmosphere and clean the air we breathe.

Storing and Sequestering Carbon

Carbon dioxide is a greenhouse gas associated with driving climate change. Trees capture, secure and store carbon dioxide within their biomass and use photosynthesis to convert carbon dioxide and water into sugar and oxygen.

1.3.3 ECONOMIC BENEFITS

Urban forests are good for the economy, they attract people to shopping areas, increase property values, and reduce cooling costs and stormwater expenses (Mckercher, 2020; Roy et al, 2012).

Some of the economic benefits of the urban forest include:

Reducing Energy Costs

Shading buildings in the summer can keep buildings cool naturally, reducing the need for air-conditioning and lowering energy costs. (McDonald et al., 2020)

Research suggests that landscaped vegetation when planted correctly around buildings can provide heating savings of 5 to 15 % and cooling savings of 10 to 50%. (McPherson et al., 1993)

Reducing Infrastructure Damage and Renewal Costs

Shading key assets, such as road surfaces and asphalt from harmful UV rays can increase the life span of infrastructure and reduce maintenance and renewal costs.

Increased Retail Activity and Local Character

City streets that are lined with trees attract people to linger at shopping areas and promote increased spending in retail areas.

The quality of the urban environment helps to develop a city's character and define its image. Well-designed green spaces with corridors that link between places play a role in developing local character, fostering a sense of connection to place, increasing accessibility, attracting tourism and boosting business activity. Research has shown that when a community feels connected to a place this results in stronger economic activity.

Increase Property Values

Urban forests enhance neighbourhood characteristics and aesthetics, resulting in increasing property values. Research has shown that treed suburbs, tree-lined avenues, and street trees and landscaped vegetation outside the front of houses can increase property values (Pandit et al., 2013).

Reducing Health Care Costs

In urban areas where there are more trees above footpaths, roads and cycleways, people are more likely to walk and exercise, making them physically fitter (Veitch et al., 2022). Increased levels of physical activity and improved mental health can help alleviate the burden on the national health system and reduce health care costs for the community. Higher levels of tree canopy cover (30% or more) are associated with lower incidence of cardio-vascular disease (Astell-Burt et al., 2021) and studies have shown that people who have a view over natural areas recover faster from illness and disease (Wolf et al., 2020).

2 Issues Challenges and Opportunities

Image: City of Launceston

2.1 Launceston's Existing Levels of Canopy Cover

Canopy cover describes the percentage of urban land covered by tree canopy when viewed from above.

A key objective of many urban forest plans is to increase canopy cover to provide shade and cooling and increase the absorption of carbon dioxide in the environment and is commonly used as an indicator of the success of the urban forest.

In 2021 Geoneon Pty Ltd. developed an artificial intelligence-based algorithm using a method called Convolutional Neural Network (CNN) to map canopy cover across the area of interest. The canopy cover is defined by the extent of leaves, branches and stems of trees viewed from above. The model was trained and run on high-resolution (50cm), multispectral (8-band) satellite imagery from 2021. The main advantage of this technology is its cost-effectiveness and reproducibility, which makes it easier to monitor the urban forest canopy cover over time.

Council contracted GeoNeon to accurately determine the extent of the current canopy cover using this methodology. This analysis provides a baseline of the canopy distribution and density across the area of interest, suburbs, land-use types, and categories before implementing the Urban Greening Strategy.

The results of the research indicated that the urban canopy cover base line for City of Launceston was 19.49%. This sits well below the national standard of 39% as identified in the Institute for Sustainable Futures Urban Tree Canopy Benchmark report.

Figure 5 identifies the key areas where canopy cover is an issue. Most significant are the northern suburbs of Invermay (6.9%), Newham (7.7%) and Rocherlea (10.3%) and the urban core (6.9%). These areas have a high proportion of suburban land use which are characterised by larger lots with significant building envelopes or urban density that makes integration of trees more challenging. Across the municipality, most of the existing canopy coverage is on private land (56% of total canopy). There is an opportunity to increase tree canopy on private land across the region but specifically in the northern suburbs and urban core. Where development has already occurred, landowners should be incentivised to help achieve the canopy increase on private lots.

Further to this, Geoneon analysed the percentage of canopy cover along the City of Launceston's cycling paths and around bus stops, health centres and educational facilities.

The analysis indicated most of City of Launceston's cycle paths have less than 5% canopy cover within a two-metre corridor and that the canopy cover of schools and health facilities vary depending on their location, with southern schools having more surrounding canopy cover than their northern counterparts, and health facilities in the centre of the City of Launceston have less canopy cover than in surroundings suburbs.

The percentage of canopy cover across bus stops in urban areas shows that most bus stops (57%) have a canopy cover between 0% and 7.5% while the remaining bus stops (43%) have a canopy coverage between 7.5% and 45%.

Active commuting to school is a known way to mitigate the negative effects of school drop-off, including air pollution, high traffic, car accidents, and lack of exercise for children. Studies have shown that one way to increase healthy and children-friendly routes for the walk to school is to increase green infrastructure (Laszkiewicz and Sikorsa, 2020).

There are significant opportunities for the City of Launceston to increase canopy cover along cycle path, at bus stops and around schools to promote the use of active transport.

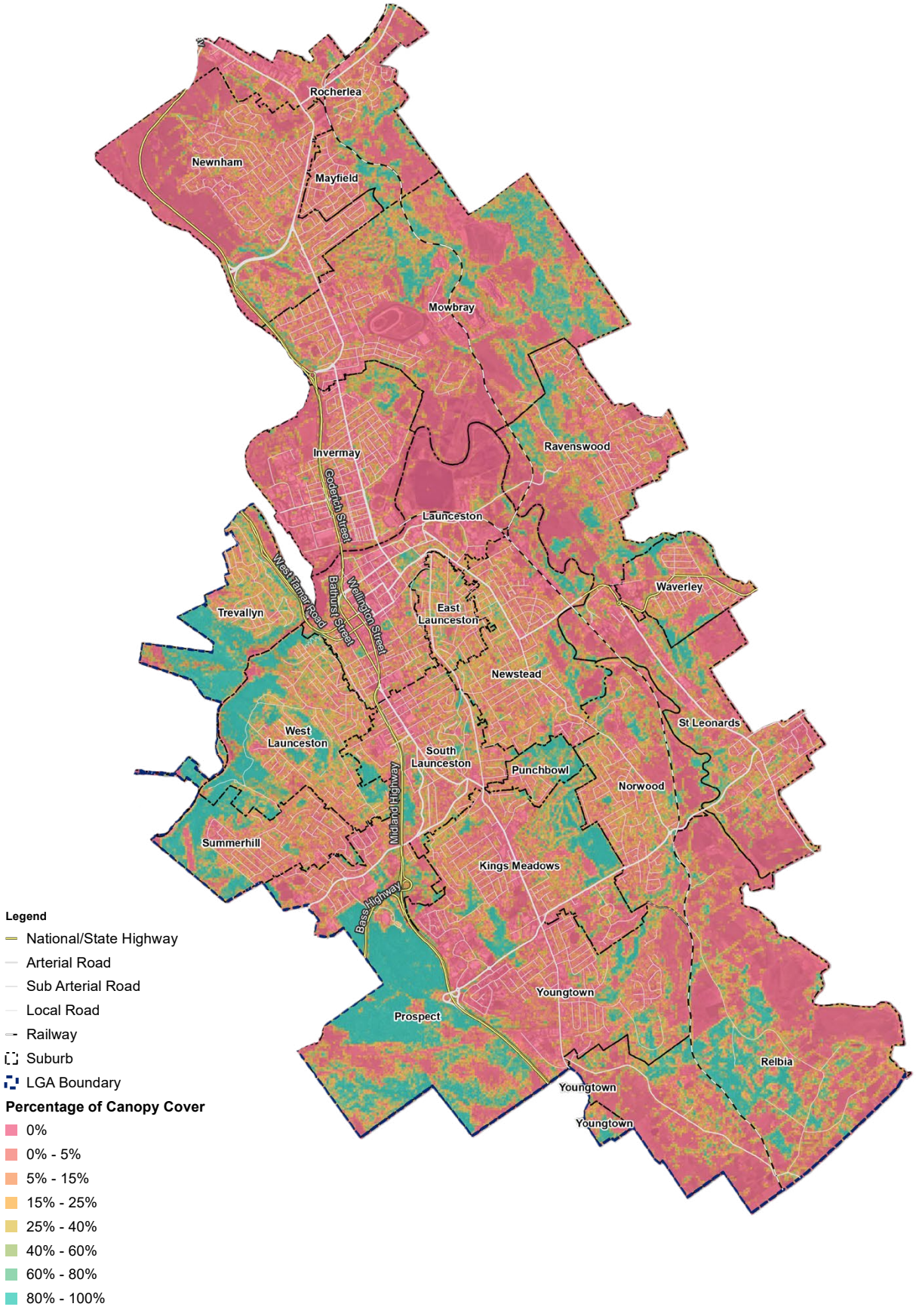


Figure 5: Percentage of Canopy Cover

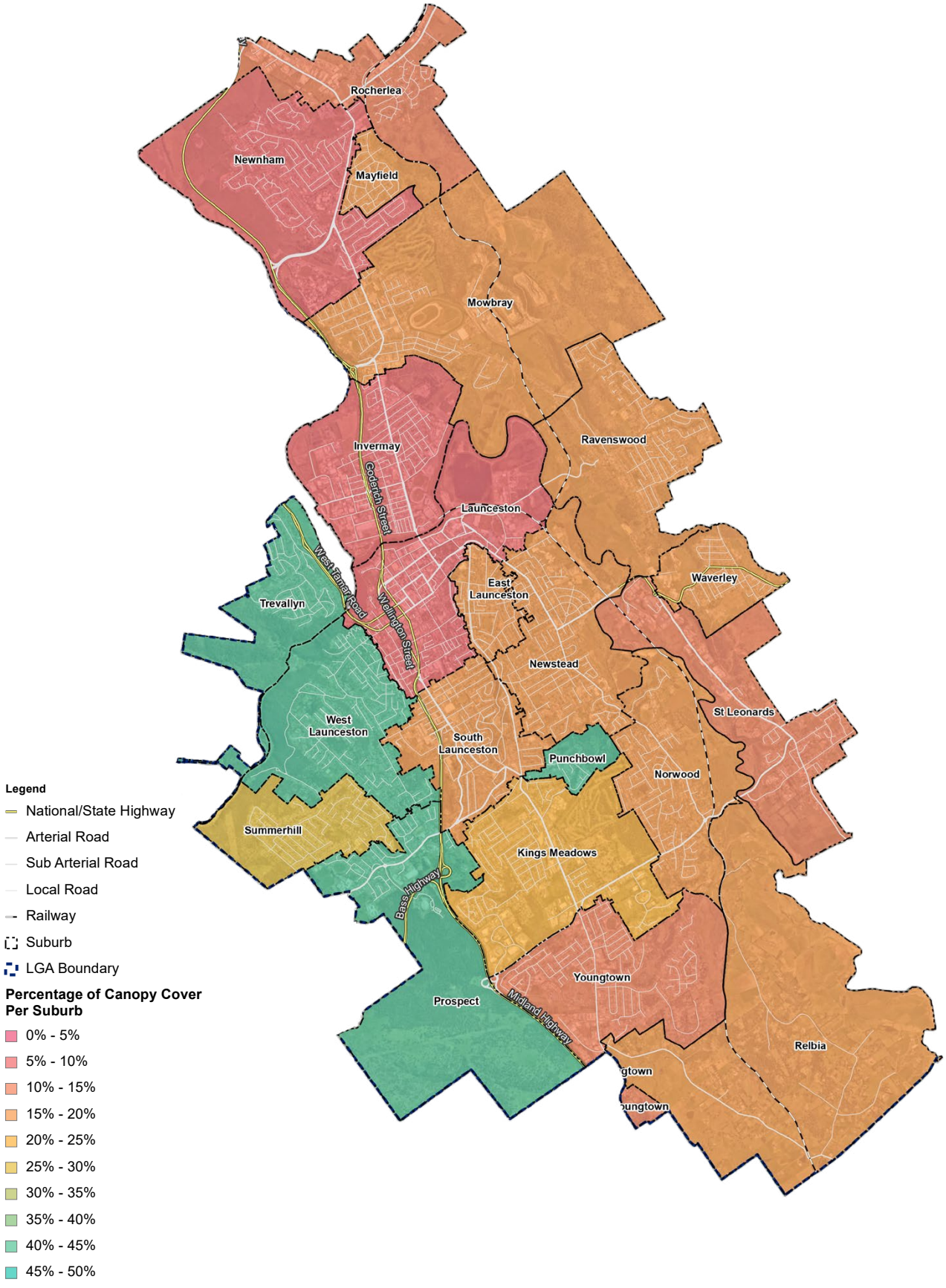


Figure 6: Percentage of Canopy Cover per Suburb

2.2 Biodiversity

A healthy urban forest supports biodiversity and provides broad environmental and health benefits to the community. Biodiversity is necessary for functioning ecosystems and enables the growth and preservation of flora and fauna (Berthon et al., 2021; Wood & Esaian, 2020). An urban forest provides a suitable environment to increase biodiversity in urban areas (Fuller et al., 2007). Supporting greater biodiversity in cities is a core part of climate change adaptation and increases resilience. Green space with greater biodiversity delivers physical and psychological benefits for the community. It is important that the Urban Greening Strategy is grounded in the biodiversity of the local environment so that enhanced or complementary ecosystems can be established. In practice, this means ensuring tree species are locally appropriate to support greater diversity of insects and animals.

Spatial areas that are more 'wild' or larger in scale have a greater potential to provide biodiversity benefits (Uchida et al., 2021). These areas also support smaller scale areas of greening which are nearby. These places provide opportunities for green linkages and increased canopy to create connections for wildlife and improve broader biodiversity outcomes.

Improved biodiversity will be achieved through the selection of appropriate species and the creation of green corridors connecting urban areas to the broader ecosystem. This will provide new habitat for plants and animals increasing resilience to climate impacts.

Image: istock

2.3 Urban Heat Island Effect

The urban heat island effect is a common phenomenon worldwide and occurs when temperatures in built-up urban areas have significantly warmer air and land surface temperatures than surrounding suburban and rural areas.

This occurs because heat-absorptive thermal mass materials, like buildings, concrete and bitumen absorb and retain daytime heat. After a hot day, these urban areas can be up to 7% warmer than surrounding areas. Whilst urban heat island effects occur all year round, they become more prominent in the hot weather. At night these materials continue to release heat after air temperatures have cooled and prevent night-time cooling. The effect occurs at all times of year, but creates a significant issue during hot weather.

Urban heat islands can put pressure on the city and exacerbate heat stress as people cannot recover from the heat stress in the day. This disproportionately affects vulnerable people, including the elderly, very young children or people with pre-existing medical conditions.

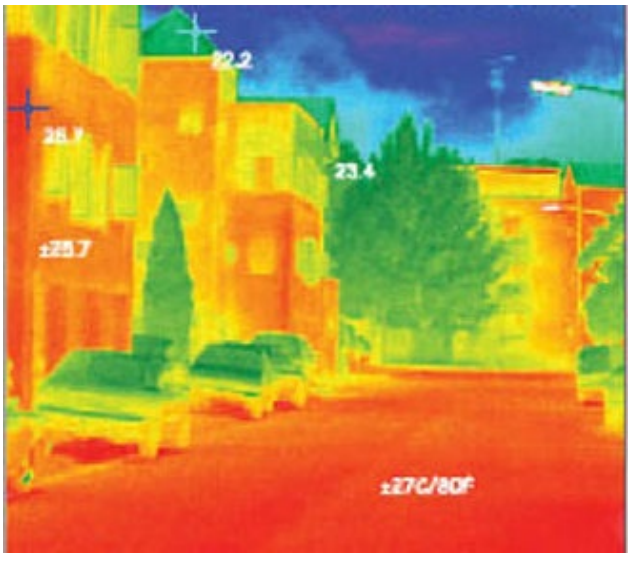
Heatwaves are known as the deadliest climatic disaster in Australia causing more than five times more fatalities than bushfires. In recent decades, heatwave events have increased in intensity, frequency, and duration across Australia (Steffen et al, 2014; Royal Commission into National Natural Disaster Arrangement, 2020). Extreme heat events in urban areas have significant negative impacts, including increasing pressure on physical and mental health, on power systems and the economy, as well as decreasing productivity of the population (UNEP, 2021). People living in dense areas are at greater risk during heatwaves because of the heat island effect.

With temperatures predicted to rise with climate change, the urban heat island effect has the potential to adversely impact the liveability of cities and health and well-being of the community.

Trees with high canopy cover and other vegetation in cities play a significant role in decreasing extreme heat and cooling surrounding areas by providing shade and evapotranspiration, mitigating heat retention and regulating temperature extremes.

To better understand the correlation between heat and tree coverage and the urban heat island effect in the City of Launceston, recent analysis calculated the Land Surface Temperature, the urban heat island effect and the correlation between tree canopy coverage and temperature. Figure 7 shows the summer median temperature anomalies occurring between suburbs in relationship to percentage of canopy cover.

Launceston's core has the equal lowest percentage of canopy cover of any suburb in the municipality (6.9%). In contrast to the northern suburbs with a high proportion of suburban land use, increasing canopy coverage in Launceston will primarily need to be achieved in the public realm with street trees the priority opportunity. Along with greening of public spaces and buildings with street trees, using low plantings, green walls or arbour structures will also provide an effective strategy to reduce the urban heat island effect.



Thermal imaging of a streetscape (City of Melbourne 2014)

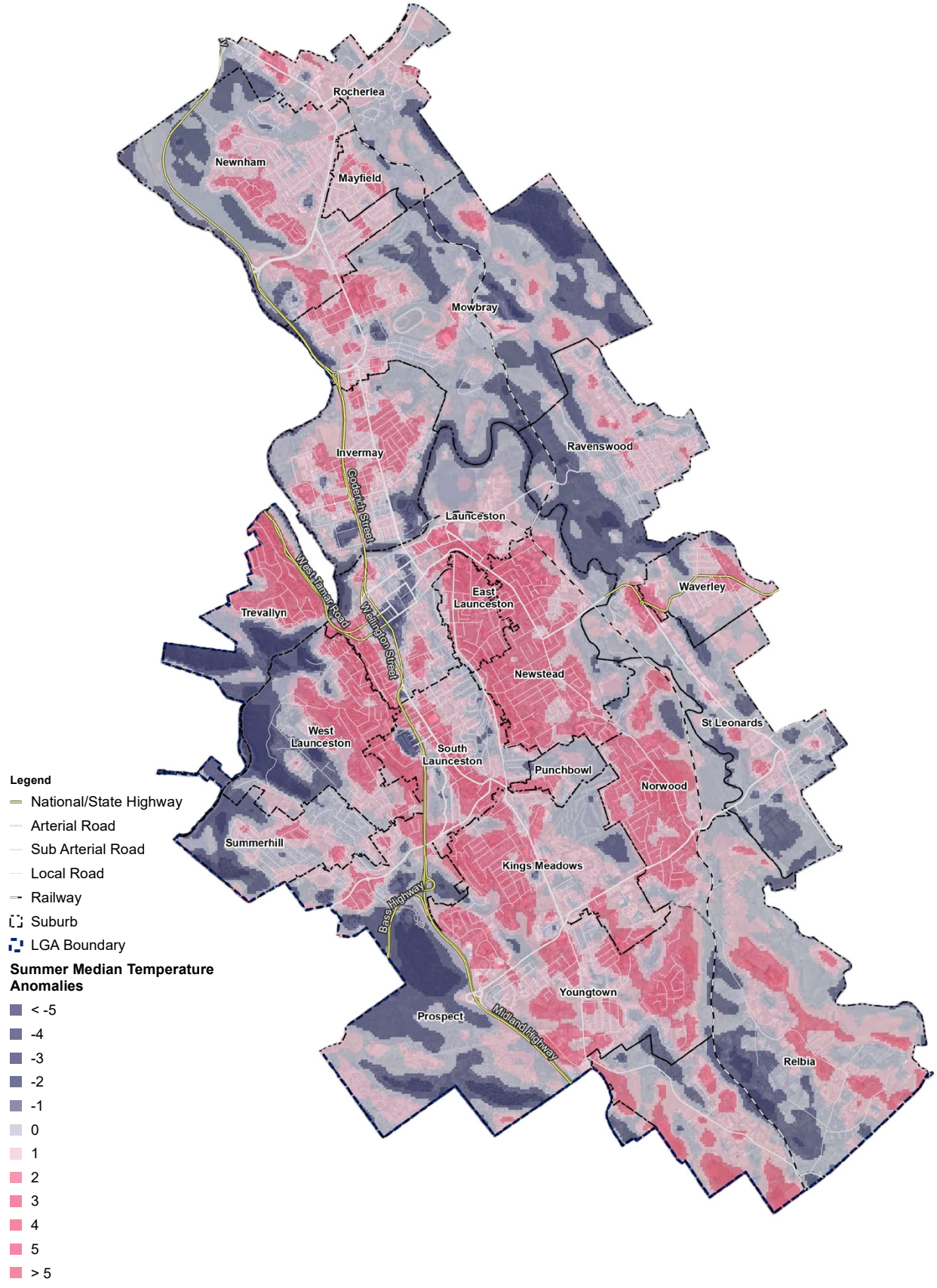


Figure 7: Summer Median Temperature Anomalies

Image: istock

Image: City of Launceston

Image: City of Launceston

2.4 Urban Densification and Competition for Space

As Launceston grows in population, new dwellings will be needed. This urban development will result in increased density both in existing areas, and the addition of new suburbs. Urban density relates to the number of people inhabiting a given urbanised area.

The development of land for large scale or single family residential has a major impact on tree canopy loss; higher-density development in urban infill, smaller block sizes in greenfield developments, increased building footprints, the preference for level sites, the use of impervious materials, higher land values and landowners redeveloping to the maximum allowable building size all play critical roles in reducing vegetation on private land. As vegetation on private land shrinks, opportunities for conservation are challenged, people's connection with nature is limited and the urban forest is reduced. New developments will need to protect, maintain, nurture and enhance trees and other vegetation on private land to expand the urban forest.

For new developments, there are opportunities in the assessment process to protect existing canopy cover and other vegetation. The development application process could seek opportunities to minimise the footprint of driveways on private property which can impact existing trees and other vegetation and identify areas for deep soil and new trees. There may be future opportunities for planning controls to influence improved greening and canopy development outcomes.

The competition for space extends into the public domain as the development pressures of roads, transport networks and services all pose threats to the urban forest. Making space on the streetscape for carriageways, footpaths and nature strips has a significant impact on street trees, new or modified roadworks affect the retention of street trees, overhead powerlines conflict with the management of trees, and underground services impacting the space needed for street trees to grow and mature. The provision of new street trees and protecting existing canopy is a priority, yet challenging with these constraints.

To achieve the urban forest objectives, greater collaboration is needed with and between utility providers. Greater collaboration can enable the colocation of cables which can reduce infrastructure costs and protect existing trees, while also future proofing opportunities for new trees and other vegetation by protecting appropriate planting areas on streets and medians.

Other areas of competition that limit the available space for tree planting include the open space needed for recreation in parks, parking in streets, driveway crossings and awning construction. A balance must be maintained between tree cover and areas of canopy free open space. The implementation plan should look for innovative planting opportunities to allow for canopy cover in contested spaces and where this is not achievable identify other forms of urban greening such as green roofs, vertical gardens, arbours and green structures that mitigate against heat impact and utilise water sensitive urban design.

2.5 Social Equity

The urban forest can play a role in social equity however, research shows that urban forest cover is not equitably distributed across many cities and the impact of heat is not evenly distributed across the population (Nesbitt et al., 2019).

Studies have shown that during heatwave events, vulnerable community members – including younger children, the elderly, people who are unwell or socially isolated, culturally and linguistically diverse communities, public housing tenants, and socio-economically disadvantaged people are the most impacted as they are less likely to be able to afford or access thermal comfort (UNEP, 2021).

Age is a critical factor in determining the vulnerability to extreme heat. People over 65 years old and youth less than 5 years old are the most vulnerable. Tasmania has a greater proportion of vulnerable population with 19.8% of the population over 65 years old (Campbell et al, 2019).

Launceston's residents are currently unprepared for extreme heat events. Launceston has a cool, temperate climate, and historically buildings and public spaces have not been designed with high temperatures in mind. Average temperatures in Tasmania have risen 1.1 degrees Celsius since 1910. This warming has been accompanied by reduced annual rainfall and heightened bushfire risk (Commonwealth of Australia, 2021). By the middle of this century (2040-2059), Launceston is expected to see a further 0.3°C temperature rise. The number of hot days above 30°C is also expected to rise to around 8 days a year and by the end of this century, the City of Launceston's annual average temperature could increase by up to 3.3°C (Grose, n.d.). Very hot days are expected to be 3-4°C hotter than currently experienced. Heatwaves will become more common, occurring up to twice a year. Warm spells will last up to two weeks (Grose, n.d.; White et al., 2010) and the number of summer days above 25°C will more than double to around 70 days per year (Grose, n.d.).

Because Tasmania has a rapidly ageing population, as does Launceston (Denny and Pisanu, 2019), it is important to take steps now to lessen the effects of extreme heat in the decades ahead.

One response that can help cool Launceston in the future is to plant more trees now. Recent studies have shown that people living in areas covered by less trees have a 5% higher risk of death from heat related causes (Schinasi et al, 2018; UNEP, 2021).

Urban greening is already being used by other cities in Australia and internationally to make cities cooler and more liveable (Bowler et al., 2010). A key goal of this Strategy is to support equitable distribution of the urban forest so that all can benefit from it. This means ensuring planting is prioritised in the areas where canopy cover is lowest and where residents are most vulnerable.

Figure 8 shows the correlation between socio-economic disadvantage, age vulnerability, and median temperatures. This shows the areas where people are at the greatest risk during extreme heat events. This mapping should inform the implementation priorities, identifying areas for planting to increase equity and improve resilience. Key areas where limited canopy coverage results in high levels of vulnerability to heat include the northern suburbs (particularly Invermay, Newnham, Rocherlea and Mowbray), and to the south in Youngtown. These areas have a combination of high vulnerability and low canopy cover. The community benefit of increased canopy in these areas is very high.

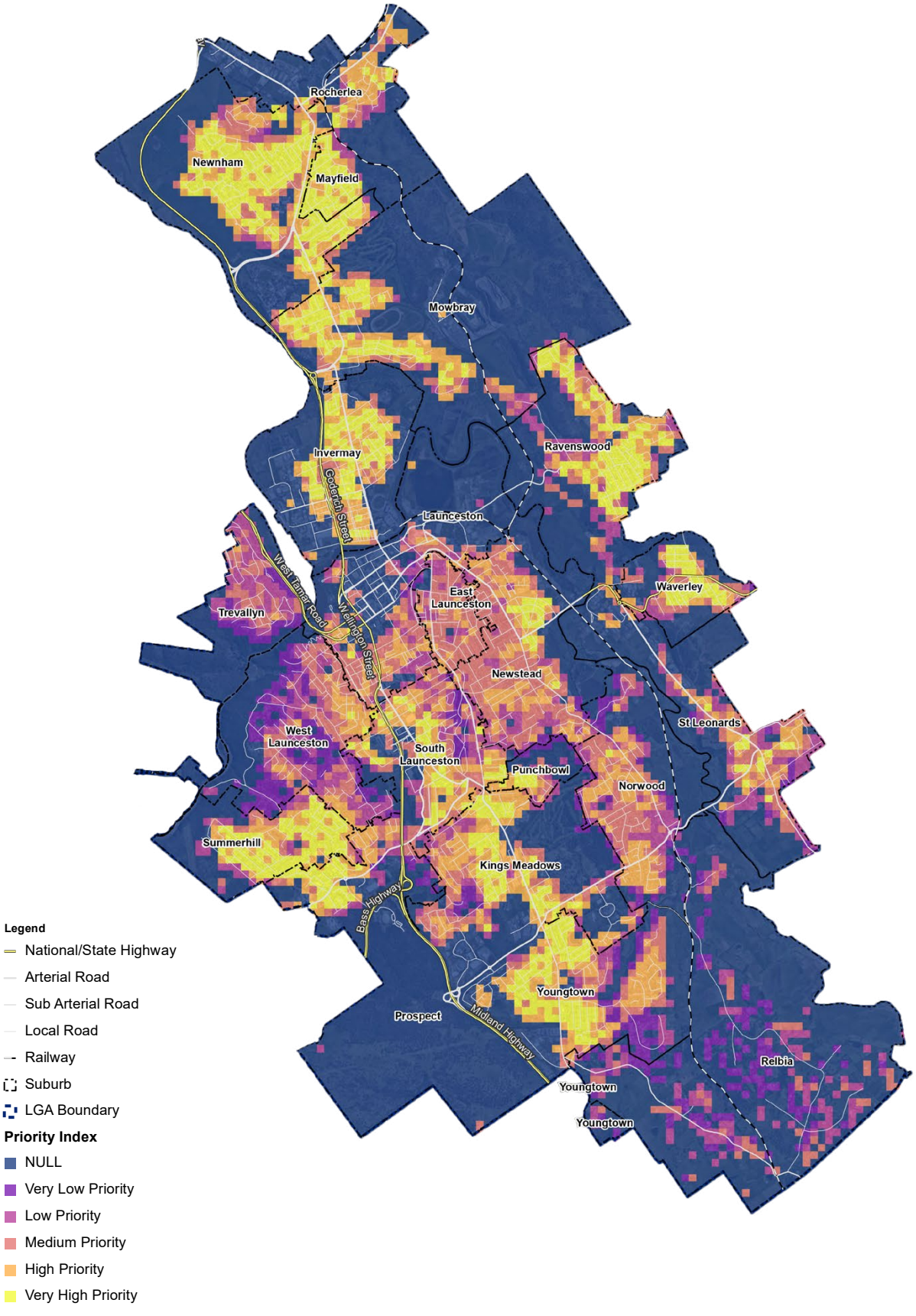


Figure 8: Priority Areas - Correlation between Socio-Economic Disadvantage and Summer Median Temperature

2.6 Community Engagement

The knowledge, awareness, perspectives, and perceptions of a city's residents and workers are important for the success for urban greening strategies (Kendal et al., 2022). Even with the best tree planning and management policies in place, unless residents and business owners value trees, urban greening will be challenging, and maintaining larger trees in the urban landscape will be difficult (Kirkpatrick et al., 2012). People's perception, attitudes and values can affect whether trees are seen as important and worth looking after, or a nuisance and a burden (Kirkpatrick et al., 2012). Where communities and businesses are involved in decision-making about urban trees, have the opportunity express diverse viewpoints and learn about the perspectives of others, there is a higher chance of success in urban forestry and greening (Carmichael et al., 2018).

It is essential that the implementation of Launceston's Urban Greening Strategy occurs in a collaborative and participatory way to ensure the wider community and landowners understand the many benefits that trees can provide, that species selection can reduce risks, and can increase 'buy-in' to the urban greening strategy (Barron et al., 2021; Kendal et al., 2022). It will be necessary to work closely with residents, to understand their needs, preferences and concerns, and then to share experiences and test different approaches that may work better in particular places.

Some of the ways that local communities have been involved in delivering urban forest strategies are through 'Adopt-A-Tree' programs where the community can request free street trees in exchange for tree care and watering, free tree giveaway programs where community members plant trees on private land and balconies, community co-design planting processes, tree inventories supported by community participation, community gardens, education programs such as planting days that involve the community in ongoing management of the urban forest. Incentives like 'Adopt-A-Patch' where schools or groups use a patch as an outdoor classroom create a sense of connection between trees and places. Another example from the City of Melbourne allows community members to write trees an email. The implementation plan should develop a program for how the community is to be engaged in a participatory way.

In May and June 2022, the University of Tasmania held five workshops on behalf of Launceston City Council. This consultation included community groups, residents, business, culturally and linguistically diverse residents, older people, and council staff and decision-makers.

Participants spoke with deep affection about the benefits of trees in Launceston. Some of the benefits included making the city more beautiful, providing shade in summer, attracting birds and wildlife into the city, providing fruit and seasonal colour, creating a sense of belonging, and improving people's health and wellbeing. Overall, workshop participants were supportive of efforts to increase tree canopy cover across the city, especially in those areas where residents face cost of living challenges and where tree canopy cover is currently very low.

Participants also identified numerous concerns related to trees in the city. Concerns identified included overshadowing, damage to pavements, pipes and house foundations, concerns about safety and vandalism, and concerns about maintenance costs for council and property owners.

New ways of working together are required to understand diverse perspectives and to ensure that urban greening strategies can better meet the needs of all residents, within budget and staffing limitations and complex planning and decision-making frameworks (Ordóñez et al, 2020). Through the engagement a range of innovative solutions were suggested by participants including:

- providing incentives for tree planting
- opportunities to retain trees and greenery on private property
- working with the community to pilot demonstration projects

Broadly there was strong support to commit to a bold vision to increase canopy cover within the city. Across all the workshops, the most frequently mentioned aspect of a liveable city was greenery – both trees and greenspace. The community holds a strong affinity for tress already and understand the importance of increased tree canopy to mitigate climate impacts in the future. The community appreciates the complexities of tree planting in urban settings. Participatory engagement and activities during the implementation will further strengthen community support.

Image: City of Launceston

3 A Vision for Launceston's Urban Forest

The City of Launceston's Urban Forest will be resilient, connected and diverse and will contribute to the health and wellbeing of our community and to the creation of a vibrant, liveable and sustainable city.

Image: istock

The Urban Greening Strategy is part of a broader system that contributes towards creating a sustainable and liveable city.

The Urban Forest Vision is complementary to *Launceston Sustainability Strategy (2019)*, *Launceston City Deal (2017)*, *City of Launceston Open Space Strategy (2007)* and *City of Launceston Transport Strategy (2020–2040)* and is underpinned by these five themes.

The five themes were derived from an alignment with sections of the City of Launceston *Corporate Strategic Plan (2014 – 2024)*, which were structured on the overarching goals within the Greater Launceston Plan. These five themes have also been influenced by the *Street Tree Strategy (2012)*, *Launceston City Heart Master Plan* and *My Place My Future (Northern Suburbs Revitalisation Plan)*. Each theme informs priority objectives for the basis of interventions and applies a key target to monitor success.

The following section provide an overview of the principles driving decisions, the five themes and the priority objectives which support them.

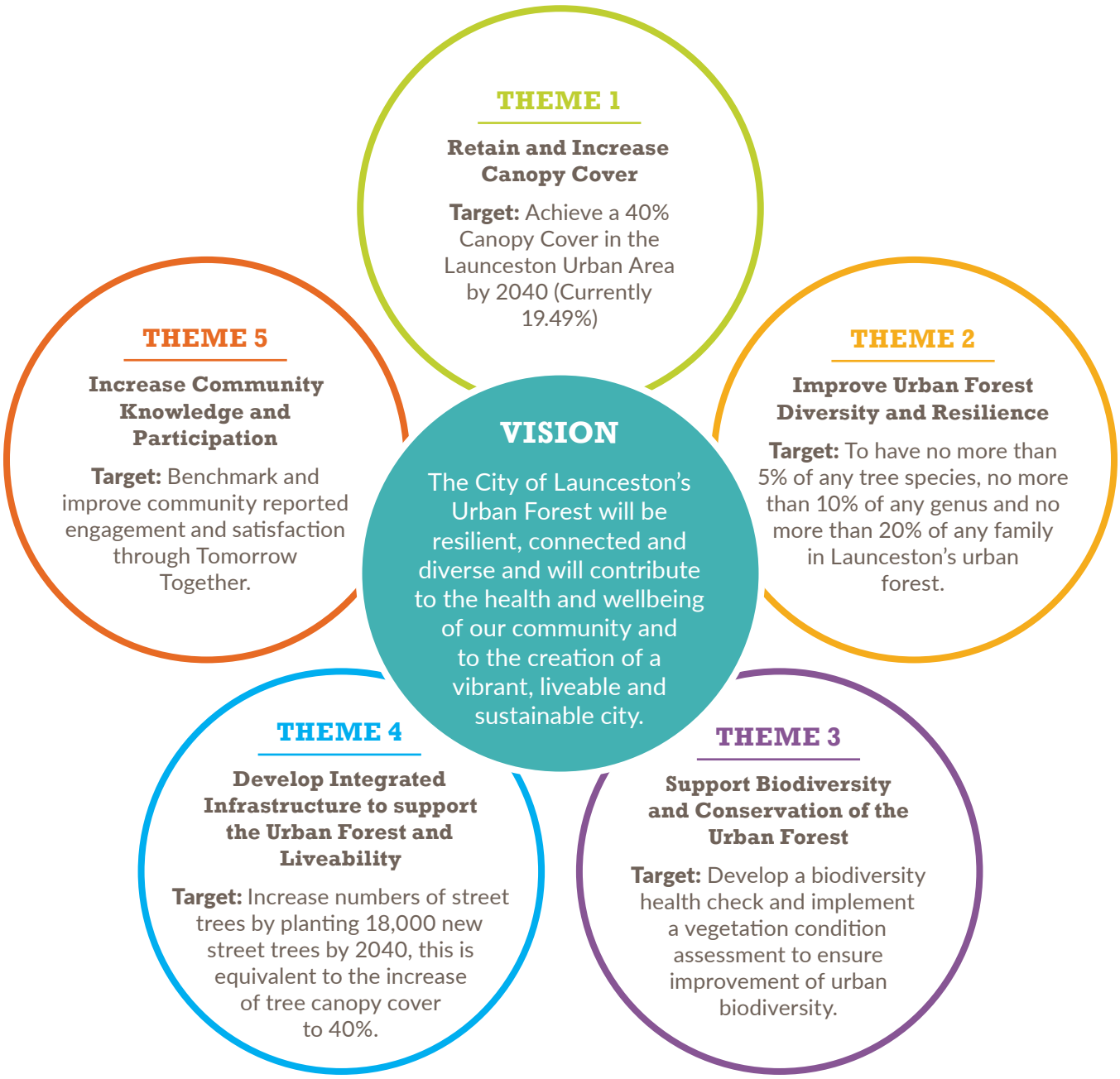


Figure 9: Launceston's Urban Forest Vision, Key Themes and Targets

4 Principles, Themes and Priorities

Image: iStock

4.1 Principles

Principles will guide decision-making to achieve the vision and directly address the local issues and challenges.

The Guiding Principles for developing the urban greening in the City of Launceston are:

- mitigate and adapt to climate change
- reduce the urban heat island effect
- design a water sensitive city
- design for health and wellbeing
- design for liveability and sustainability
- create healthier ecosystems
- design for heritage sensitivity

4.2 Themes

THEME 1

Retain and Increase Canopy Cover

Priority Objectives

T1.1 Increase upper, mid and low canopy cover in the City of Launceston in parks, recreation and open space areas, civic spaces, streets and road corridors and in residential areas, including private and public areas.

T1.2 Monitor tree health and, as appropriate, replace dead trees and vacant tree sites in areas where trees previously existed.

T1.3 Monitor, maintain and enhance the urban forest in the network of Parks and Recreation areas and Environmental Management areas.

T1.4 Enhance resilience of most vulnerable human populations and mitigate the impacts of extreme heat by increasing canopy cover.

T1.5 Promote nature-based solutions to greening areas of high density, such as green roofs, vertical gardens, arbours and structures.

T1.6 Develop a policy and guidelines to encourage the inclusion of trees and other vegetation in planning and development processes.

T1.7 Develop a policy and guideline to minimise tree loss through the development assessment process.

Target

Achieve a 40% canopy cover in the Launceston Urban Area by 2040

THEME 2

Improve Urban Forest Diversity and Resilience

Priority Objectives

T2.1 Seek positive solutions for climate change mitigation and adaptation including planting species variety for current climate, seasonal adaptation and future climate scenarios.

T2.2 Identify priority planning areas for local species and species diversity, including native and non-native heat and drought tolerant trees and plant accordingly.

T2.3 Understand soil suitability and where possible plant in deep soils or environments that provide appropriate solutions for nutrition and water storage.

T2.4 Integrate the urban forest with water sensitive urban design, using stormwater and other sources of irrigation that minimises water consumption.

T2.5 Provide appropriate protection for existing trees and other vegetation.

T2.6 Work with other infrastructure providers to:

- **a.)** address any infrastructure challenges which prevent the planting of trees and other vegetation, and
- **b.)** develop strategies to maintain street trees.

Target

To have no more than 5% of any tree species, no more than 10% of any genus and no more than 20% of any family In Launceston's urban forest.

THEME 3

Support Biodiversity and Conservation of the Urban Forest

Priority Objectives

T3.1 Develop a species Biodiversity Report to:

- **a.)** identify local species and habitat corridors and plant appropriately, and
- **b.)** engage with stakeholders and develop a planting strategy.

T3.2 Maintain responsible environmental management and conservation of natural resources.

T3.3 Create and protect natural habitat corridors between reserves, open and green space

T3.4 Promote, provide and maintain other urban ecosystems, such as green roofs, walls, gardens and other structures.

T3.5 Improve vegetation and facilitate safe native fauna movement along transport and service corridors.

Target

Develop a biodiversity health check and implement a vegetation condition assessment to ensure improvement of urban biodiversity.

THEME 4

Develop Integrated Infrastructure to support the Urban Forest and Liveability

Priority Objectives

T4.1 Combine green infrastructure with urban development to improve urban amenity and city attractiveness.

T4.2 Create a green network that provides linkages between places and connects people to key destinations e.g., public transport and open spaces, key public spaces or places and habitat corridors.

T4.3 Align green network to the walking and cycling corridors as in the *City of Launceston Transport Strategy 2020-2040*, to encourage the use of active and public transport.

T4.4 Integrate the green network with urban water infrastructure and promote water sensitive urban design.

T4.5 Provide approachable and accessible green elements and use trees, green structures, and other plantings as shaded and welcoming places to sit or stay in the city centre.

Target

Increase numbers of street trees by planting 18,000 new street trees by 2040, this is equivalent to the increase of canopy cover to 40%

THEME 5

Increase Community Knowledge and Participation

Priority Objectives

T5.1 Increase community education on the role of trees and other vegetation in climate change mitigation and urban heat island effect.

T5.2 Raise awareness of the Urban Greening Strategy and promote the benefits of greening City of Launceston's parks, recreation areas and open space areas, civic spaces, and roads.

T5.3 Partner with the community and establish an Urban Forest Advisory Committee to support community participation, address community concerns and provide guidance on the management of the urban forest.

T5.4 Create opportunities for the community, including youth and minority groups to act and take ownership of the urban forest.

T5.5 Promote and incentivise the planting of trees and other vegetation on private land.

Target

Benchmark and improve community reported engagement and satisfaction through Tomorrow Together.

5 Implementation framework

Image: City of Launceston

5.1 Governance

This strategy puts forward principles and themes that will guide the long-term planning, development and management of the City of Launceston's urban greening. It also outlines a set of targets to evaluate the success of implementation. A more detailed implementation and action plan, with interim targets will be developed.

Key considerations in developing an effective urban greening strategy include political leadership, stakeholder engagement, supporting design standards and guidelines, financial support, long-term monitoring, and supportive regulatory frameworks.

The City of Melbourne Urban Forest Strategy is widely used as a benchmark for the development of resilient urban forest strategies in Australia (2020 Vision, 2013). The City of Melbourne has used three main steps, which are mapping and modelling to inform priorities; engage and consult with experts and senior representatives of the council; and engage with community through workshops (Hartigan et al, 2021).

Over the past year, the City of Launceston has completed the following activities:

- **Map and model to inform priorities.** Engaged Geoneon Pty Ltd to map and model the current canopy cover, identify vulnerable populations, and identify priorities for urban greening
- **Engage with the community through workshops.** Worked with the University of Tasmania to engage with key stakeholder groups to determine the level of understanding of urban greening, identify key priorities for the strategy, understand what has and hasn't worked in the past, and identify engagement opportunities for the future. Worked with the Launceston Chamber of Commerce on a shared commitment to the protection and enhancement of green infrastructure in the city. In an MOU signed in May 2022, both organisations committed to develop an urban greening strategy and implementation plan that builds on recent and current projects and establishes priority actions and timelines to enhance the greening of Launceston
- **Engage and consult with senior representatives of the council, community leaders, and experts.** Completed a series of workshops with Council experts and community leaders to inform the development of the strategy.
- **Identify, implement, monitor and review.** The next step is to develop an implementation and adaptive planning process to meet the objectives in the strategy, establish interim milestones, and establish a monitoring, review, and adjustment cycle.

5.2 Measurement, Monitoring and Review

The implementation plan will drive the delivery of the strategy through short, medium and long-term actions that will be monitored and measured within set timeframes to help track the progress of implementing each of the principles, themes and actions to improve our urban forest by 2040 and beyond.

The adaptive planning approach will include a review of progress every year, with the opportunity to make operational adjustments in the implementation plan.

This strategy will be subject to a review every 5 years.

Image: istock

Image: istock

Glossary

Biodiversity	Refers to the wide variety of ecosystems and living organisms from all sources including terrestrial, marine and other aquatic ecosystems, their habitats and their genes, and the ecological complexes of which they are part. Biodiversity also refers to the degree of variation of life forms within a given species or ecosystem, and is a measure of the health of ecosystems
Canopy Cover	The area over which tree branches and foliage cover when viewed from above.
Density	In relation to canopy cover, the trees per unit of area. In relation to urban areas, the number of people (residents or workers) per unit of area, which typically correlates to built-up areas with more buildings and pavement (and thus less green cover).
Ecosystem	A system across various geographic scales where living organisms, weather and the physical environment interact.
Green Infrastructure	The network of green spaces which intersperse, connect and provide vital life support for humans and other species within urban environments. It includes elements such as green networks and links, cemeteries, community gardens, domestic gardens, roof gardens, green walls, living walls and verges.
Liveability	A combination of conditions required for community to live with adequate physical and mental wellbeing.
Resilience	The capacity to adapt or recover from change and continue to develop. Ecological resilience refers to the capacity of an ecosystem or natural population to recover from impacts to function following natural or human-caused disturbances. Social resilience is the ability of human communities to withstand and recover from stresses, such as environmental change or social, economic or political upheaval.
Sustainability	Meeting the needs of the current population while protecting and providing resources to meet the needs of future generations.
Urban Forest	The urban forest is made up of all the trees, shrubs, grassland and other vegetation, growing on public and private land within the city, and the soil and water that supports them.
Urban Forestry	'The art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide society' (Helms, 1998).
Urban Heat Island	Described the effect where developed urban areas capture and store heat at a higher rate than natural and biodiverse areas.
Whole-of-Forest Approach	The whole-of-forest approach recognises the contribution of all trees and other vegetation to the ecological system and their symbiotic relationship. Each individual tree and all other plants provide a combined contribution of benefits which are amplified by connected corridors and the forest as an entire system. The forest includes all trees and other vegetation in the municipality irrespective of land ownership.

Bibliography

Aznarez, C., Svenning, J., Taveira, G., Baró, F., & Pascual, U. (2022). Wildness and habitat quality drive spatial patterns of urban biodiversity. Landscape and Urban Planning, Volume 228

Astell-Burt, T. and Feng, X (2019). Association of urban green space with mental health and general health among adults in Australia. JAMA Network Open

Astell-Burt, T., Navakatikyan, M.A., Walsan, R., Davis, W., Figtree, G., Arnolda, L. and Feng, X. (2021). Green space and cardiovascular health in people with type 2 diabetes. Health & Place, 69, p.102554.

Astell-Burt, T., Navakatikyan, M., Eckermann, S., Hackett, M. and Feng, X., (2022). Is urban green space associated with lower mental healthcare expenditure?. Social Science & Medicine

Bardsley, D.K., Moskwa, E., Weber, D., Robinson, G.M., Waschl, N. and Bardsley, A.M., (2018). Climate change, bushfire risk, and environmental values: examining a potential risk perception threshold in peri-urban South Australia. Society & Natural Resources

Barron, S., Sheppard, S., Kozak, R., Dunster, K., Dave, K., Sun, D. and Rayner, J., (2021). What do they like about trees? Adding local voices to urban forest design and planning. Trees, Forests and People

Berthon, K., Thomas, F. and Bekessy, S., (2021). The role of 'nativeness' in urban greening to support animal biodiversity. Landscape and Urban Planning

Bijoor, N.S., McCarthy, H.R., Zhang, D. and Pataki, D.E., (2012). Water sources of urban trees in the Los Angeles metropolitan area. Urban Ecosystems

Bowler, D.E., Buyung-Ali, L., Knight, T.M. and Pullin, A.S., (2010). Urban greening to cool towns and cities: A systematic review of the empirical evidence. Landscape and Urban Planning

Brown, J.A. (2020). Influences of environmental and social factors on perceived bio-cultural services and disservices. Frontiers in Ecology and Evolution

Bush J, (2020). The role of local government greening policies in the transition towards nature-based cities. Environmental Innovation and Societal Transitions

Byrne, J. and Sipe, N., (2010). Green and open space planning for urban consolidation–A review of the literature and best practice, Issues Paper 11, Urban Research Program, Griffith University, Brisbane Australia

Byrne, J., Ambrey, C., Portanger, C., Lo, A., Matthews, T., Baker, D. and Davison, A., (2016). Could urban greening mitigate suburban thermal inequity?: the role of residents' dispositions and household practices. Environmental Research Letters

Callaghan C T, Major R E, Lyons, M B, Martin J M, Kingsford R T (2018) The effects of local and landscape habitat attributes on bird diversity in urban greenspaces. Ecosphere. 9, e02347.

Campbell-Arvai, V. and Lindquist, M., (2021). From the ground up: Using structured community engagement to identify objectives for urban green infrastructure planning. Urban Forestry & Urban Greening, 59, p.127013.

Campbell S L, Remenyi T A, Williamson G J, White C J, Johnston F H (2019) The Value of Local Heatwave Impact Assessment: A Case-Crossover Analysis of Hospital Emergency Department Presentations in Tasmania, Australia. Int. J. Environ. Res. Public Health 2019, 16, 3715.

Carmichael, C.E. and McDonough, M.H., (2018). The trouble with trees? Social and political dynamics of street tree-planting efforts in Detroit, Michigan, USA. Urban Forestry & Urban Greening, 31, 221-229.

Chandra, K.K., Kumar, R. and Baretha, G., (2022). Tree Benefits in Urban Environment and Incidences of Tree Vandalism: A Review for Potential Solutions. Urban Ecology and Global Climate Change, 163-181.

Cheng, J., Xu, Z., Bambrick, H., Su, H., Tong, S. and Hu, W., (2019). Impacts of heat, cold, and temperature variability on mortality in Australia, 2000–2009. Science of the Total Environment, 651, 2558-2565.

City Of Launceston (2021) City of Launceston Transport Strategy 2020-2040. Launceston, Tasmania.

City of Launceston, Codesign Studio, Aspect Studios, Urban&Public (2015) Launceston City Heart People, Place, Lifestyle. Launceston, Tasmania.

City of Launceston. (2012) Launceston Street Tree Strategy 2012. Launceston, Tasmania.

City of Launceston. (2014) Strategic Plan. Launceston, Tasmania.

City of Launceston. (2018) Tree Management Policy. Launceston, Tasmania.

City of Launceston. (2019) My Place. My Future. Launceston, Tasmania.

City of Launceston. (2019) Sustainability Strategy. Launceston, Tasmania.

City of Launceston. (2020) Nature Strip Policy. Launceston, Tasmania.

City of Launceston. (2021) Launceston City Deal.

City of Melbourne (2014) Urban Forest Strategy Making a Great City Greener 2012-2032. Melbourne, Australia.

City of Sydney (2013 Urban Forest Strategy. Sydney, Australia.

City of Perth. (2016) Urban Forest Plan 2016-2036. Perth, Australia.

Clark, C., Ordóñez, C. and Livesley, S.J., (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

Coleman, A.F., Ryan, R.L., Eisenman, T.S., Locke, D.H. and Harper, R.W., 2021. The influence of street trees on pedestrian perceptions of safety: Results from environmental justice areas of Massachusetts, US. Urban Forestry & Urban Greening

Commonwealth of Australia (2021) Climate Change in Australia: Tasmania's Changing Climate.

Croeser, T., Ordóñez, C., Threlfall, C., Kendal, D., van der Ree, R., Callow, D. and Livesley, S.J., (2020). Patterns of tree removal and canopy change on public and private land in the City of Melbourne. Sustainable Cities and Society

CSIRO, (2020). Climate change in Australia: Climate information, projections, tools and data (climate analogues)

Cook N, Hughes R, Taylor E, Livelsey S, Davern M (2015) Shading liveable cities: exploring the ecological, financial and regulatory dimensions for the urban tree canopy. University of Melbourne. Working Paper.

Cristóbal, J., Ninyerola, M., and Pons, X. (2008), Modeling air temperature through a combination of remote sensing and GIS data, J. Geophys. Res.

Crooks K, Sanjayan M (2006). Connectivity Conservation. Cambridge University Press: New York, NY, USA.

Daniel C, Morrison T H, and Phin, S., (2016). The governance of private residential land in cities and spatial effects on tree cover. Environmental science & policy.

Dennis, M., Cook, P.A., James, P., Wheater, C.P. and Lindley, S.J., (2020). Relationships between health outcomes in older populations and urban green infrastructure size, quality and proximity. BMC Public Health.

Denny, L. and Pisanu, N., (2019). Regional population trends in Tasmania: Issues and options, Insight Nine, Institute for the Study of Social Change, Hobart, Australia.

Department of Health (2016) Heatwave ready Tasmania Resources for residential aged care facilities in Tasmania. State of Tasmania 2016.

Department of State Growth. (2016) By Foot, Bike, or Bus. Hobart, Tasmania.

Eisenman T S, Coleman A F, LaBombard G (2021) Street Trees for Bicyclists, Pedestrians, and Vehicle Drivers: a Systematic Multimodal Review. Urban Sciences.

Draus, P., Haase, D., Napieralski, J., Roddy, J. and Qureshi, S., (2019). Wounds, ghosts and gardens: Historical trauma and green reparations in Berlin and Detroit. Cities.

Draus, P., Haase, D., Napieralski, J., Qureshi, S. and Roddy, J., 2021. Lurking in the bushes: informality, illicit activity and transitional green space in Berlin and Detroit. Cultural Geographies, 28(2), 319-339.

Eisenman, T.S., Jariwala, S.P. and Lovasi, G.S., (2019). Urban trees and asthma: a call for epidemiological research. The Lancet Respiratory Medicine.

Ellena M, Breil M, Soriani S (2020) The heat-health nexus in the urban context: a systematic literature review exploring the socio-economic vulnerabilities and built environment characteristics. Urban Climate.

Endreny, T.A., (2018). Strategically growing the urban forest will improve our world. Nature Communications.

Fernandes, C.O., da Silva, I.M., Teixeira, C.P. and Costa, L., (2019). Between tree lovers and tree haters. Drivers of public perception regarding street trees and its implications on the urban green infrastructure planning. Urban Forestry & Urban Greening

Fischer, L.K., Brinkmeyer, D., Karle, S.J., Cremer, K., Huttner, E., Seebauer, M., Nowikow, U., Schütze, B., Voigt, P., Völker, S. and Kowarik, I., (2019). Biodiverse edible schools: Linking healthy food, school gardens and local urban biodiversity. Urban Forestry & Urban Greening.

Filazzola, A., Shrestha, N. & MacIvor, J.S. (2019). The contribution of constructed green infrastructure to urban biodiversity: A synthesis and meta-analysis.

Fuller, R.A., Irvine, K.N., Devine-Wright, P., Warren, P.H. & Gaston, K.J. (2007). Psychological benefits of greenspace increase with biodiversity. Biol. Lett. 3390–394

Flynn a, Mcgreevy C, Mulkerrin E (2005) Why do older patients die in a heatwave? QJM International Journal of Medicine.

Fors, H., Hagemann, F.A., Sang, Å.O. and Randrup, T.B., 2021. Striving for inclusion—A systematic review of long-term participation in strategic management of urban green spaces. Frontiers in Sustainable Cities.

Geoneon (2022) Urban Forest Strategy Technical Report. University of Tasmania. Jason Byrne, Emma Williams, Bradley Johnson, Roxane Bandini-Maeder

Goh, K., 2018. Safe cities and queer spaces: The urban politics of radical LGBT activism. Annals of the American Association of Geographers.

Government Architect New South Wales (2020) Greener Places: An urban green infrastructure design framework for New South Wales. Sydney, Australia.

Grose MR (n.d.) Local Climate Profile: Launceston City Municipality, Hobart, Antarctic Climate & Ecosystems Cooperative Research Centre.

Hansen F, Barton D N, Venter Z S, Nowell M S, Cimburova Z (2021) Utilising LiDAR data to map tree canopy for urban ecosystem extent and condition accounts in Oslo. Ecological Indicators.

Hansen, A., Nitschke, M., Saniotis, A., Benson, J., Tan, Y., Smyth, V., Wilson, L., Han, G.S., Mwanri, L. and Bi, P., 2014. Extreme heat and cultural and linguistic minorities in Australia: perceptions of stakeholders. BMC Public Health.

Harrington, L.J., 2021. Rethinking extreme heat in a cool climate: A New Zealand case study. Environmental Research Letters.

Hartig T, Mitchell R, De Vries S, Frumkin H (2014) Nature and Health. Annual Review of Public Health.

Hartigan, M., Fitzsimons, J., Grenfell, M. and Kent, T., 2021. Developing a metropolitan-wide urban forest strategy for a large, expanding and densifying capital city: Lessons from Melbourne, Australia. Land.

Ho H C, Knudby A, Chi G, Aminipouri M, Lai D Y-F (2018) Spatiotemporal analysis of regional socio-economic vulnerability change associated with heat risks in Canada..

Ho H C, Knudby A, Huang W (2015) A Spatial Framework to Map Heat Health Risks at Multiple Scales. International Journal of Environmental Research and Public Health.

Holtan, M.T., Dieterlen, S.L. and Sullivan, W.C., 2015. Social life under cover: tree canopy and social capital in Baltimore, Maryland. Environment and Behavior, 47(5), 502-525.

Ignatieva, M., Meurk, C., van Roon, M., Simcock, R., & Stewart, G. (2008). How to put nature into our neighbourhoods : application of low impact urban design and development (LIUDD) principles, with a biodiversity focus, for New Zealand developers and homeowners. Manaaki Whenua Press.

Johnson D P, Wilson J S, Luber G C (2009) Socioeconomic indicators of heat-related health risk supplemented with remotely sensed data. International Journal of Health Geographics 2009.

Kashfi S A, Bunker, J M, Yigitcanlar T (2016) Modelling and analysing effects of complex seasonality and weather on an area's daily transit ridership rate. Journal of Transport Geography.

Kendal, D., Ordóñez, C., Davern, M., Fuller, R.A., Hochuli, D.F., van der Ree, R., Livesley, S.J. and Threlfall, C.G., (2022). Public satisfaction with urban trees and their management in Australia: the roles of values, beliefs, knowledge, and trust. Urban Forestry & Urban Greening.

Kirkpatrick, J.B., Davison, A. and Daniels, G.D., (2012). Resident attitudes towards trees influence the planting and removal of different types of trees in eastern Australian cities. Landscape and Urban Planning.

Kirkpatrick, J.B., Davison, A. and Daniels, G.D., (2013). Sinners, scapegoats or fashion victims? Understanding the deaths of trees in the green city. Geoforum.

Kirkpatrick, J.B., Davison, A. and Harwood, A., (2013). How tree professionals perceive trees and conflicts about trees in Australia's urban forest. Landscape and Urban Planning.

Koeser, A.K., Klein, R.W., Hasing, G. and Northrop, R.J., (2015). Factors driving professional and public urban tree risk perception. Urban Forestry & Urban Greening.

Koszowski C, Gerike R, Hubrich S, Götschi T, Pohle M, Wittwer R (2019) Active mobility: bringing together transport planning, urban planning, and public health. In: Müller, B., Meyer, G. (Eds.), Towards User-Centric Transport in Europe: Challenges, Solutions and Collaborations, Lecture Notes in Mobility. Springer International Publishing, Cham.

Kovats, R.S., Hajat, S. and Wilkinson, P., (2004). Contrasting patterns of mortality and hospital admissions during hot weather and heat waves in Greater London, UK. Occupational and Environmental Medicine.

KPMG (2021) Demystifying Natural Capital and Biodiversity.

Lachowycz K, Jones A P (2013) Towards a better understanding of the relationship between greenspace and health: Development of a theorical framework. Landscape and Urban Planning.

Landry F, Dupras J, Messier C (2020) Convergence of urban forest and socio-economic indicators of resilience: a study of environmental inequality in four major cities in Eastern Canada. Landscape and Urban Planning.

Langenheim N, White M, Tapper N, Livesley SJ, and Ramirez-Lovering D, 2020. Right tree, right place, right time: A visual-functional design approach to select and place trees for optimal shade benefit to commuting pedestrians. Sustainable Cities and Society.

Lanza K, Durand C P, (2021) Heat-Moderating Effects of Bus Stop Shelters and Tree Shade on Public Transport Ridership/ International Journal of Environmental Research and Public Health.

Lee, H. and Mayer, H., (2018). Maximum extent of human heat stress reduction on building areas due to urban greening. Urban Forestry & Urban Greening.

Leone M, D'Ippoliti D, De Sario M et al (2013) A time series study on the effects of heat on mortality and evaluation of heterogeneity inro European and Eastern-Southern Mediterranean cities: results of EU CIRCE project. Environmental Health.

Li, Zhao-Liang & Tang, Bohui & Wu, Hua & Yan, Guangjian & Wan, Zhengming & Trigo, Isabel & Sobrino, Jose. (2013). Satellite-Derived Land Surface Temperature: Current Status and Perspectives. Remote Sensing of Environment.

Lin, B., Meyers, J. and Barnett, G., 2015. Understanding the potential loss and inequities of green space distribution with urban densification. Urban Forestry & Urban Greening, 14(4).

Lin, J., Wang, Q. and Huang, B., 2021. Street trees and crime: What characteristics of trees and streetscapes matter. Urban Forestry & Urban Greening.

Lo AY, Byrne, JA and Jim CY. 2017. How climate change perception is reshaping attitudes towards the functional benefits of urban trees and green space: Lessons from Hong Kong. Urban Forestry & Urban Greening.

Lonsdale M, Fuller R (2014) Biodiversity Sciences And Solutions for Australia. Chapter 8 Cities and Towns. CSIRO.

Matthews, T., Lo, A.Y. and Byrne, J.A., 2015. Reconceptualizing green infrastructure for climate change adaptation: Barriers to adoption and drivers for uptake by spatial planners. Landscape and Urban Planning.

Maclaurin, J. & Sterelny, K. (2008). What Is Biodiversity?, Chicago: University of Chicago Press.

Marques, B., McIntosh, J., Hatton, W. & Shanahan, D. (2019). Bicultural landscapes and ecological restoration in the compact city: The case of Zealandia as a sustainable ecosanctuary. Journal of Landscape Architecture

Marselle, M.R., Bowler, D.E., Watzema, J., Eichenberg, D., Kirsten, T. and Bonn, A., (2020). Urban street tree biodiversity and antidepressant prescriptions. Scientific Reports.

McDonald, R.I., Kroeger, T., Zhang, P. and Hamel, P., (2020). The value of US urban tree cover for reducing heat-related health impacts and electricity consumption. Ecosystems, 23(1), 137-150.
Mckercher, B., 2020. Anatomy of successful tourism shopping districts. International Journal of Tourism Cities.

Mc Geehin M, Mirabelli M (2001) The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States. Environmental Health Perspectives.

McPherson E.G, Rowntree R., 1993. Energy Conservation Potential of Urban Tree planting. Journal of Arboriculture 19(6), 324.

Meyers J, Langston A, Devereux D and Lin BB (2020) Mapping land surface temperatures and heat-health vulnerability in Darwin. CSIRO, Australia.

Miao, C., Yu, S., Hu, Y., Liu, M., Yao, J., Zhang, Y., He, X. and Chen, W., 2021. Seasonal effects of street trees on particulate matter concentration in an urban street canyon. Sustainable Cities and Society.

Miao Q, Welch E W, Sriraj P (2019) Extreme weather, public transport ridership and moderating effect of bus stop shelters. Journal of Transport Geography.

Moore, T., Ridley, I., Strengers, Y., Maller, C. and Horne, R., 2017. Dwelling performance and adaptive summer comfort in low-income Australian households. Building Research & Information.

Ngo N S (2019) Urban bus ridership, income, and extreme weather events. Transportation Research Part D: Transport and Environment.

Norton, B.A., Coutts, A.M., Livesley, S.J., Harris, R.J., Hunter, A.M. and Williams, N.S., 2015. Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes. Landscape and Urban Planning.

Ordóñez, C., Threlfall, C.G., Livesley, S.J., Kendal, D., Fuller, R.A., Davern, M., van der Ree, R. and Hochuli, D.F., 2020. Decision-making of municipal urban forest managers through the lens of governance. Environmental Science & Policy.

Ordóñez-Barona, C., Bush, J., Hurley, J., Amati, M., Juhola, S., Frank, S., Ritchie, M., Clark, C., English, A., Hertzog, K. and Caffin, M., 2021. International approaches to protecting and retaining trees on private urban land. Journal of Environmental Management.

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

Park, C.E., Jeong, S., Harrington, L.J., Lee, M.I. and Zheng, C., 2020. Population ageing determines changes in heat vulnerability to future warming. Environmental Research Letters.

Parsons, P., Neale, R., Wolski, P. & Green, A. 1998, 'The shady side of solar protection', Medical Journal of Australia, 168: 327–to330.

Pearce L M , Kirkpatrick J B, and Davison A (2013) Using size class distributions of species to deduce the dynamics of the private urban forest. Arboriculture and urban forestry.

Phelan K, Hurley J, Bush J (2018) Land-use Planning's Role in Urban Forest Strategies: Recent Local Government Approaches in Australia. Urban Policy and Research.

Pomerantz, M. and Taha, H., 2001. Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar Energy.

Porter, L., Hurst, J. and Grandinetti, T., 2020. The politics of greening unceded lands in the settler city. Australian Geographer.

Renaissance Planning Pty Ltd. (2014) Greater Launceston Plan. Melbourne, Victoria.

Riedman, E., Roman, L.A., Pearsall, H., Maslin, M., Ifill, T. and Dentice, D., 2022. Why don't people plant trees? Uncovering barriers to participation in urban tree planting initiatives. Urban Forestry & Urban Greening.

Roman, L.A., Conway, T.M., Eisenman, T.S., Koeser, A.K., Ordóñez Barona, C., Locke, D.H., Jenerette, G.D., Östberg, J. and Vogt, J., (2021). Beyond 'trees are good': Disservices, management costs, and tradeoffs in urban forestry.

Rothman L, Buliung R, Howard A, Macarthur C, Macpherson A (2017) The school environment and student car drop-off at elementary schools. Travel Behaviour Sociology.

Roy S, Byrne J and Pickering C. (2012). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. Urban Forestry & Urban Greening.

Royal Commission into National Natural Disaster Arrangements (2020) Royal Commission into National Natural Disaster Arrangements Report. Commonwealth of Australia, Canberra.

Sangiorgio V, Fiorito F, Santamouris M (2020) Development of a holistic urban heat island evaluation methodology. Nature Research.

Saunders, A., Duncan, J., Hurley, J., Amati, M., Caccetta, P., Chia, J. and Boruff, B., (2020). Leaf my neighbourhood alone! Predicting the influence of densification on residential tree canopy cover in Perth. Landscape and Urban Planning.

Schinasy L H, Benmarhnia T, De Roos A J (2018) Modification of the association between high ambient temperature and health by urban microclimate indicators: a systematic review and meta-analysis. Environmental Research 161 (February), 168-180.

Schwaab J, Meier R, Musetti G, Seneviratne S, Burgi C, Davin L (2021) The role of urban trees in reducing land surface temperatures in European cities. Nature Communication 12, 6763 (2021).

Seebass K (2017) Who is feeling the heat? : vulnerabilities and exposures to heat stress-individual, social, and housing explanations. Nature and Culture.

Shanahan, D.F., Lin, B.B., Gaston, K.J., Bush, R. and Fuller, R.A., 2014. Socio-economic inequalities in access to nature on public and private lands: A case study from Brisbane, Australia. Landscape and Urban Planning.

Steffen W, Hughes L, Perkins S (2014) Heatwaves: hotter, longer, more often. Climate Council of Australia Limited.

Stover V W, McCormack, E D (2012) The impact of weather on bus ridership in Pierce County, Washington. Journal of Public Transportation.

Tong, S., Wang, X.Y., Yu, W., Chen, D. and Wang, X., 2014. The impact of heatwaves on mortality in Australia: a multicity study. BMJ Open.

Uchida, K., Blakey, R.V., Burger, J.R., Cooper, D.S., Niesner, C.A. & Blumstein, D.T. (2021). Urban Biodiversity and the Importance of Scale. Trends in Ecology & Evolution.

United Nations Environment Programme, Cool Coalition, RMI, Global Covenant of Mayors for Climate & Energy, Mission Innovation, Clean Cooling Collaborative (2022) Beating the heat: a sustainable cooling handbook for cities.

Vandentorren S, Bretin P, Zeghnoun A, Mandereau-Bruno L , Croisier A, Cochet C, Riberon J (2006) People living at home. European Journal of Public Health.

Veitch, J., Ball, K., Rivera, E., Loh, V., Deforche, B., Best, K. and Timperio, A., (2022). What entices older adults to parks? Identification of park features that encourage park visitation, physical activity, and social interaction. Landscape and Urban Planning.

Villanueva K, Badland H, Hooper P, Koohshari M J, Mavoa S, Davern M, Roberts R, Goldfield S, Giles-Corti B (2015) Developing indicators of public open space to promote health and wellbeing in communities. Applied Geography.

Webber, J.L., Fletcher, T.D., Cunningham, L., Fu, G., Butler, D. and Burns, M.J., (2020). Is green infrastructure a viable strategy for managing urban surface water flooding?. Urban Water Journal.

White CJ, Grose MR, Corney SP, Bennett JC, Holz GK, Sanabria LA, McInnes KL, Cechet RP, Gaynor SM & Bindoff NL (2010) Climate Futures of Tasmania: Extreme Events Technical Report., Hobart, Antarctic Climate & Ecosystems Cooperative Research Centre.

White J G, Antos, M J, Fitzsimons J A, Palmer G C (2005) Non-uniform bird assemblages in urban environments: The influence of streetscape vegetation. Lands. Urban Plan.

Wolch, J.R., Byrne, J. and Newell, J.P., (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. Landscape and Urban Planning.

Wolf, K.L., Lam, S.T., McKeen, J.K., Richardson, G.R., van den Bosch, M. and Bardekjian, A.C., (2020). Urban trees and human health: A scoping review. International Journal of Environmental Research and Public Health.

Wood, E M., & Esaian, S. (2020). The importance of street trees to urban avifauna. Ecological Applications

World Economic Forum (2022) The Global Risks Report 2021.

World Health Organisation (2016) Urban green spaces and health. Copenhagen: WHO Office for Europe.

Yan J, Zhou W, Han L, Quian Y (2018) Mapping vegetation functional types in urban areas with WorldView-2 imageries: Integrating object-based classification with phenology. Urban For. Urban Green.

Wong NH, Tas CL, Kolokotsa DD, and Takebayashi H (2021) Greenery as a mitigation and adaptation strategy to urban heat. Nature Reviews Earth & Environment.

Wood, E.M. and Esaian, S., (2020). The importance of street trees to urban avifauna. Ecological Applications

Yu W, Vaneckova P, Mengersen K, Pan X, Tong S (2010) Is the association between temperature and mortality modified by age, gender and socio-economics status? Scienced of the Total Environment.

Zhou M, Wang D, Li Q, Yue, Y, Tu W, Cao R (2017) Impacts of weather on public transport ridership: Results from mining data from different sources. Transportation Research Part C: Emergeing Technologies.

Zhou, D, Xiao J, Bonafoni S, Berger C, Deilami K, Zhou Y, Frolking S, Yao R, Qiao Z, Sobrino JA (2019) Satellite Remote Sensing of Surface Urban Heat Islands: Progress, Challenges, and Perspectives. Remote Sens.

Zuniga-Teran, A.A., Staddon, C., de Vito, L., Gerlak, A.K., Ward, S., Schoeman, Y., Hart, A. and Booth, G., (2020). Challenges of mainstreaming green infrastructure in built environment professions. Journal of Environmental Planning and Management.

Image: City of Launceston

Town Hall, 18 St John Street Launceston
T 03 6323 3000
E contactus@launceston.tas.gov.au
www.launceston.tas.gov.au

City of LAUNCESTON