TWEED
SHIRE COUNCIL

Cool Towns – Tweed Shire Urban Forest Program

Planting a healthy green future

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“The best time to plant a tree was 20 years ago. The second best time is right now.”
“The true meaning of life is to plant trees under whose shade, you do not expect to sit.”
Nelson Henderson

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Executive summary

The Tweed's natural landscape and biodiversity is of international significance and this program endeavours to bring the benefits of nature into the urban centres.

Trees in urban areas bring a multitude of benefits to the community, the environment and the economy and there is a growing body of evidence that support this.

- Trees in urban areas provide a **healthier environment** with cleaner air and filtered stormwater that results in better water quality in our waterways.
- Trees, shrubs and other plants provide important **habitat for wildlife**.
- Trees **store carbon** removing it from the atmosphere contributing to the war against climate change.
- Urban heat mapping highlights how urban trees result in **lowered temperatures**.
- Trees make urban streets **more attractive** while providing psychological benefits to the population in reducing stress, creating a **sense of wellbeing** in addition to providing spaces for relaxation and social interaction.
- Trees help make a healthy community **reducing sun exposure** and heat-related illness while **encouraging outdoor activity** and **active transport**.
- Residential streets with tree canopy have been found to have **higher property values**.
- Streetscape trees can be used to **strengthen the local economy** by making commercial areas more welcoming with research identifying improved consumer and investor behaviour on tree lined streets.

The economic benefits provide a business case for investing in urban trees. A Brisbane study found that residential areas where footpaths feature a 35% tree canopy cover were 'paying their way' through house sale price increases. The increases in rate revenue and stamp duty taxes were worth almost twice as much as was invested annually in street tree planting and maintenance by the local council (Plant et al., 2017). Additionally, data from computer applications like i-Tree have established a solid economic business case for the urban forest movements in cities around the world.

Urban Forestry is a term used to describe the care and management of trees within urban settings for the purpose of improving the urban environment and recognises the benefit urban trees provide.

The objective of this urban forest program is to increase and improve the amount and quality of tree canopy within urban areas of the Tweed and to obtain the optimal economic, environmental, public health and social benefits of trees over the coming decades. However, Council cannot achieve this alone. The program also involves creating a cultural change where trees in urban areas are recognised by Council and the community as a primary component of the urban fabric and are valued like all other infrastructure.

An audit of the tree canopy in urban areas has been undertaken to obtain a useful snapshot of the current landscape. The audit revealed that urban areas within the shire featured a tree canopy coverage of approximately 26.8%. The results of the audit provided a percentage measure to improve from and identified hot spots to be targeted. These results are to be used in conjunction with site assessments which include analysis of pedestrian traffic, land uses and site constraints.

The goal is to increase the average total canopy cover in urban areas from 26.8% to 35% by 2030 and then to 40% by 2040.

To reach this goal, a multi-faceted approach is proposed. Actions include community engagement to increase the community awareness, understanding and appreciation of the value and benefits of trees in urban areas.

This plan assesses and covers potential responses to any challenges that may prevent the Tweed reaching this goal, which include competition for urban space, prioritising trees in development and streetscape design, public safety, difficult growing conditions, bushfire, diseases and vegetation vandalism. Good planning is key to addressing many challenges and as such a review of relevant legislation, Council policy and protocols are proposed.

Further, the plan outlines Council's approach to caring for existing trees on public land with a 'no net loss' approach to any project. This is in addition to new tree planting projects and cultivating canopy growth. However, the community is needed in implementing planting and maintenance actions for on both private and public land. The community can help cultivate and protect trees in public spaces while creating their own green spaces on private land.

A whole of community approach is needed. Together we can cultivate more trees in the Tweed for future generations.

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Why grow an urban tree canopy?

1 Why grow an urban tree canopy?

1.1 Introduction

At its 19 September 2019 Council meeting, Tweed Shire Council declared a climate emergency that requires urgent action by all levels of government, including local councils.

Adapt NSW has projected that climate change could impact the Tweed in a range of ways including increased maximum and minimum temperatures, increased number of hot days, decreased number of cold nights, rainfall is projected to decrease in winter and increase in autumn and spring and an increase in severe fire weather days in summer and spring.

The North Coast Enabling Regional Adaptation Report by the NSW Office of Environment and Heritage (2019) outlines the likely vulnerability to climate change of the north-coast region and aims to stimulate action to plan adaptation.

The report outlines adaptation initiatives, which included coastal and flood risk management, natural resource management, and waste and energy management. Tree planting for urban cooling was identified within the report as one of the many adaptation initiatives that councils are undertaking.

At its meeting 24 October 2019, Council resolved to develop a program with the objective of increasing canopy cover within the shire, targeting hot spots. The initial phase of the program will build on existing tree planting projects. Council will then develop a longer-term program including community education and engagement programs, review of the assessment and approval process for new developments with reference to optimising tree canopy coverage.

1.2 Urban Forestry

'Urban Forestry' is a term used to describe the care and management of trees within urban settings for the purpose of improving the urban environment and recognises the benefit urban trees provide.

The modern Urban Forestry movement stemmed from research conducted by Erik Jorgensen at the University of Toronto, Canada in 1965. It started to gain momentum in the 1970s in the United States and gradually pervaded American urban policy. The Urban Forestry movement has expanded across the world. It reached the UK in the 1980s with the 'Forest of London' project with Scandinavian, European and Asian cities integrating the concept into projects and policies.

The Urban Forestry movement has initiated many programs including the Million Tree Initiative, which involves ongoing environmental programs across multiple cities aimed at increasing the urban forest through the planting of one million trees. Cities that are known to be currently involved in this initiative are: Los Angeles, Denver, New York City, Shanghai, London, Ontario, Amherst and New York.

In Australia, in 2003, the NSW Local Government Association Conference endorsed an Urban Forest Policy, which aims "*to improve urban forest planning, management and practices throughout NSW Local Government areas so that communities receive maximum benefit from their urban forest on all land, for an acceptable cost and in a manner based on the principles of Ecologically Sustainable Development (ESD)*". Since its adoption, many cities and local government areas have developed Urban Forest strategies or policies that enhances established vegetation management and urban design practices.

Although Urban Forestry in an Australian context is not yet extensively researched and evaluated, practices and programs are supported by research and literature from the US, Europe and Asia.

1.3 Biophilic principles

Biophilia is defined as 'Mankind's innate biological connection with nature; the urge to affiliate with other forms of life'.

Biophilic design is the process of basing decisions about the built environment on intuition or credible research – derived from either an affinity for nature or measurable biological responses, respectively – to achieve the best possible health outcomes. Biophilic design seeks to create good habitat for people as a biological organism in the modern built environment that advances people's health, fitness and wellbeing.

The successful application of biophilic design necessitates consistently adhering to certain basic principles. These principles represent fundamental conditions for the effective practice of biophilic design. They include:

- biophilic design requires repeated and sustained engagement with nature
- biophilic design focuses on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing
- biophilic design encourages an emotional attachment to particular settings and places
- biophilic design promotes positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for the human and natural communities
- biophilic design encourages mutual reinforcing, interconnected, and integrated architectural solutions.

References:

Kellert, S. and Calabrese E. 2015. *The Practice of Biophilic Design*. www.biophilic-design.com

link.springer.com/referenceworkentry/10.1007%2F978-1-0716-0684-1_1034

Ryan C.O., Browning W.D. (2020) *Biophilic Design*. In: Loftness V. (eds) Sustainable Built Environments. Encyclopedia of Sustainability Science and Technology Series. Springer, New York, NY. https://doi.org/10.1007/978-1-0716-0684-1_1034

1.4 Objective

The objective of this program is to increase and improve the amount and quality of tree canopy within urban areas of the Tweed and to obtain the optimal economic, environmental, public health and social benefits of trees over the next 50 years.

The tree canopy subject to this program consists of all trees and vegetation located within urban areas irrespective of the tree species, location (park, streetscape, backyard) or land ownership (public, private, institutional). The focus and priority of the program is the expansion of tree canopy within urban areas.

From just trees to 'green infrastructure'

Tree canopy in urban areas is internationally recognised as a significant community asset that warrants protection and growth and is essential to a liveable community.

This program advances the perspective of trees from an 'optional burden' to being considered as 'green infrastructure'.

Unlike traditional 'grey' infrastructure such as roads or water or sewer systems, which depreciate immediately from installation, green infrastructure accrues value with time providing ongoing benefits for many decades.

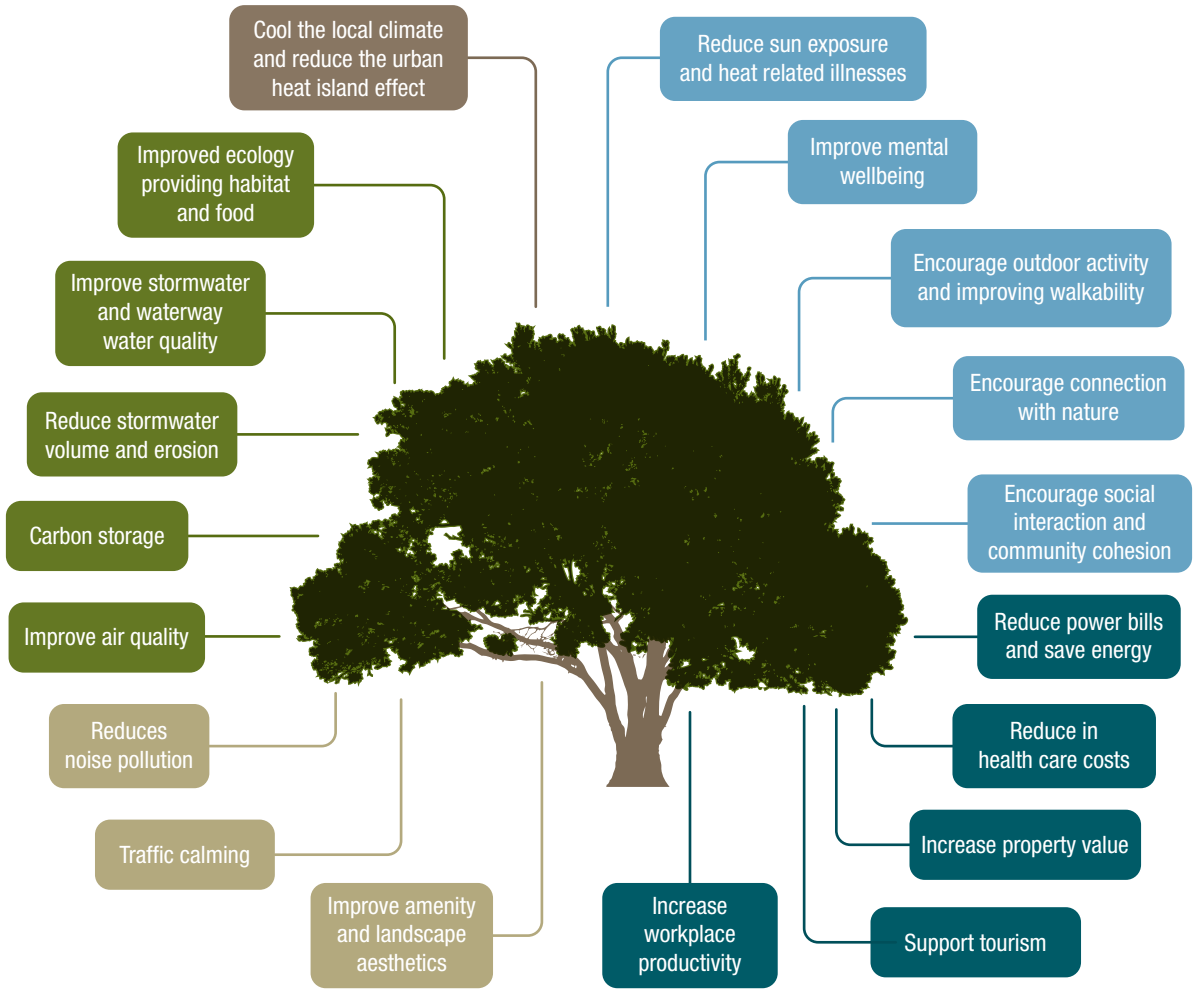
A change in perspective of what trees are, their importance and the role they play is required. An example of this change is summarised overleaf:

From traditional tree management	To green infrastructure model
Trees are optional ornaments	Trees are necessary infrastructure
Trees as individuals	Green infrastructure network comprising a collective tree canopy
Trees are not prioritised	Green infrastructure is prioritised just like other grey infrastructure
Trees are a liability to be maintained	Green infrastructure is an asset to be managed

Green infrastructure provides important ecological and social functions that translate into tangible benefits that span many areas including health, social interactions, ecology, water and air quality, climate and economy.

This program intends to utilise a wide range of tools, including planning and regulatory mechanisms, investment in planting and renewal, incentivisation, education and environmental research and reporting. Both public and private lands are included.

1.5 Benefits of urban tree canopy



Summary of the broad array of benefits offered by urban trees.

Urban tree canopy provides benefits to the amenity of the area, environment, local climate, economy and to social and public health outcomes. The public has long perceived these benefits however now there is an extensive body of research that supports this.

Following is a high-level overview of the benefits of urban trees and vegetation.

1.5.1 Amenity benefits

Landscape benefits

Trees offer aesthetic beautify to our community, provide shade, reduce glare, soften the built environment and screen unwanted views. Trees provide seasonal variety and natural beauty through foliage, flowers, bark and fruit.

Reduction in noise pollution

Trees contribute to reducing noise pollution by absorbing and blocking urban noise, which can reduce stress for people in the area. Vegetation planted along main roads can form a small sound buffer that reduces traffic noise to adjoining residences.

Traffic management

Trees play an important role in creating calm, safe street environments for both motor vehicles and pedestrians. Trees can be used to provide a clear delineation between vehicle and pedestrian spaces, provide a cue for motorists to reduce speed in areas of high pedestrian activity while providing shade to parking spaces.

1.5.2 Environmental benefits

Trees absorb water, nutrients and carbon dioxide and provide cleaner air, improved soils, shade and habitat. Following is an overview of environmental benefits of the urban forest.

Improved air quality

Trees remove carbon dioxide from the atmosphere through photosynthesis and return oxygen back to the atmosphere.

Trees can absorb airborne pollutants including ozone, carbon monoxide, nitrogen dioxide and suspended particles for storage in their branches and roots. Street trees have a particular role because of their proximity to the source of vehicle emissions.

Trees reduces smog. Smog is formed when air pollutants such as nitrogen oxides (NOx) and volatile organic compounds (VOCs) are mixed with sunlight and heat. The rate of the chemical reaction increases with higher temperatures. Trees reduce the generation of photochemical smog through both absorbing airborne pollutants and reducing temperatures from shade.

Carbon storage and reduction

Carbon dioxide (CO_2) is a greenhouse gas because it traps heat near the earth's surface, contributing to observed and predicted climate change. Human activities, including the burning of fossil fuels and destruction of natural forests, are greatly increasing the level of CO_2 in the atmosphere. Trees remove CO_2 from the atmosphere through the process of photosynthesis and store the carbon in their leaves, branches, stems, bark and roots.

Further, carbon reduction occurs through energy savings from reduced cooling requirements due to both shading of buildings and urban heat island reduction.

People are encouraged to walk, cycle or catch public transport rather than drive if the commute features street trees offering more shaded and aesthetically appealing streetscapes. This results in a reduction in carbon emission from car use.

Stormwater management and waterway water quality

Impervious surfaces such as roofs, roads and concrete pavements have had major effects on urban hydrology where the volume and speed of stormwater runoff is increased, which could lead to local flooding and greater erosion. Pollutants from buildings or road surfaces are flushed directly into waterways. Also, heat from the impervious surfaces increases the temperature of runoff water. This creates water quality challenges when large volumes of heated, polluted stormwater flows into waterways creating nutrient imbalances and impacting biodiversity, providing conditions for algal blooms.

Trees can significantly moderate environmental impacts

Runoff is intercepted, stored and absorbed by leaves, branch surfaces, trunk bark and soil, reducing runoff volumes and slowing the speed of runoff therefore reducing local flooding. Also, root growth and decomposition increase the capacity of soil infiltration further reducing overland flow.

Trees offering shade to impervious surfaces minimise the heat transfer to water runoff.

Vegetation helps stabilise soil and therefore prevents erosion.

Soil microbes and vegetation play a direct role in filtering stormwater through bioretention. This process involves the removal of contaminants and sedimentation from stormwater, which can be then either stored or metabolised within various parts of the tree.

Ecology

Trees can contribute to improving the Tweed's ecology by:

- providing habitat and food for birds, animals and insects
- providing habitat corridors (smaller areas of remnant bushland or areas with significant canopy cover are important in enabling certain wildlife to move through an urban area, connecting with natural habitat outside the urban area and reducing fragmentation of natural ecosystems.)
- contributing to maintaining the genetic diversity of species
- supporting endangered species by planting and managing for a high level of biodiversity, which may, at times, exceed that of surrounding natural or rural areas.

1.5.3 Climate improvement and reducing urban heat island effect

The 'urban heat island effect' is localised warming in urban areas due to:

- the large amounts of hard surfaces like paving or concrete, which more readily absorb and store heat when compared to vegetation
- the large amounts of heat-absorbing, solid dark coloured surfaces like roads, large buildings or carparks
- human heat production (for example from car engines or air conditioners).

Urban areas create their own microclimates and become warmer than nearby regional areas, particularly at night. After a hot day, urban areas can be several degrees hotter than surrounding rural areas. This temperature increase impacts local flora and fauna, air quality and public health.

Vegetation and trees in particular improve the local climate and reduce the urban heat island effect by:

- shading heat-absorbing surfaces like west-facing masonry walls, shading hard dark surfaces, shading of windows and air conditioning units
- providing tree shade and the transfer of water from plants into the air contribute to cooling of the local environment
- providing shade over footpaths and pedestrian zones, which reduces exposure to ultraviolet (UV) radiation, which is an important public health issue due to the high incidence of skin cancers in Australia
- providing shelter from the wind.

1.5.4 Public health and social benefits

There is increasing evidence of the physical, mental and social health benefits of trees. The health and social benefits to the community include:

Reducing heat related illnesses

The presence of mature trees in urban areas helps reduce local temperatures and reduce the urban heat island effect, which contributes to a reduction in heat-related illness like heat stroke or dehydration where children, the elderly or those unwell are particularly susceptible to in summer.

Higher temperatures can negatively impact air quality aggravating respiratory issues such as asthma.

Heat stress has been linked to increased rates in domestic violence.

Reducing sun exposure

Sun exposure contributes to the prevalence of skin cancer and other illnesses. The natural shade from trees provide protection from UV radiation from the sun.

Improving mental wellbeing

A growing body of evidence supports wellbeing is positively influenced by proximity to, access to or views of trees or green open spaces.

Trees in urban areas have been found to improve mental and general health contributing to create a sense of wellbeing.

Being outdoors and among trees can have a restorative effect, which can assist people in their recovery from stress, illness and injury.

Studies have shown that green spaces can be therapeutic for children encouraging creativity of mind, exploration and adventure, promoting physical activity, resilience building and enhanced experiential learning.

Views of vegetation from workplaces has been found to contribute to improved employee wellbeing and productivity.

Encouraging outdoor activity and improving walkability

In 2017–18, the Australian Bureau of Statistics' National Health Survey found that 67% of Australian adults are overweight or obese. Physical activity contributes to improved physical and mental health and helps reduce lifestyle related illnesses including obesity.

Landscaped parks and gardens provide settings for physical activity or nature based recreation. Trees and vegetation make parks, gardens and streets more welcoming, encouraging the community to make use of open spaces, and experience the benefits of an active lifestyle.

Residential or community gardens encourage gardening as an active recreational pursuit.

Providing a tree lined streets or footpaths encourage people to choose active modes of transport like walking or cycling.

Encouraging connection with nature

Nature based recreation and tourism is a growing trend and one of the Tweed's primary assets.

Complementing the stunning natural environment on show across the Tweed, the presence of vegetation in urban areas encourages nature appreciation and people's connection with nature with opportunities to learn about the natural environment.

Encourage social interaction

Landscaped areas provide social settings and encourage people to interact more with others, bringing opportunities to improve social connections.

Improving community cohesion

Landscaped areas provide settings for community events or celebrations important in bringing the community together in the public realm.

There is evidence that urban areas with more trees experience lower crime rates.

Creation of local identity

Trees and vegetation can physically define a place, provide orientation and contribute to an area's character, supporting civic pride, which can cultivate a positive community identity.

Landscaped areas are the setting for many everyday recreational activities such as walking the dog or having a picnic. The presence of trees contributes to developing a sense of connection to place.

Cultural heritage

Council is proud to acknowledge that we are located on and share the traditional lands of the Bundjalung nation. The program contributes to improved stewardship of the natural environment and can contribute to the concept of 'caring for country'.

1.5.5 Economic benefits

Economic benefits can be quantified across many disciplines including health, tourism, engineering, sustainability and real estate.

Given most decisions regarding infrastructure (green and built) are based on economic cost benefit analysis, solid data in this regard is valuable. Computer applications like i-Tree have been developed to value the economic benefits of trees in cities across the world. However, these programs are yet to be collaborated for Tweed specific conditions. An Australian example is North Sydney Council who reported their results from using urban forest modelling software (i-Tree) in calculating the benefit value provided by the North Sydney street tree population. Street tree audit data from 2014 showed a total of 17,214 street trees with the following values:

- structural (replacement) value of $546 million (an average of $31,000/street tree)
- value of carbon currently stored in street trees is $1.75 million
- annual net benefits of $3.73 million (pollution removal, avoided stormwater runoff, carbon sequestration and energy/carbon emission savings).

Data from systems like these have established a solid economic business case for the urban forest movements in cities in Australia, USA, Canada and Europe. A Brisbane study[1] found that residential areas where footpaths feature a 35% tree canopy cover were 'paying their way' through house sale price increases. The increases in annual council rate revenue and state stamp duty taxes were found to be worth almost twice as much as what was being invested annually in street tree planting and maintenance by the local council. Some of the economic benefits of trees within urban areas include:

Trees increase property value

Residential streets that are tree lined have been found to increase property values by between 5% and 30%.

Consumer and investor behaviour

Trees have been found to enhance economic stability by attracting businesses.

Research has shown that consumer behaviour is positively associated with the urban forest and that trees can be used to strengthen local economies[2].

Trees contribute to the attractiveness of an urban area, influencing public perceptions of a town's image and status. This is increasingly important for maintaining economic competitiveness, particularly for attracting labour and investment to sectors such as tourism and creative industries.

1 Plant, L., A. Rambaldi and N. Sipe (2017). *Evaluating Revealed Preferences for Street Tree Cover Targets: A Business Case for Collaborative Investment in Leafier Streetscapes in Brisbane, Australia*. Ecological Economics 134: 238-249

2 Wolf, K. L. (2005). *Trees in the small city retail business district: Comparing resident and visitor perceptions*. Journal of Forestry 103(8): 390-395

Supporting tourism

Tourism is an important part of the Tweed economy. Tweed tourism marketing is centred on the shire's internationally significant natural landscape including the beaches, national parks and waterways.

Continuing the valued natural character into urban centres would create attractive settings bringing more tourists (and economic benefits) into towns and villages.

Reduce power bills and save energy

Trees near buildings can reduce the demand for heating and cooling as much as 15%, which results in lower power bills (and less carbon emissions).

Deciduous trees planted on the north side of buildings will provide shade in summer and make way for sunlight in winter.

Reduction in health care costs

Outlined above, there is evidence of the benefits to public health and wellbeing linked to the presence of mature trees in urban areas and green open space. As such, research suggests the improved health and wellbeing of the population results a reduction in public health care costs.

A reduction in health care costs could be associated with reduced sedentary behaviour, obesity, mental illness and quicker hospital patient recovery times.

Minimising infrastructure damage and renewal

Trees that offer significant shade improve the lifespan of various assets such as asphalt by providing protection from UV radiation for example.

The canopies and root systems of mature trees also help reduce local flooding impacts to assets during extreme events by reducing or slowing stormwater flows into drainage infrastructure.

There is potential for some negative impacts arising from leaves clogging drains or roots impacting stormwater pipes, footpaths and roads. This generally results from legacy planting where inappropriate species were selected or landscape designs does not meet current best practice. Future tree selection and landscape design will mitigate these negative impacts and then the overall benefit provided by the trees far outweighs these less frequent issues.

Workplace productivity

Office workers with a view of vegetation have been found to have greater job satisfaction and productivity with less sick leave taken.

Food products

Backyard or rooftop gardens provide opportunities for food production.

1.6 Strategic context – Relationship to other plans and policies

This program is consistent with the following strategies and policies, which is outlined below:

- Tweed Shire Open Space Strategy
- Urban Forest Policy – NSW Local Government Association
- NSW Premier's Priorities
- North Coast Regional Plan 2036
- Tweed Shire Council Community Strategic Plan 2017–2027
- The Tweed Vegetation Management Strategy 2004
- Tweed Shire Roadside Vegetation Management Plan 2013
- Vegetation Vandalism on Public Land 2016 – Council Policy

1.6.1 Tweed Shire Open Space Strategy

The Tweed Shire *Open Space Strategy 2019–2029* (OSS) establishes the following vision:

> *The Tweed Shire is recognised for its diverse network of quality open spaces that meet the needs of a healthy and active community, whilst protecting our rich natural and cultural heritage for future generations.*

The OSS supports this vision with guiding principles and strategic outcomes in determining the priorities, strategies and action of Council and its partners to deliver an open space network that is socially, environmentally, culturally and economically sustainable.

Developing an urban forest program forms part of the priorities and actions within the OSS. Developing an urban forest program will contribute to the priority of ensuring environmental sustainability and develop resilience to the impacts of climate change. The OSS details the following:

> *We will develop an Urban Street Tree Planting Program to increase the tree canopy in our urban areas. Protecting significant trees, improving canopy cover, ensuring the right tree is planted in the right place and making provisions for community horticulture are key priorities. Priority locations for street tree planting will include arterial roads, along shared paths, in civic spaces, urban residential streets, in parks, foreshore reserves and over playgrounds. The provision of natural shade is highly valued by the community, to improve user comfort, safety and amenity. All future open space improvement programs will enhance opportunities for natural shade from trees.*

This new approach will require a change in Council's focus, from a reactive approach where resources are expended in managing risk, replacing vandalised trees or based on community requests, to a more proactive asset management approach with a focus on broader management and maintenance of the urban forest – on a life cycle basis, similar to the way Council manages its built assets. The program will require additional financial investment, so we will investigate external funding and community volunteer partnership opportunities. A more holistic approach to tree planting across the Shire's urban landscape will maximise the capacity of Tweed's urban forest to deliver ecological, economic, social and aesthetic benefits to both present and future generations. We will also aim to develop a greater public knowledge of the benefits of street trees.

Aligned strategies and actions include the following:

Increase the extent of the tree canopy to create an urban forest

- Review existing tree coverage and the provision of natural shade in highly utilised parks and open spaces, and over playgrounds.
- Develop and monitor an Urban Street Tree Planting Program to increase tree planting where there are limited trees or where trees are in decline and require replacing. Priority locations include along arterial roads, shared paths, in civic spaces, in urban residential streets with minimal tree coverage, in highly utilised parks, foreshore reserves and over playgrounds.
- Integrate the objectives of the proposed Urban Street Tree Planting Program with Council's structure planning, master planning and infrastructure delivery programs to maximise opportunities for street tree planting.
- Maximise opportunities to create habitat nesting places for birds and mammals by making artificial hollows or enlarging old ones in older or dead trees. This approach will be considered in context of Council's risk management framework for trees on public land.
- Review the Tweed DCP Section A5 – Subdivision Manual and the Development Design Specification D14 Landscaping to reflect best practice landscaping and street tree management. Investigate opportunities to review the design of streets, where appropriate, to widen verges to create more space for street trees.
- Monitor the compliance of consent conditions around the planting and protection of street trees.
- When upgrading existing or developing new parks and open spaces and in new residential developments, select local indigenous plantings to enhance ecological values and reflect original landscape character (in accordance with Council's plant selection guidelines for landscaping public open space and the Native Species Planting Guide).
- Ensure the protection of remnant indigenous vegetation (including single remnant mature indigenous trees) within new residential developments in accordance with the relevant planning documents.
- Select tree species that will reach maturity and provide adequate shade without compromising other assets and property in the immediate vicinity. Utilise, where appropriate, root barriers and other technologies to prevent damage to infrastructure.
- Continue to implement a routine pruning and maintenance program to provide regular maintenance of Tweed Shire's street trees.

- Increase community's awareness and knowledge of Tweed Shire's urban forest, its ecological processes, the benefits it provides and their role in its management. Use events such as National Tree Day, Living for the Future Home Expo and World Environment Day as opportunities to build community capacity.
- Replace vandalised trees (where practical) and increase the community's awareness of vegetation vandalism.

Other consistent strategies and actions related to this program include:

- Create a connected open space network of greenways, blueways (waterways) and incorporate the street network:
  - Enhance streetscapes along pathways that link key open spaces, activity centres and community facilities to delineate connections.
- Plan, design and manage a network of sustainable open spaces:
  - Maximise funding streams that help build our open space system's resilience to climate change e.g. funding programs that protect river and coastal foreshores and funding programs for street tree planting.
  - Increase awareness of the role of open spaces in the mitigation and adaptation to climate change, particularly in urban areas. Continue to implement a routine pruning and maintenance program to provide regular maintenance of Tweed Shire's street trees.

1.6.2 Urban Forest Policy: NSW Local Government Association

Urban forest has been acknowledged at the State level by the NSW Local Government Association, which adopted an Urban Forest Policy in November 2003. The policy defines urban forest as:

> *The totality of trees and shrubs on all public and private land in and around urban areas (including bushland, parkland, gardens and street trees) and is measured as a canopy cover percentage of the total area, and is recognised as a primary component of the urban ecosystem.*

The Policy recommends an integrated inter-governmental approach facilitating a planned, systematic and integrated framework to manage trees within an urban forest structure. The Policy recommended that its member councils:

a) Recognise the urban forest as a community asset with values and costs that will maximise the benefits to the community if managed holistically in a strategic and systematic manner.
b) Recognise the arboricultural industry and support best practice tree planting and maintenance.
c) Integrate tree management expertise with civil design and construction and strategic planning.
d) Adopt the urban forest principles identified in this policy.

1.6.3 Premier's Priorities

Premier Priorities outline the government's key policies focused on enhancing the quality of life of the people of NSW. Two priorities directly relevant to the program are:

- Greener Public Spaces – Increase the proportion of homes in urban areas within 10 minutes' walk of quality green, open and public space by 10 per cent by 2023
- Greening Our City – Increase the tree canopy and green cover across Greater Sydney by planting one million trees by 2022 and five million trees by 2030.

The NSW Government states the importance of Greener Public Spaces:

> *Quality green, open and public space is for everyone – these spaces include parks, green spaces, plazas, libraries, streets, landscapes, museums, and public transport. Great public spaces that delight communities are especially important in growing cities and towns.*
>
> *Walkable, connected and accessible public spaces promote healthier lifestyles and bring people together. A network of welcoming and connected public spaces will create communities where people love to live.*

The NSW Government states the importance of Greening Our City:

> *Trees play an important role in creating great open spaces for communities, enhancing the experience of outdoor recreation and exercise. Green canopy enhances the amenity of local parks and streets and is crucial in providing vital shade that reduces ambient temperatures and mitigates the urban heat island effect.*
>
> *Trees improve local character and enhance property values. They extend habitat, increasing the biodiversity of cities serving as a home for animals and birds. Air quality is improved by removing fine particles from the air and trees mitigate the impact of climate change, acting as a storehouse for carbon dioxide.*

1.6.4 North Coast Regional Plan 2036

The North Coast Regional Plan 2036 is a 20-year blueprint for the future of the North Coast. The NSW Government's vision for the North Coast is to create the best region in Australia to live, work and play thanks to its spectacular environment and vibrant communities. To achieve this vision the government has set four goals for the region with aligning Directions and Actions:

1. the most stunning environment in NSW
2. a thriving, interconnected economy
3. vibrant and engaged communities
4. great housing choice and lifestyle options.

This program is considered to be consistent with Goal 1, Direction 3 is to *manage natural hazards and climate change*. The Plan states:

> *Thermal and energy-efficient buildings, greenways and stormwater re-use should be incorporated into the design of developments and subdivisions to create resilient environments for the future.*

Further toward achieving Goal 3 for vibrant and engaged communities, Action 15.1 is to deliver best-practice guidelines for planning, designing and developing healthy built environments that respond to the ageing demographic and subtropical climate. A primary objective of this program is to create a healthier urban environment.

1.6.5 Tweed Shire Council Community Strategic Plan 2017–2027

Tweed's *Community Strategic Plan 2017–2027* (CSP) represents the highest level of strategic planning undertaken by a local government. It outlines Council's roles and services and nominates goals, strategies/actions and targets for each service stream. This program will contribute to the fulfilment of several goals and targets within this plan including:

- 1.1 Natural resource management
- 1.2 Asset protection
- 2.1 Built environment
- 3.1 People
- 3.2 Places

1.6.6 Tweed Vegetation Management Strategy 2004

The Tweed Vegetation Management Strategy 2004 addressed vegetation across the shire in both rural and urban areas. The strategy provided a detailed assessment and analysis of vegetation across the shire. It also provided a Management and Rehabilitation framework, setting out Guiding Principles and Priorities, which included existing bushland, potential habitat areas, species-based recovery, management of threatening processes and education, planning, monitoring and research. Most of these actions are not focused on urban areas, which this program provides for.

1.6.7 Tweed Shire Roadside Vegetation Management Plan 2013

Tweed Shire Roadside Vegetation Management Plan 2013 outlines best practice management guidelines for areas of remnant native vegetation and individual species within road reserves.

The plan focuses on rural roads identification and protection of:

- native vegetation of high conservation significance, including Endangered Ecological Communities (EECs), other mature native vegetation in good condition and fauna habitat
- threatened flora species
- features of cultural significance.

1.6.8 Vegetation Vandalism on Public Land Policy 2016

The purpose of this policy is to promote a consistent shire wide approach to the protection and management of vegetation. This Policy is considered to support the objectives of this program.

1.6.9 Tree Management Guidelines for Council Managed Land 2010

The objective of the Tree Management Guidelines was for the management of trees in a safe, effective and efficient manner to provide maximum aesthetic, physical and psychological benefits to the community. The guidelines provided a framework for the management and maintenance of the Shire's street roadside and other trees to deliver positive outcomes in a fair and consistent manner for our community. These guidelines only apply to Council managed land and as such have informed this program.

These guidelines have been reviewed and are to be updated with the Tree Management Protocol, which is Appendix A of this document.

1.7 Natural Resource and Land Management Legislation

This program not only seeks to comply with the relevant legislation; it endeavours to add green infrastructure and mature trees into the urban fabric and aim towards best practice. The program seeks to both utilise existing legislative frameworks in addition to setting Council's standards for land management practices.

In addition to the abovementioned strategies and policies, this program is supported by the following natural resource and land management legislation and policy:

- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *Local Government Act 1993*
- *Crown Land Management Act 2016*
- *Coastal Management Act 2016*

The *Biodiversity Conservation Act 2016* focuses on avoiding, minimising and offsetting the impacts of proposed development and land use change on biodiversity specifically. This program focuses on greening the urban areas, which hopes to build on the outcomes from this Act.

The *Crown Land Management Act 2016* and *Local Government Act 1993* outline how Council is to manage Council owned or managed land. Plans of management are required to be adopted for community land and land is to be managed in accordance with these. This program is designed to support the desired outcomes within existing and proposed plans of management. The proposed programs are permitted under the plans of management.

The *Environmental Planning and Assessment Act 1979* (EP&A Act) regulates development through State Environmental Planning Policies (SEPPs), Local Environmental Plans (LEPs) and Development Control Plans (DCPs). The following summarises how the EP&A Act works regulating different situations involving vegetation removal or planting requirements in urban areas:

- **Vegetation removal associated with developments subject to a Development Application (DA)**

  Vegetation removal is a matter for consideration for the DA assessment. SEPPs and DCPs apply vegetation removal restrictions or landscaping requirements to developments. Conditions of consent maybe applied to restrict or compensate for proposed vegetation removal or ensure landscaping outcomes are achieved.
- **Vegetation removal associated with developments that are exempt or complying development**

  SEPPs and DCPs regulating exempt or complying developments include controls related to vegetation removal, which may include the requirement for a permit.
- **Vegetation removal associated with developments that are permitted without consent**

  This situation generally occurs in association with minor works by Council or other government agencies. Council is required to undertake a review of environmental factors prior to undertaking works and may propose offsetting, mitigation measures or landscape embellishment.
- **Vegetation removal not associated with development**

  A SEPP and Section A16 of Tweed DCP include controls that regulate non-development related vegetation removal, which in certain circumstances includes the requirement for a permit from Council.
- **Vegetation offsetting or protections on title**

  DA approvals can include conditions of consent that enact offsetting provisions of the Biodiversity Conservation Act 2016 or apply covenants on titles by way of a section 88B instrument under the Conveyancing Act, which can regulate vegetation management.

Relevant policies empowered under the *Environmental Planning and Assessment Act 1979* include SEPP (Vegetation in Non-Rural Areas) 2017, Tweed Local Environmental Plans, Tweed DCP – Section A16 – Preservation of Trees or Vegetation and Section A19 – Biodiversity and Habitat Management.

2
The plan – objective and goals

2 The plan – objective and goals

2.1 Program overview

The objective of this program is to increase and improve the amount and quality of tree canopy within urban areas of the Tweed and to obtain the optimal economic, environmental, public health and social benefits of trees over the next 30 years.

The tree canopy subject to this program consists of all trees and vegetation located within urban areas; irrespective of the tree species, location (park, streetscape, backyard) or land ownership (public, private, institutional).

The focus and priority of the program is the expansion of healthy tree canopy within urban areas.

The goals of the program are:

Value green assets

To increase awareness of the value and importance of tree canopy in urban areas of the Tweed and to manage trees in urban areas as an integral and essential component of urban infrastructure.

Grow more tree canopy

To strengthen and expand Tweed's urban tree canopy to maximise the environmental, economic, social and public health benefits of trees in urban areas to both present and future generations;

Plan together

To strategically plan and collaborate between Council units, government agencies and landowners to effectively manage trees within the urban areas of the Tweed.

Plant together

To cultivate community awareness, understanding and appreciation of trees in the urban setting and engage the community as active partners in the expansion of tree canopy within the urban areas of the Shire.

2.2 Value green assets

To increase awareness of the value and importance of tree canopy in urban areas of the Tweed and to manage trees in urban areas as an integral and essential component of urban infrastructure.

A goal of this program is to facilitate cultural change and to adjust how people see and value trees in urban areas from demanding ornaments to an integral and valuable factor of the urban fabric. A change in perspective is required as summarised below, which recognises the value and importance of trees and the significant benefits they provide.

From traditional tree management	To green infrastructure model
Trees are optional ornaments	Trees are necessary infrastructure
Trees as individuals	Green infrastructure network comprising a collective tree canopy
Trees are not prioritised	Green infrastructure is prioritised just like other grey infrastructure
Trees are a liability to be maintained	Green infrastructure is an asset to be managed

The following highlights how valuing trees collectively makes a difference:

- **Private landowners, residents and tenants**
  From family homes to commercial developments; trees on private land need to be planted and maintained to be enjoyed.
- **Developers and builders**
  From single houses to subdivisions creating new suburbs; new developments are the future homes and workplaces of the Tweed so they need to be designed to include the space and nurturing conditions for mature trees. From driveway and utility placement that caters for street trees through to backyard design that breaks up the hard-pavement with space for a garden and mature trees. Trees need to be valued and provided for.
- **Engineers and planners**
  When planning for development works, future tree canopy and providing conditions for healthy trees need to be included as a primary matter for consideration alongside water, sewer, stormwater and electricity. This applies to works on private land and public land including the road reserve. Trees are easily excluded in developments when their value isn't recognised.
- **Public institutions or public asset managers**
  From NSW Government departments to maintenance contractors; From schools to Council. Anyone who is responsible for land or asset maintenance is needed to value and prioritise trees. From decision making for future upgrade works through to ongoing tree management, recognition of the value and importance of trees results in making trees a priority.
- **All members of the community**
  When the community recognises the importance of trees in urban areas, everyone can do their bit. For example, by participating in community street tree planting days; by looking after trees in the road reserve out the front of your property; by not harming trees in public places or by not arranging for the removal of an otherwise healthy tree in your backyard only because it drops leaves.

  If the community from individuals to business chambers or residents' associations, are able to recognise the value and benefits of green infrastructure and trees in urban areas, the rest of the program's goals are easily achieved.

2.3 Grow more tree canopy

To strengthen and expand Tweed's urban tree canopy to maximise the environmental, economic, social and public health benefits of trees in urban areas to both present and future generations.

Growing more tree canopy involves:

- managing our existing trees to be healthy so they keep growing
- planting more trees and cultivating their canopy growth.

An audit of the tree canopy in urban areas has been undertaken, which is detailed in section 3. The tree canopy audit revealed that approximately 4.7% of the Tweed Shire is considered to be urban area and approximately 26.8% of urban areas across the shire feature tree canopy coverage higher than 3m. Tree canopy coverage varied between suburbs and between land management types and it is noted that the audit did not include larger areas of vegetation adjacent to urban areas.

While the area of urban tree canopy is to be used as a generic baseline measure. Further, Urban Heat mapping was also generated for the north east section of the shire, which features most of the urban development. This mapping highlights the impact on surface temperature urban development has when compared to nearby vegetated areas.

The goal is to increase the average total canopy cover in urban areas from 26.8% to 35% by 2030, and then to 40% by 2040.

International agencies, state governments and other Councils have set targets in the range of 25% to 50% as the ideal overall tree canopy cover to maximise benefits to the community. Target rates and how they are measured vary. For example, they may vary in tree heights included or can encompass the entire local government area and not just urban areas. Some set targets for different land use zonings or different land tenures.

Tweed is located within a subtropical climate, which supports vegetation growth when compared to many other Australian, American and European cities who also endeavour to achieve these targets.

Reaching the target tree canopy cover is a challenging yet achievable target, which requires resources and a strategic approach with actions that vary with the land tenure and site constraints.

Actions for Council managed land

Council is committed to a significant increase in tree planting efforts on its own land in streets and parks.

For public land comprising Council Managed Crown land and Council owned land, actions include:

- Protect and manage existing trees including tree health and soil conditions in accordance with Council's *Tree Management Protocol* (see appendix A) and Council's *Guidelines for Road Reserve Vegetation in Urban Areas* (see Appendix B).
- No net loss. Where trees are removed, they will be replaced.
- Integrate street trees where possible into grey infrastructure projects, park upgrades or streetscape upgrades.
- New planting projects.

New Council planting projects

New planting projects will be prioritised in accordance with the following criteria:

- How many members of the public will benefit? Considering shade or visual impact for example. High use areas are targeted.
- Is the site exposed to the urban heat island effect? Hot spots are targeted.
- What is the likelihood that the project will create tree canopy? Is it a challenged site featuring poor soil conditions or are single trees too exposed and will struggle?

Decision making related to new planting projects or existing tree management, other desired outcomes include:

- To plant the largest canopy growing and longest lived species of tree possible for appropriate to the site.
- To improve the age spread of trees.
- To enhance strategic canopy linkages between areas of remnant bushland.
- To manage urban trees in a manner that maintains tree risk at an acceptable level.

Tree Management Protocol

Council's aim is to plant species of trees that are the largest-canopy-growing and longest-lived species possible for the given growing conditions and site constraints taking into consideration such issues as soils, climate, physical access, existing vegetation, heritage, character/aesthetics, scenic views and solar access. Council's *Tree Management Protocol* (see Appendix A) outlines tree management considerations to achieve this goal while address risk management and hazard abatement strategies.

Guidelines for Road Reserve Vegetation in Urban Areas.

Roadside nature strips are generally Council land and are important to the streetscape and can be the perfect site for vegetation. However, this area of road reserve is a common site for land use conflict given the area is important for pedestrian and vehicle access, visibility and safety and generally contains underground and overhead infrastructure including water, sewer, stormwater, electricity and telecommunications. These factors need to be considered with any vegetation plantings.

As this area is Council land, any planting undertaken by the community in these areas requires Council approval not only to make sure that Australian Standards relevant to pedestrian and vehicle safety and access are met, but to ensure species planted are appropriate for any infrastructure in the area and the proposal is the best outcome for the area in achieve the desired outcomes for this program.

Unfortunately, historically Council has had to remove well intentioned plantings from the road reserve as the species choice was not appropriate or the design did not facilitate other requirements of the space.

The aim of these guidelines is to ensure that the community that wish to plant vegetation in the road reserve do so addressing the requirements of the space while contributing to the success of this program.

See Appendix B for *Road Reserve Vegetation in Urban Areas Policy* and Appendix C for Council's *Guidelines for Road Reserve Vegetation in Urban Areas*.

Vegetation vandalism

An unfortunate issue is that wilful damage to trees in public spaces can destroy years of cultivation efforts and cannot be immediately repaired with a coat of paint or a day of reconstruction works. Therefore, prevention of vegetation vandalism is vital. However, if trees are damaged, Council's Policy on *Vegetation Vandalism on Public Land 2016* outlines Council's response to vandalism or unauthorised removal of existing vegetation. See Appendix D for this Policy.

Non-Council tree management

Council alone cannot create this vision. Council can provide controls within the existing legislative framework and encourage other parties to protect and cultivate trees on both public and private land however the success of this program requires active participation by the community as outlined later.

2.4 Plan together

To strategically plan and collaborate between Council units, government agencies and landowners to effectively manage trees within the urban areas of the Tweed.

Like any type of infrastructure, tree maintenance and cultivation requires planning. The need for good planning is reinforced by the nature of the challenges outlined in section 3.6.

Challenges include competition for urban space, prioritising trees in development and streetscape design, leaf litter, public safety and legal liability, difficult growing conditions and climate events, pests and diseases, vandalism and theft, bushfire risk, budget constraints, community expectation and resistance to change.

As trees and tree canopy take time to grow, it may require 10 to 20 years to achieve a significant increase in canopy cover hence the importance of developing a comprehensive long-term strategy.

Planning actions include:

- review Tweed Development Control Plan 2008 with regard to:
  - vegetation removal controls and permit requirements to protect existing trees
  - landscaping and streetscaping controls and specifications within residential, commercial and subdivision developments to ensure future developments provide for future urban tree canopy
- review Council protocols and procedures regarding Council works to ensure operations across Council are in alignment with the objectives of this program
- review Council policy regarding regulation and compliance of vegetation vandalism or unauthorised removal
- ensure consistent language with state, regional local planning documents
- develop partnerships with NSW Government agencies e.g. NSW Health or NSW Department of Education, in coordinating aligned initiatives
- support community groups in the tree canopy cultivation projects including existing and new groups e.g. Youth Council, Landcare.

Legislation alone cannot create this vision, but it can contribute by deterring inconsistent behaviour and ensure people with an alternative focus do not undermine the actions undertaken by the proactive program participants. A summary of the legislative and policy framework is provided in sections 1.6 and 1.7.

The NSW Government including National Parks and Wildlife Service, Crown Lands and Department of Education currently manages land within the shire. Council will seek to work in partnership with those agencies in order to establish urban tree canopy cover and prevent canopy removal from those sites.

2.5 Plant together

To cultivate community awareness, understanding and appreciation of trees in the urban areas and engage the community as active partners in the expansion of tree canopy within the urban areas of the Shire.

Council alone cannot create this vision.

The community is needed in implementing planting and maintenance actions for on private and public land. The community can help cultivate and protect trees in public spaces while creating their own green spaces on private land.

Partnerships are needed with other government agencies and community groups to support and build upon actions undertaken under this program and promote enhanced greening of land under their management.

Actions include:

- **Educate:** To increase the community awareness, understanding and appreciation of the value and benefits of trees in urban areas.
- **Engage:** To engage the community including other government agencies and community groups as active partners in the planting, cultivation, management and protection of trees in urban areas.
- **Encourage:** To provide incentives for private landowners and residents to contribute to the urban green spaces.
- **Enjoy and celebrate:** To recognise private landowners or community members who contribute to urban green spaces and enjoy the benefits.

Community engagement will include:

- informing, consulting or involving the community on planting projects being undertaken
- fact sheets or participation kits, for example outlining the benefits of trees, road reserve planting guidelines or tree maintenance and care support materials
- promotion of greening events and workshops, for example community street tree planting days
- promotion of greening initiatives and competitions.

Council will encourage the community to anonymously report any theft of or damage to trees on public land.

3
Where we begin – urban tree canopy audit

3 Where we begin – urban tree canopy audit

An audit of the tree canopy in urban areas has been undertaken to obtain a snapshot of the presence of tree canopy within the current urban landscape. The current urban landscape reflects historical trends in development, planning controls, landscaping practices and climate events.

The audit involved identifying urban areas across the shire then identified vegetation greater than three metres. The percentage of the urban area with tree canopy coverage was calculated.

The results of the urban tree canopy audit not only provided a percentage measure to improve from, but also identified hot spots or localised areas, which did not reflect the amount of canopy across the rest of the suburb. The results outlined below give an overall snapshot however, these results are to be used in conjunction with site assessments, which include analysis of pedestrian traffic, land uses and constraints.

Tree canopy coverage varied between suburbs and between land management types and it is noted that the audit did not include larger areas of vegetation adjacent to urban areas.

In addition to the urban tree canopy audit, urban heat mapping was generated for the north east section of the shire, which features most of the urban development. This mapping although low resolution, has highlighted the impact on surface temperature urban development has when compared to nearby vegetated areas.

How did we go?

The tree canopy audit revealed that approximately 26.8% of the urban areas across the shire feature tree canopy coverage higher than 3m. Approximately 4.7% of the Tweed Shire is considered to be urban area.

A review was undertaken of similar tree canopy and urban heat assessments of other local government areas around Australia.

International agencies, state governments and other Councils have set tree canopy coverage targets in the range of 25% to 50% as the ideal overall tree canopy cover to maximise benefits to the community depending on what parameters were used.

Parameters of the measurements varied between Councils regarding, for example, what tree heights were included, or the land use types included. Some set different targets for different land use zonings or different land tenures.

3.1 Methodology

The scope of the urban area under assessment was determined by land use zoning under the Local Environmental Plans and whether the areas are developed or proposed for development. The scope generally follows lot boundaries and excludes larger waterways. Of note is that the Tweed Shire features protected natural landscape in proximity to urban areas. The audit generally did not include these within the assessment.

Within these urban areas, Council's LiDAR data was utilised, which identified vegetation greater than three metres in height to a resolution of 1m^2. Polygons were then generated to measure the areas via Council's GIS mapping system. The percentage of the urban area that featured tree canopy coverage was calculated.

LiDAR is a method for measuring distances by illuminating a target with laser and measuring the reflection with a sensor. Differences in laser return times and wavelengths are used to make digital 3-D representations of the target. LiDAR is commonly used to make high-resolution maps.

Statistics were then collated against various land management types (also known as land tenures). *Council managed land* includes Council owned Community land and Operational land, Council Managed Crown land and Crown land devolved to Council. *Other government owned land* (non-Council) includes State managed Crown Land and NSW Department of Education for example. Freehold land means privately owned.

Map showing the urban areas and tree canopy coverage at a Tweed Shire scale – indicative only.

3.2 Tree canopy cover audit – points to note

Some questions to consider when interpreting the results include:

- What will be the most effective actions in each area to create the greatest impact on the tree canopy coverage for that area?
- What are the common land uses and development types of the area and how do they that impact the prevalence of tree canopy?
- What historical trends in development, planning controls, landscaping practices and climate events that may have created the current urban landscape in each area.
- Are there any factors preventing trees being planted or surviving?

The audit of tree canopy in urban areas offers a snapshot of the presence of tree canopy within the current urban landscape. Attempting to measure tree canopy is not a simple task and therefore even with the use of LiDAR technology, the data obtained is approximate. Nonetheless, the audit offers a useful snapshot of urban tree canopy coverage that can be compared with in future reassessments.

Also, it is noted that the mapping shown in this report is indicative only given the detailed resolution provided by the LiDAR data in the mapping system when compared to line thicknesses of the maps generated.

Land management types were highlighted as a variable for investigation. This is because any plan to increase the amount of the tree canopy in an area needs to consider who owns/manages the land (and the trees) and therefore what approaches will be most effective.

An example of this is where it is noted that Kingscliff and Casuarina have a relatively low tree canopy coverage of 19.5% and 23.4% respectively. A substantial difference is noted between land management types where freehold land features 10.7–12.8% coverage while there is 32–50% coverage of Council managed land. Additionally, a high percentage (48–50%) of Kingscliff and Casuarina is freehold therefore, it can be recommended that a focus should be to encourage private land holders to plan for, plant and cultivate trees. This approach would have a greater impact than solely relying on Council to create the change in the neighbourhood as Council managed land already features a higher tree canopy coverage amount.

Conversely, in Fingal Head or Tyalgum village, freehold land features around 40.8% canopy coverage with a relatively high percentage of the areas under that type of management (42.3–45.6%). Council managed land comprises of 10–20.5% of the areas and displays quite a substantially lower tree canopy coverage of 25.8% and 17.6% respectively. Therefore, an important approach to these areas improving their suburb wide tree canopy coverage would be to assess the existing land uses of the Council managed land and identify tree planting opportunities.

It is noted that variability within suburbs needs to be identified. Tweed Heads South is a good example of this. Tweed Heads South features areas of very low tree canopy coverage. However, the suburb wide statistic does not reflect this due to the golf course's relatively high canopy coverage and other localised areas of greater tree density. Further, the urban heat mapping highlights how areas lacking tree canopy suffer from temperature increases in summer and as such, the most effective way for the community to benefit from changes urban tree canopy offers would be to target these areas.

It is noted that newer subdivisions generally do not feature the tree canopy of established subdivisions. This could reflect the lack of integration of tree planting within new developments or that following subdivision earthworks, there hasn't been sufficient time for new trees to grow to the measured 3m height. If an established subdivision or area does not feature much urban vegetation, it needs to be investigated why this is the case. For example, whether it be due to poor planning of infrastructure location, protection of view corridors or the lack of landscaping planning controls in place at the time of the developments.

3.3 Tree canopy cover audit results

The following provides a summary of the results from the tree canopy audit and highlights the tree canopy coverage differences between suburbs and land management types.

3.3.1 Across the Tweed Shire

- There is approximately 6,253ha of urban area in the Tweed Shire (4.74% of the shire) and with a tree canopy coverage of 26.8% within the urban area.
- Of the urban area in the shire, 14.4% is Council managed land. This Council managed land features 39.5% tree canopy coverage.
- Of the urban area in the shire, 22.9% is road reserve. This road reserve area features 23.5% tree canopy coverage.
- Of the urban area in the shire, 8.4% is other government owned land (non-Council). This government owned land features 35.2% tree canopy coverage.
- Of the urban area in the shire, 54.0% is freehold (privately owned). This freehold land features 23.4% tree canopy coverage.

Therefore generally, Council managed land and other Government owned land has a higher tree canopy coverage than freehold land and road reserve.

3.3.2 Suburb by suburb

Tweed Heads

- Approximately 78.1% of Tweed Heads is urban area and has a tree canopy coverage of 19.8% within the urban area.
- Of the urban area in Tweed Heads, 13.0% is Council managed land. This Council managed land features 39.1% tree canopy coverage.
- Of the urban area in Tweed Heads, 24.3% is road reserve. This road reserve area features 18.7% tree canopy coverage.
- Of the urban area in Tweed Heads, 4.8% is other government owned land (non-Council). This government owned land features 18.6% tree canopy coverage.
- Of the urban area in Tweed Heads, 57.6% is freehold (privately owned). This freehold land features 15.8% tree canopy coverage.

Therefore, Tweed Heads has a relatively low tree canopy cover with all land types reflecting this except for Council managed.

Indicative Tree Canopy Audit mapping – Tweed Heads.

Tweed Heads South

- Approximately 60.3% of Tweed Heads South is urban area and has a tree canopy coverage of 28.2% within the urban area.
- Of the urban area in Tweed Heads South, 16.9% is Council managed land. This Council managed land features 47.1% tree canopy coverage.
- Of the urban area in Tweed Heads South, 19.2% is road reserve. This road reserve area features 26.8% tree canopy coverage.
- Of the urban area in Tweed Heads South, 6.0% is other government owned land (non-Council). This government owned land features 18.2% tree canopy coverage.
- Of the urban area in Tweed Heads South, 57.3% is freehold (privately owned). This freehold land features 24.1% tree canopy coverage.

Tweed Heads South as a suburb has a tree canopy cover similar to the shire average. However, Tweed Heads South includes areas of low tree canopy and areas of greater. It's the areas of low tree canopy cover that is noted on the urban heat mapping as being the most pronounced with regard to increases in land temperatures reflective of the development patterns.

Indicative Tree Canopy Audit mapping – a section of Tweed Heads South.

Tweed Heads West

- Approximately 50.2% of Tweed Heads West is urban area and has a tree canopy coverage of 36.8% within the urban area.
- Of the urban area in Tweed Heads West, 10.0% is Council managed land. This Council managed land features 61.0% tree canopy coverage.
- Of the urban area in Tweed Heads West, 16.3% is road reserve. This road reserve area features 29.8% tree canopy coverage.
- Of the urban area in Tweed Heads West, 38.0% is other government owned land (non-Council). This government owned land features 40.0% tree canopy coverage.
- Of the urban area in Tweed Heads West, 35.6% is freehold (privately owned). This freehold land features 29.7% tree canopy coverage.

Indicative Tree Canopy Audit mapping – a section of Tweed Heads West.

Banora Point

- Approximately 68.4% of Banora Point is urban area and has a tree canopy coverage of 21.7% within the urban area.
- Of the urban area in Banora Point, 9.1% is Council managed land. This Council managed land features 45.4% tree canopy coverage.
- Of the urban area in Banora Point, 20.0% is road reserve. This road reserve area features 17.5% tree canopy coverage.
- Of the urban area in Banora Point, 5.5% is other government owned land (non-Council). This government owned land features 40.6% tree canopy coverage.
- Of the urban area in Banora Point, 65.4% is freehold (privately owned). This freehold land features 18.1% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Banora Point and surrounds.

Fingal Head

- Approximately 10.7% of Fingal Head is urban area and has a tree canopy coverage of 35.8% within the urban area.
- Of the urban area in Fingal Head, 20.5% is Council managed land. This Council managed land features 25.8% tree canopy coverage.
- Of the urban area in Fingal Head, 35.0% is road reserve. This road reserve area features 35.3% tree canopy coverage.
- Of the urban area in Fingal Head, 2.0% is other government owned land (non-Council). This government owned land features 34.5% tree canopy coverage.
- Of the urban area in Fingal Head, 42.32% is freehold (privately owned). This freehold land features 40.9% tree canopy coverage.

Indicative Tree Canopy Audit mapping – a section of Fingal Head.

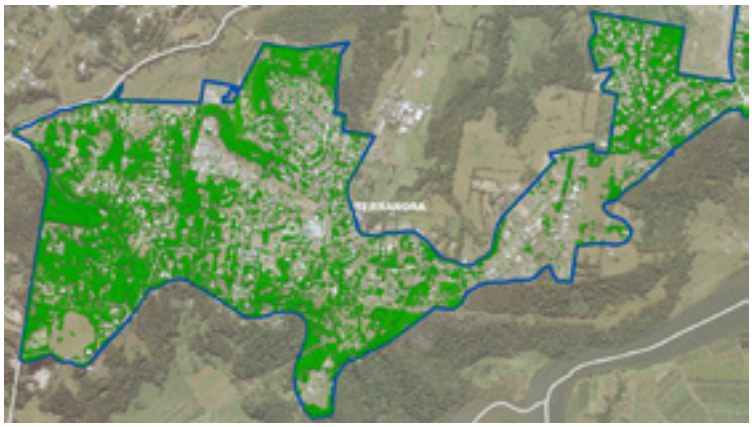
Bilambil and Bilambil Heights

- Approximately 11.6% of Bilambil and Bilambil Heights is urban area and has a tree canopy coverage of 37.5% within the urban area.
- Of the urban area in Bilambil and Bilambil Heights, 15.9% is Council managed land. This Council managed land features 40.2% tree canopy coverage.
- Of the urban area in Bilambil and Bilambil Heights, 19.8% is road reserve. This road reserve area features 35.8% tree canopy coverage.
- Of the urban area in Bilambil and Bilambil Heights, 1.0% is other government owned land (non-Council). This government owned land features 33.9% tree canopy coverage.
- Of the urban area in Bilambil and Bilambil Heights, 63.6% is freehold (privately owned). This freehold land features 37.5% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Bilambil and Bilambil Heights.

Terranora

- Approximately 30.9% of Terranora is urban area and has a tree canopy coverage of 37.8% within the urban area.
- Of the urban area in Terranora, 5.0% is Council managed land. This Council managed land features 50.3% tree canopy coverage.
- Of the urban area in Terranora, 13.0% is road reserve. This road reserve area features 30.9% tree canopy coverage.
- Of the urban area in Terranora, 3.3% is other government owned land (non-Council). This government owned land features 40.9% tree canopy coverage.
- Of the urban area in Terranora, 78.7% is freehold (privately owned).This freehold land features 37.9% tree canopy coverage.



Indicative Tree Canopy Audit mapping – Terranora.

Chinderah

- Approximately 20.0% of Chinderah is urban area and has a tree canopy coverage of 29.9% within the urban area.
- Of the urban area in Chinderah, 5.1% is Council managed land. This Council managed land features 32.1% tree canopy coverage.
- Of the urban area in Chinderah, 38.0% is road reserve. This road reserve area features 28.9% tree canopy coverage.
- Of the urban area in Chinderah, 2.6% is other government owned land (non-Council). This government owned land features 52.47% tree canopy coverage.
- Of the urban area in Chinderah, 54.1 % is freehold (privately owned). This freehold land features 29.2% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Chinderah.

Kingscliff

- Approximately 66.5% of Kingscliff is urban area and has a tree canopy coverage of 19.5% within the urban area.
- Of the urban area in Kingscliff, 23.5% is Council managed land. This Council managed land features 32.3% tree canopy coverage.
- Of the urban area in Kingscliff, 18.3% is road reserve. This road reserve area features 11.3% tree canopy coverage.
- Of the urban area in Kingscliff, 9.3% is other government owned land (non-Council). This government owned land features 34.5% tree canopy coverage.
- Of the urban area in Kingscliff, 48.0% is freehold (privately owned). This freehold land features 12.9% tree canopy coverage.

Cudgen

- Approximately 5.8% of Cudgen is urban area and has a tree canopy coverage of 18.2% within the urban area.
- Of the urban area in Cudgen, 4.2% is Council managed land. This Council managed land features 24.7% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Cudgen and Kingscliff.

- Of the urban area in Cudgen, 18.7% is road reserve. This road reserve area features 23.2% tree canopy coverage.
- Of the urban area in Cudgen, 28.7% is other government owned land (non-Council). This government owned land features 14.9% tree canopy coverage.
- Of the urban area in Cudgen, 48.4% is freehold (privately owned). This freehold land features 17.7% tree canopy coverage.

Casuarina

- Approximately 57.5% of Casuarina is urban area and has a tree canopy coverage of 23.4% within the urban area.
- Of the urban area in Casuarina, 28.2% is Council managed land. This Council managed land features 50.4% tree canopy coverage.
- Of the urban area in Casuarina, 21.9% is road reserve. This road reserve area features 17.4% tree canopy coverage.
- Of the urban area in Casuarina, there is no other government owned land (non-Council).
- Of the urban area in Casuarina, 49.8% is freehold (privately owned). This freehold land features 10.8% tree canopy coverage.

The tree canopy coverage of the Council managed beachside shared pathway is a good example of a highly utilised area that is well shaded and highlights how the canopy cover goals are achievable. However, Casuarina freehold land could be improved. This could be a sign of how the suburb is relatively newly developed however now is the time to establish the landscaping for the suburb, which features mature trees.

Indicative Tree Canopy Audit mapping – Casuarina and Kingscliff.

Cabarita Beach/Bogangar

- Approximately 21.3% of Cabarita Beach/Bogangar is urban area and has a tree canopy coverage of 27.2% within the urban area.
- Of the urban area in Cabarita Beach/ Bogangar, 16.4% is Council managed land. This Council managed land features 36.4% tree canopy coverage.
- Of the urban area in Cabarita Beach/ Bogangar, 25.7% is road reserve. This road reserve area features 24.9% tree canopy coverage.
- Of the urban area in Cabarita Beach/ Bogangar, 9.3% is other government owned land (non-Council). This government owned land features 29.7% tree canopy coverage.
- Of the urban area in Cabarita Beach/ Bogangar, 48.6% is freehold (privately owned). This freehold land features 24.9% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Cabarita Beach/Bogangar.

Hastings Point

- Approximately 27.7% of Hastings Point is urban area and has a tree canopy coverage of 29.1% within the urban area.
- Of the urban area in Hastings Point, 30.5% is Council managed land. This Council managed land features 35.6% tree canopy coverage.
- Of the urban area in Hastings Point, 10.7% is road reserve. This road reserve area features 25.9% tree canopy coverage.
- Of the urban area in Hastings Point, 5.6% is other government owned land (non-Council). This government owned land features 59.9% tree canopy coverage.
- Of the urban area in Hastings Point, 52.2% is freehold (privately owned). This freehold land features 22.5% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Hastings Point.

Pottsville

- Approximately 29.0% of Pottsville is urban area and has a tree canopy coverage of 21.4% within the urban area.
- Of the urban area in Pottsville, 25.4% is Council managed land. This Council managed land features 37.4% tree canopy coverage.
- Of the urban area in Pottsville, 19.3% is road reserve. This road reserve area features 15.5% tree canopy coverage.
- Of the urban area in Pottsville, 2.7% is other government owned land (non-Council). This government owned land features 65.1% tree canopy coverage.
- Of the urban area in Pottsville, 51.4% is freehold (privately owned). This freehold land features 12.9% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Pottsville.

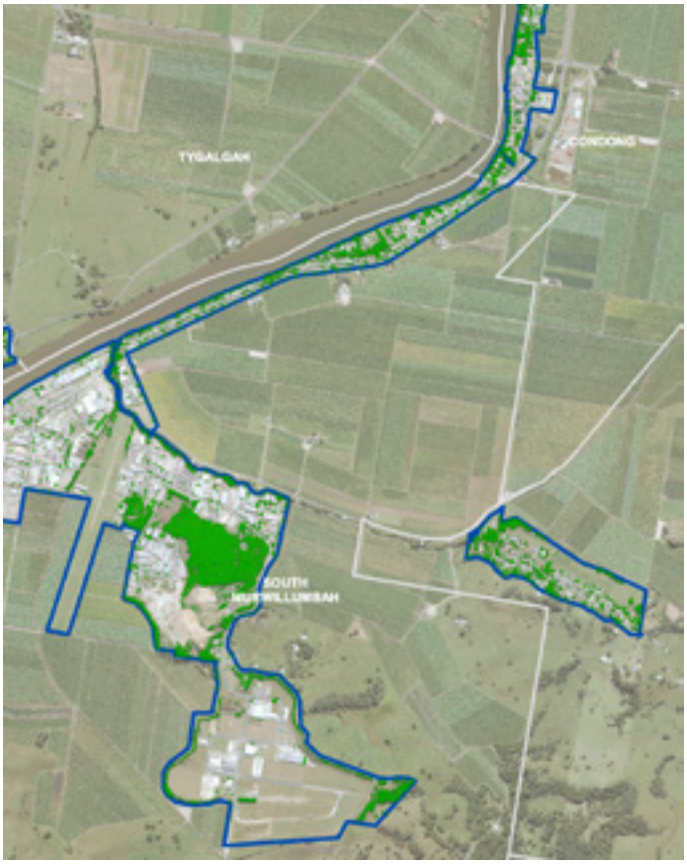
Tumbulgum

- Approximately 2.5% of Tumbulgum is urban area and has a tree canopy coverage of 29.4% within the urban area.
- Of the urban area in Tumbulgum, 11.6% is Council managed land. This Council managed land 30.6% tree canopy coverage.
- Of the urban area in Tumbulgum, 29.1% is road reserve. This road reserve area features 27.1% tree canopy coverage.
- Of the urban area in Tumbulgum, 5.4% is other government owned land (non-Council). This government owned land features 46.3% tree canopy coverage.
- Of the urban area in Tumbulgum, 54.0% is freehold (privately owned). This freehold land features 28.8% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Tumbulgum.

Condong

- Approximately 6.7% of Condong is urban area and has a tree canopy coverage of 23.3% within the urban area.
- Of the urban area in Condong, 9.2% is Council managed land. This Council managed land features 27.6% tree canopy coverage.
- Of the urban area in Condong, 20.3% is road reserve. This road reserve area features 14.2% tree canopy coverage.
- Of the urban area in Condong, 4.8% is other government owned land (non-Council). This government owned land features 38.8% tree canopy coverage.
- Of the urban area in Condong, 65.8% is freehold (privately owned). This freehold land features 24.4% tree canopy coverage.



Indicative Tree Canopy Audit mapping – Parts of Condong, Kielvale and South Murwillumbah.

Kielvale

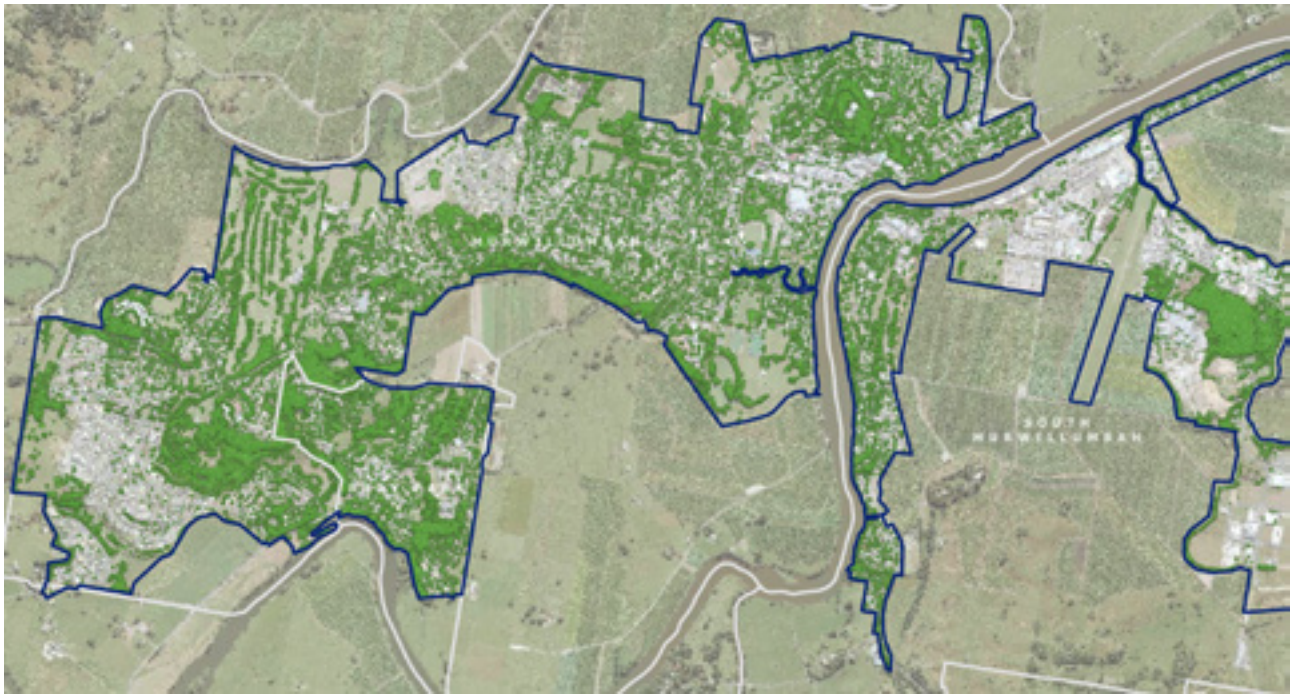
- Approximately 2.6% of Kielvale is urban area and has a tree canopy coverage of 21.5% within the urban area.
- Of the urban area in Kielvale, 0.8% is Council managed land. This Council managed land features 65.7% tree canopy coverage.
- Of the urban area in Kielvale, 12.9% is road reserve. This road reserve area features 31.3% tree canopy coverage.
- Of the urban area in Kielvale, there is no is other government owned land (non-Council).
- Of the urban area in Kielvale, 86.3% is freehold (privately owned). This freehold land features 19.7% tree canopy coverage.

South Murwillumbah

- Approximately 23.5% of South Murwillumbah is urban area and has a tree canopy coverage of 17.9% within the urban area.
- Of the urban area in South Murwillumbah, 28.6% is Council managed land. This Council managed land features 24.5% tree canopy coverage.
- Of the urban area in South Murwillumbah, 17.3% is road reserve. This road reserve area features 21.1% tree canopy coverage.
- Of the urban area in South Murwillumbah, 4.9% is other government owned land (non-Council). This government owned land features 22.4% tree canopy coverage.
- Of the urban area in South Murwillumbah, 49.2% is freehold (privately owned). This freehold land features 12.5% tree canopy coverage.

Murwillumbah and Bray Park

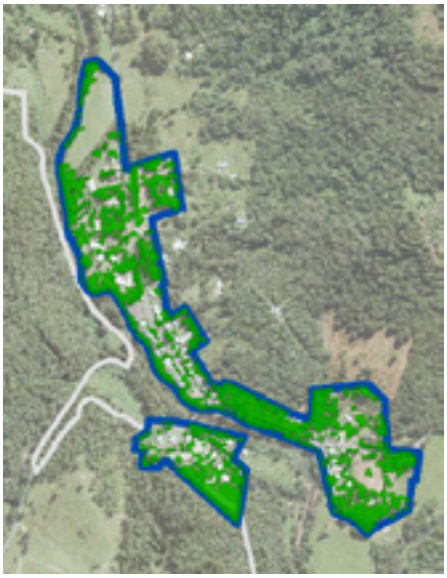
- Approximately 50.5% of Murwillumbah and Bray Park is urban area and has a tree canopy coverage of 23.2% within the urban area.
- Of the urban area in Murwillumbah and Bray Park, 17.5% is Council managed land. This Council managed land features 31.7% tree canopy coverage.
- Of the urban area in Murwillumbah and Bray Park, 17.4% is road reserve. This road reserve area features 21.3% tree canopy coverage.
- Of the urban area in Murwillumbah and Bray Park, 7.8% is other government owned land (non-Council). This government owned land features 28.4% tree canopy coverage.
- Of the urban area in Murwillumbah and Bray Park, 57.2% is freehold (privately owned). This freehold land features 20.5% tree canopy coverage.



Indicative Tree Canopy Audit mapping – Murwillumbah, Bray Park and a section of South Murwillumbah.

Chillingham Village

- Approximately 1.4% of Chillingham Village is urban area and has a tree canopy coverage of 44.5% within the urban area.
- Of the urban area in Chillingham Village, 18.4% is Council managed land. This Council managed land features 32.5% tree canopy coverage.
- Of the urban area in Chillingham Village, 14.0% is road reserve. This road reserve area features 43.5% tree canopy coverage.
- Of the urban area in Chillingham Village, 3.0% is other government owned land (non-Council). This government owned land features 40.9% tree canopy coverage.
- Of the urban area in Chillingham Village, 64.6% is freehold (privately owned). This freehold land features 48.3% tree canopy coverage.



Indicative Tree Canopy Audit mapping – Chillingham Village.

Tyalgum Village

- Approximately 0.98% of Tyalgum Village is urban area and has a tree canopy coverage of 33.5% within the urban area.
- Of the urban area in Tyalgum Village, 10.1% is Council managed land. This Council managed land features 17.6% tree canopy coverage.
- Of the urban area in Tyalgum Village, 17.3% is road reserve. This road reserve area features 32.9% tree canopy coverage.
- Of the urban area in Tyalgum Village, 27.0% is other government owned land (non-Council). This government owned land features 27.8% tree canopy coverage.
- Of the urban area in Tyalgum Village, 45.6% is freehold (privately owned). This freehold land features 40.8% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Tyalgum Village.

Uki

- Approximately 2.6% of Uki is urban area and has a tree canopy coverage of 58.1% within the urban area.
- Of the urban area in Uki, 22.6% is Council managed land. This Council managed land features 55.3% tree canopy coverage.
- Of the urban area in Uki, 25.0% is road reserve. This road reserve area features 57.9% tree canopy coverage.
- Of the urban area in Uki, 7.1% is other government owned land (non-Council). This government owned land features 72.3% tree canopy coverage.
- Of the urban area in Uki, 44.9% is freehold (privately owned). This freehold land features 57.0% tree canopy coverage.

Indicative Tree Canopy Audit mapping – Uki.

Stokers Siding

- Approximately 0.16% of Stokers Siding is urban area and has
  a tree canopy coverage of 48.0% within the urban area.
- Of the urban area in Stokers Siding, 2.8% is Council managed land. This Council managed land features 29.7% tree canopy coverage.
- Of the urban area in Stokers Siding, 4.0% is road reserve. This road reserve area features 25.4% tree canopy coverage.
- Of the urban area in Stokers Siding, 17.3% is other government owned land (non-Council). This government owned land features 48.2% tree canopy coverage.
- Of the urban area in Stokers Siding, 76.3% is freehold (privately owned). This freehold land features 49.7% tree canopy coverage.

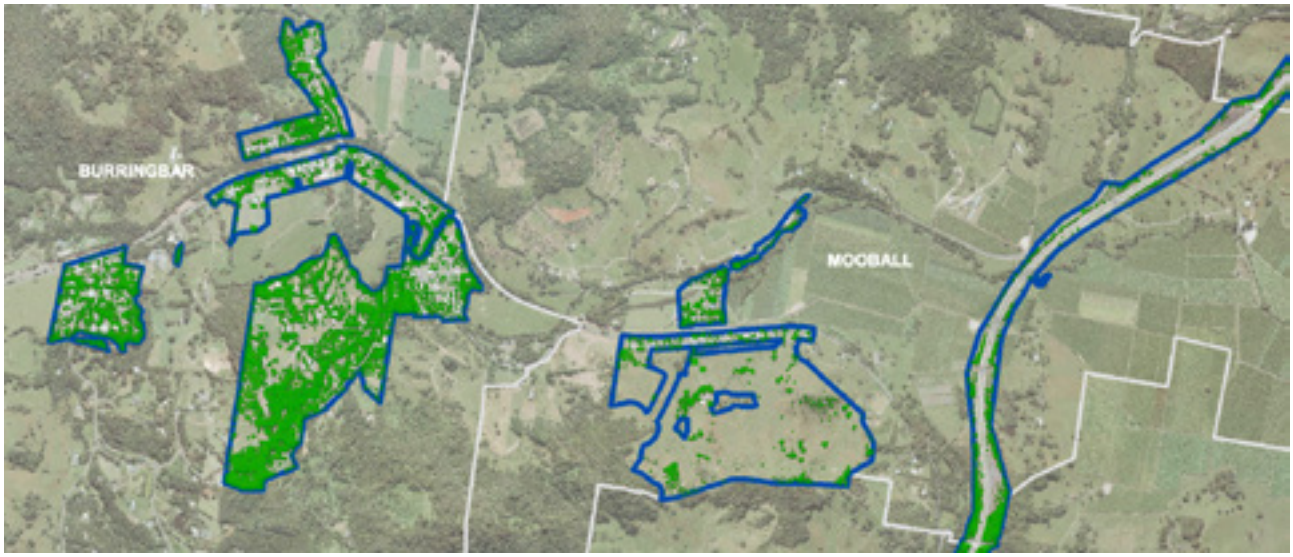
Indicative Tree Canopy Audit mapping – Stokers Siding.

Burringbar

- Approximately 4.3% of Burringbar is urban area and has a tree canopy coverage of 45.7% within the urban area.
- Of the urban area in Burringbar, 3.0% is Council managed land. This Council managed land features 79.6% tree canopy coverage.
- Of the urban area in Burringbar, 13.8% is road reserve. This road reserve area features 38.6% tree canopy coverage.
- Of the urban area in Burringbar, 3.4% is other government owned land (non-Council). This government owned land features 21.9% tree canopy coverage.
- Of the urban area in Burringbar, 79.8% is freehold (privately owned). This freehold land features 46.6% tree canopy coverage.

Mooball

- Approximately 9.2% of Mooball is urban area and has a tree canopy coverage of 14.0% within the urban area.
- Of the urban area in Mooball, 2.1% is Council managed land. This Council managed land features 32.7% tree canopy coverage.
- Of the urban area in Mooball, 33.4% is road reserve. This road reserve area features 21.3% tree canopy coverage.
- Of the urban area in Mooball, 0.1% is other government owned land (non-Council). This government owned land features 49.6% tree canopy coverage.
- Of the urban area in Mooball, 64.0% is freehold (privately owned). This freehold land features 9.3% tree canopy coverage.



Indicative Tree Canopy Audit mapping – Burringbar and Mooball.

Pacific Motorway (M1) only suburbs

- This area included the suburbs Crabbes Creek, Sleepy Hollow, Cudgera Creek, Round Mountain, Tanglewood, Clothiers Creek, Duranbah, Eviron, Stotts Creek and Cobaki Lakes. In other suburbs which have other urban areas, the tree canopy statistics has been integrated into the road reserve category.
- The Pacific Motorway road reserve in rural areas has a tree canopy coverage of 23.2%.
- Between suburbs, the tree canopy coverage ranged from 8.3% in Tanglewood to 40.7% at Crabbes Creek. Interchanges are regularly sites for tree canopy however tree canopy distribution appeared influenced by the presence of tree canopy on adjoining private land.

Indicative Tree Canopy Audit mapping – A section of the M1 – Pacific Motorway.

3.4 Tree canopy cover audit results table

	Suburb/area as urban area* (%)	Tree canopy in urban area (%)	Urban area is Council managed (%)	Tree canopy in Council managed land in urban area (%)
Tweed Shire	4.74	26.78	14.44	39.52
Coastal centres				
Tweed Heads	78.12	19.77	12.96	39.18
Tweed Heads South	60.27	28.24	16.88	47.10
Tweed Heads West	50.16	36.79	10.01	60.95
Banora Point	68.43	21.68	9.09	45.39
Fingal Head	10.74	35.81	20.48	25.82
Bilambil/Bilambil Heights	11.63	37.53	15.87	40.16
Terranora	30.90	37.75	5.01	50.29
Chinderah	19.95	29.85	5.11	32.12
Kingscliff	66.54	19.48	23.53	32.31
Cudgen	5.83	18.23	4.20	24.72
Casuarina	57.46	23.40	28.24	50.36
Cabarita Bogangar	21.30	27.24	16.41	36.40
Hastings Point	27.65	29.14	30.50	35.56
Pottsville	28.95	21.43	25.41	37.36
Rural villages				
Tumbulgum	2.48	29.42	11.58	30.56
Condong	6.71	23.32	9.21	27.55
Kielvale	2.64	21.53	0.79	65.64
South Murwillumbah	23.47	17.89	28.63	24.47
Murwillumbah Bray Park	50.47	23.21	17.46	31.66
Chillingham Village	1.42	44.51	18.39	32.48
Tyalgum Village	0.98	33.54	10.10	17.55
Uki	2.60	58.05	22.62	55.33
Stokers Siding	0.16	48.03	2.75	29.66
Burringbar	4.26	45.66	3.01	79.57
Mooball	9.20	14.04	2.12	32.71

***Urban area:** as described within methodology.

Urban area is road reserve (%)	Tree canopy in road reserve in urban area (%)	Urban area is Government owned (%)	Tree canopy in Government owned land in urban area (%)	Urban area is freehold (%)	Tree canopy in freehold in urban area (%)
22.86	23.45	8.42	35.20	54.01	23.37
24.31	18.73	4.78	18.57	57.60	15.83
19.21	26.79	6.03	18.18	57.32	24.15
16.34	29.75	37.95	40.06	35.56	29.66
20.02	17.48	5.47	40.60	65.37	18.06
34.97	35.26	2.03	34.52	42.32	40.89
19.84	35.80	0.99	33.94	63.30	37.47
12.96	30.94	3.33	40.94	78.70	37.94
37.96	28.87	2.56	52.47	54.05	29.23
18.29	11.31	9.30	34.53	47.96	12.85
18.73	23.15	28.71	14.94	48.36	17.72
21.93	17.41	0.00		49.83	10.76
25.66	24.93	9.30	29.68	48.63	24.89
10.68	25.93	5.59	59.93	52.20	22.46
19.29	15.45	2.70	65.14	51.43	12.92
29.06	27.07	5.38	46.27	53.98	28.76
20.33	14.18	4.79	38.84	65.80	24.40
12.90	31.32	0.00		86.30	19.66
17.28	21.10	4.88	22.44	49.21	12.49
17.43	21.27	7.82	28.41	57.22	20.50
14.04	43.49	3.01	40.92	64.56	48.33
17.32	32.88	27.04	27.80	45.55	40.75
25.04	57.89	7.07	72.26	44.90	56.97
3.98	25.38	17.33	48.19	76.33	49.65
13.84	38.61	3.41	21.92	79.75	46.62
33.39	21.30	0.12	49.56	64.02	9.29

Regarding tree canopy coverage rates: Red text highlights the area is under the shire average of 26.78%. Black text denotes areas between current shire average and 2040 target of 40%. Green text highlights the 2040 target of 40% is already met and requires preservation.

Table: Tree canopy coverage within the Pacific Motorway road reserve outside nominated urban areas.

Non-urban area where the M1 passes through	Tree canopy within the M1 road reserve (%)
Sleepy Hollow	19.07
Cudgera Creek	22.85
Duranbah	32.21
Eviron	30.95
Clothiers Creek	19.27
Stotts Creek	22.00
Tanglewood	8.25
Round Mountain	9.06
Crabbes Creek	40.65
Cobaki Lakes	30.27
All non-urban areas of M1	23.21

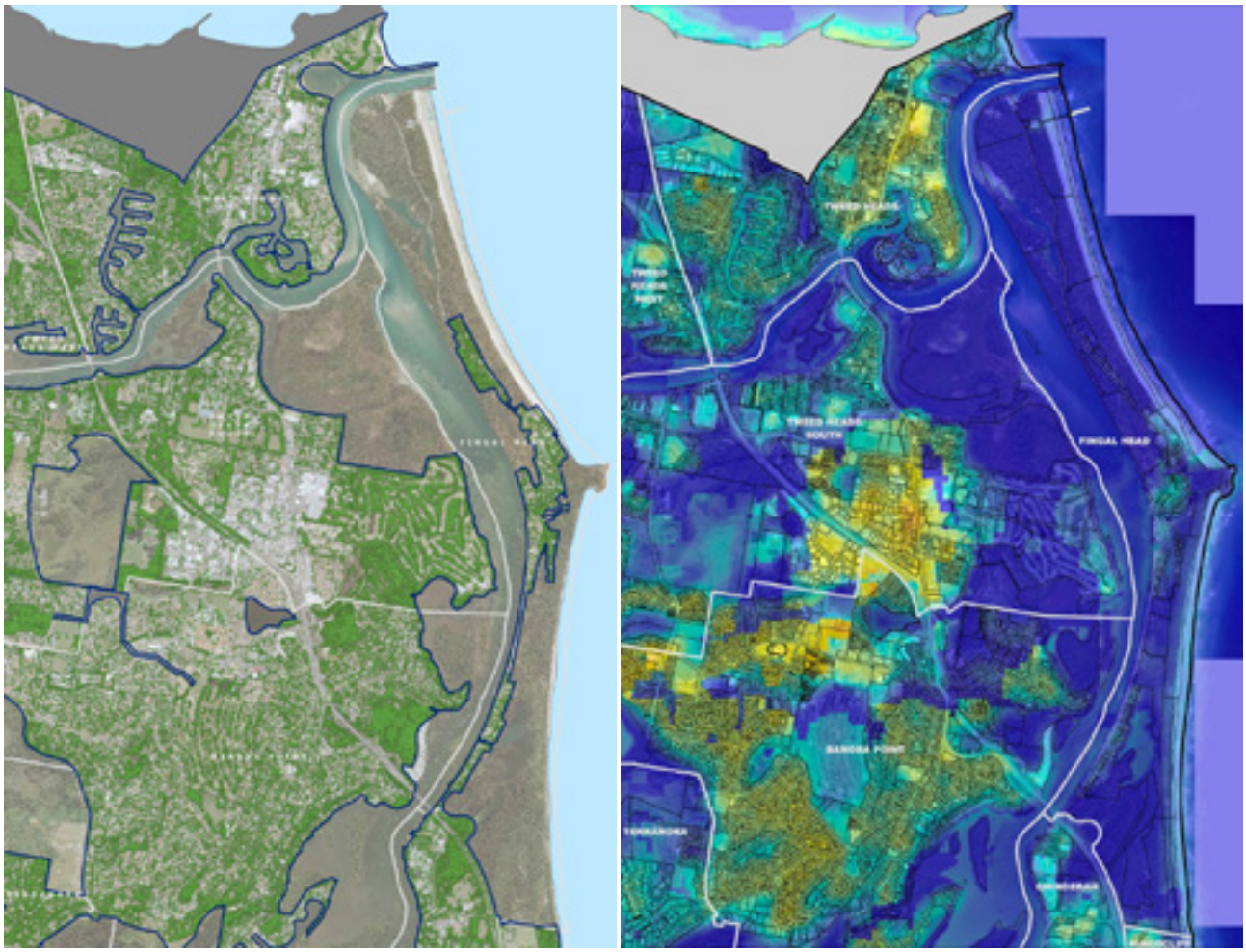
3.5 Urban heat versus tree canopy cover

As shown below, the vegetation and development patterns are found to generally reflect the temperature variations. This mapping highlights how vegetation contributes to cooling our urban areas during summer heat.

The map below (left) is from the Urban Tree Canopy Audit. The mapping shows an aerial photograph of Tweed Heads area that has been overlayed with the nominated 'urban area' in addition to the indicative green areas showing vegetation greater than 3m in height. (Please note at this scale line thickness reduces vegetation mapping accuracy).

The map below (right) is an example of urban heat mapping, which shows variations in land surface temperature. This data was collected by the Landsat 8 satellite, sourced over the summer of 2015/2016 and is provided at a resolution of 25-30m. Instead of measuring the temperature of the air, like weather stations, this reports on the ground temperature itself. Land surface temperature maps and urban heat island (UHI) mapping has been generated for Australian urban centres by the CSIRO as part of an investigation into changes in urban greenspace (researchdata.edu.au/land-surface-temperature-urban-centres/967333).

The white lines denote the suburb boundaries. Darker blues denote cooler temperatures while yellow to orange denote the hottest.



Tweed Heads to Banora Point. Left: Urban Tree Canopy Audit mapping. Right: Urban heat mapping.

3.6 Challenges and issues

In order to strengthen and expand Tweed's urban tree canopy, the following challenges and issues need to be acknowledged and effectively managed.

Short term thinking

When everything comes together, a tree can bring benefits to the community for 20 to 100 years to come. To plant trees with 5 years in mind is not only a waste of money and effort, but a missed opportunity for providing for future generations of Tweed residents.

Public safety and legal liability

The potential for litigation associated with personal injury or property damage generates pressure to remove trees, even where they are not causing any damage. Risk management objectives can conflict with vegetation management objectives and there needs to be a balanced approach considering both.

Land use conflicts including views, leaf litter and space for new development

Tree canopy is vulnerable as a result of conflicts arising between private land use and trees on private land and public land.

Examples of conflict include root invasion of infrastructure, view obstruction (water views or commercial signage), undesired shading, overhanging limbs, leaf litter into gutters or swimming pools, or removal to make way for new development. Conflicts may occur on same property as the tree or adjoining properties.

Tree injury from a lack of physical protection and street tree removal during or immediately after construction works is also prevalent. Conflicts can be reduced when consideration is given to existing backyard trees and street trees at the design and assessment stage of proposals.

Other trends that present a challenge include:

- replacement of lawn and garden areas with additional residential floorspace or impervious pavement courtyards
- increase in the number of vehicles per dwelling, resulting in conversion of front yard to car parking
- lot consolidation for larger infill developments like residential flat buildings that do not provide green space.

When conflicts arise, an appropriate assessment is required that values the importance of tree canopy in urban areas in the long term.

Vandalism and theft

Vegetation vandalism is the unlawful destruction, damage or injury to trees and vegetation on public land. In 2016 Council developed the policy, *Vegetation Vandalism on Public Land* in light of increasing vegetation vandalism and theft occurring across the Shire. Examples include the theft of new plantings from Council parks to the poisoning of vegetation on coastal reserves due to conflicts with water views. The Policy aims to address the issue by public education, monitoring, regulation, enforcement and site rehabilitation. The Policy clearly outlines responses for vandalism based upon the level of impact and significance.

Competition for space

Appropriate space needs to be provided for tree canopy and root systems. In public urban areas, trees compete for space overhead with power lines, commercial signage or building awnings. Competition for space is also at ground level with footpaths, roads or car parking spaces and underground with stormwater pipes, sewer pipes, and cables. Generally, the competition results in tree pruning that causes misshapen growth; pressure on Council to remove street trees or replacement with shrubs or not planting trees at all.

Climate change, urban heat island effect

The effects of climate change are just becoming increasingly apparent. The effects over coming decades will include warmer average temperatures, heat waves, more extreme storm or flooding events and changes in rainfall patterns.

While mature trees are one defence in mitigating the effects of climate change and the urban heat island effect, mature trees will be also subject to climate change and the urban heat island effect and therefore trees must be managed to ensure that they remain healthy and reach potential lifespans. Consideration of species selection and siting is key in growing healthy tree canopy, reducing maintenance costs and damage caused by trees during weather events.

Growing conditions and species selection

Water is the primary element needed for vegetation growth. Periods of drought following by periods of inundation will impact the health and life expectancy of trees in urban areas. Therefore, water availability and adequate drainage of the soil is important making the soil composition important.

Maintaining soil composition and moisture in the current climate presents an ongoing challenge that can be assisted with water sensitive urban design including stormwater capture and reuse to decrease reliance on potable water.

Soil erosion and deposit during rain events also presents a design challenge to be considered.

Also, the variability of rainfall and soil conditions between areas within the Tweed Shire is significant. Some species that will thrive in Murwillumbah, don't survive on the coast and vice versa.

Certain canopy types or root systems may not be appropriate for certain urban locations.

Further challenges in providing the required growing conditions include salt, wind and urban heat exposure.

In a natural setting, locally indigenous trees would be sheltered by surrounding vegetation creating a community planting featuring ground cover, mid-level shrubs and upper canopy. Roadside project plantings tend to be individual trees planted in isolation with little to no protection. Therefore, when planting a tree singularly within a road median strip for example, the local indigenous species may not thrive in these conditions. Considering the context of the planting (e.g. park, esplanade or road reserve) and growing conditions (e.g. soil type and moisture, wind or heat protection or salt exposure) is crucial in species selection to ensure the survival rate of the plantings.

The urban tree planting sites need to be designed and established to provide ideal growing conditions while species selection is key to ensuring the nature of the tree complements the site constraints and conditions to create a healthy tree that benefits the community for generations to come.

Species selection and trends

There have been major changes in species preferences over the last 150 years. Historically tree selection is usually largely based on personal preference, and on very limited criteria such as native origins, fashion, flower colour or commercial availability. Also, tree selection has been made with a lack of information available about specific species especially if it's introduced. It can take years to fully appreciate the consequences of species selection, such as unanticipated impacts on infrastructure, unacceptable risk levels, and even unintended changes to fauna composition.

Rather than being subject to fashionable trends, species selection needs to consider a multitude of factors including the existing site soils site constraints such as overhead powerlines to the features of the tree species like canopy and root growth patterns, water or sun requirements and commercial plant availability.

Pests and diseases

The susceptibility of vegetation to increasing and emerging pests and diseases present an ongoing challenge. With the change in climate, vegetation not previously at risk could become vulnerable as pests and disease change.

An example is the Pandanus planthopper (*jamella australiae*) that affects the Tweed's valued coastal Pandanus tree (*Pandanus tectorius*). Council noticed an outbreak in 2004 and following advice from Queensland National Parks and other councils, undertook an insecticide treatment program. Ongoing, Council only buys certified plants and inspects the trees regularly and utilises insecticide where necessary.

Aging tree population – replacement planting

Trees grown in the urban environment do not generally live as long as trees grown in their natural environment. Trees reaching the end of their safe useful life expectancy will require removal and replacement. All trees removed are to be replaced.

Managing bushfire risk

Bushfire presents a significant risk to buildings, infrastructure and human life. Bushland in close proximity to built assets has to be managed in accordance with the *Rural Fires Act 1997* and NSW Rural Fire Service guidelines, *Planning for Bushfire Protection 2019*. The provision of asset protection zones is an important risk management measure. However, bushfire risk management through asset protection zones does not completely exclude the prevalence of trees. Other considerations include building construction materials, vegetation type, topography and proximity to continuous bushland canopy therefore the bushfire risk must be considered on a site-specific basis.

Planting and maintenance costs

All Council planting projects and ongoing replacement and maintenance requires funding. Council's Operational budget provides for a portion of the ongoing maintenance and new plantings. Beyond this, plantings may form part of projects funded by Section 7.11 developer contributions while other planting projects are subject to grant funding.

Measuring Outcomes

Although the research regarding assessment of the benefits (e.g. carbon sequestration or health benefits) is growing, data specific to urban areas like the Tweed is currently limited. We may not be able to completely measure the entirety of the benefits achieved.

Community expectation and resistance to change

The Tweed community is diverse and includes tree lovers who may find this program 'not enough' through to people who would prefer low maintenance paved yards and are indifferent to greenery.

The primary principles behind the program are that:

- climate change impacts everyone
- there are a wide range of benefits that have been observed in individuals and communities who live in greener urban environments.

The initiative offers a pragmatic approach with the aim of starting with small wins that we then build upon together without neglecting the concerns of sectors of the community.

Every tree counts and we need the whole community on board in order for the program to be a success.

4
Implementation plan

4 Implementation plan

This is about the trees in the Tweed both now and in twenty years time.

Priority actions:

- Community engagement – educate, engage, encourage, enjoy and celebrate
- Existing tree management
- New tree planting projects
- Planning and regulation review – for both private and public land.
- Address challenges

4.1 Community engagement

Council alone cannot create this vision. The community is needed to be a partner in implementing actions for on private and public land. The community can help cultivate and protect trees in public spaces while creating their own green spaces on private land.

Council will develop and undertake a community engagement campaign that proposes the following.

- Educate:
  - to increase the community awareness, understanding and appreciation of the value and benefits of trees in urban areas
  - to shift the community's perspective from 'just trees' to 'essential green infrastructure'.
- Engage:
  - to recruit the community as active partners in the planting, cultivation, management and protection of trees in urban areas
  - to promote the planning, growing and protecting trees on private land
  - to engage the community in the cultivation and protection of trees in public spaces
  - to develop partnerships with NSW Government agencies or community groups e.g. NSW Health or NSW Department of Education, in coordinating aligned initiatives
  - to support community groups in the tree canopy cultivation programs including existing and new groups e.g. Youth Council, Landcare
  - to engage with consultants, developers and builders to make it easy for them to plan and provide for trees in new and existing urban developments

- Encourage:
  - to provide incentives for private landowners, residents and developers to create urban tree canopy on private land
  - to encourage the community to anonymously report any theft of or damage to trees on public land
- Enjoy and celebrate:
  - to recognise private landowners or community members who contribute to urban green spaces
  - to celebrate the benefits of the trees and planting success stories.

Community engagement via Council's standard avenues will include:

- informing, consulting or involving the community on planting projects being undertaken
- fact sheets and participation kits, for example, outlining the benefits of trees, road reserve planting guidelines or tree maintenance support materials
- promotion of greening events and workshops, for example community street tree planting days
- promotion of greening initiatives and competitions
- community surveys to observe any changes in community awareness, understanding and appreciation of the value and benefits of trees in urban areas.

4.2 Existing tree management

Non-Council tree management

Council will revise controls within the existing legislative framework targeting planning for trees within new developments, street trees and protecting existing trees on private land. This includes review of relevant sections of *Tweed Development Control Plan 2008*.

However, Council alone cannot create this vision. Through community engagement and planting initiatives, Council will encourage other parties to protect and cultivate trees on private land as part of existing or proposed developments. The success of this program requires active participation by the community.

Council tree management

Council is committed to a significant increase in tree planting on its own land in streets and parks building on current planting and maintenance schedules. For public land comprising Council Managed Crown land and Council owned land, actions include:

- protect and manage existing trees including tree health and soil conditions in accordance with Council's *Tree Management Protocol* (see Appendix A) and Council's *Guidelines for Roadside Vegetation in Urban Areas* (see Appendix B)
- no net loss – where trees are removed, they will be replaced
- integrate street trees where possible into grey infrastructure projects, park upgrades or streetscape upgrades. This involves reviewing internal Council processes and collaboration between units
- zero tolerance to public tree damage or theft. Regulation and compliance action is to be taken on tree vandalism in accordance with Council's Policy *Vegetation Vandalism on Public Land 2016*
- new planting projects outlined in detail following

4.3 New Council planting projects

New planting projects will be prioritised in accordance with the following criteria:

- How many members of the public will benefit? The benefits to be considered include shade provision or visual amenity. High use areas are targeted.
- Is the site exposed to the urban heat island effect? Hot spots are targeted.
- What is the likelihood that the project will create tree canopy? Is it a challenged site featuring poor soil conditions or are single trees too exposed and will struggle?
- Does the project align with other outcomes within the Tweed Shire Open Space Strategy?
- Are works already being undertaken for other reasons (e.g. stormwater upgrades or footpath repair) and outcomes may result in making the site more difficult to plant trees (e.g. concreting the road reserve) in the future.
- Funding availability.

Example projects include (but aren't limited to):

Location	Description	Comment
Jack Evans Boat Harbour, Tweed Heads	Shade trees over seating	In response to community consultation associated with the JEBH Plan of Management.
John Follant Park, Tweed Heads	Trees to shade the footpath from Jack Evans Boat Harbour to the exercise equipment.	Subject to community consultation and site analysis.
Convent Gardens Way, Banora Point	Street trees	Subject to community consultation and site analysis.
Tweed Heads Civic Centre	Pathway connectivity, weed species removal and shade tree planting	Subject to site analysis.
Black Rocks Sports Field, Pottsville	Shade trees for spectators, which also provide as koala food trees	Community consultation already undertaken and planting consistent with the Black Rocks Sports Field Master Plan.
Pottsville Waters and Black Rocks, Pottsville	Street trees	Subject to community consultation and site analysis.
Fingal Road Tweed Riverbank park pathway	Trees to shade the footpath.	Subject to community consultation and site analysis.
Marine Parade, Kingscliff	North of Kingscliff Bowls Club, trees to shade the footpath	Subject to community consultation and site analysis.
Tweed Coast Road, Cabarita Beach	From Sandalwood Drive to Hastings Road, trees to shade the footpath.	Subject to community consultation and site analysis.
Murwillumbah CBD	Street trees	Subject to community consultation and site analysis.
South Murwillumbah	Street trees	Subject to community consultation and site analysis.
Morton and Ozone Street Industrial Estate, Chinderah	Street trees	Subject to community consultation and site analysis.
Minjungbal Drive South and South Tweed Industrial Area	Street trees	Subject to site analysis and community consultation.

Additionally, Council will look for any opportunities for tree(s) to be integrated into routine maintenance or upgrade works as budgets allow.

For example, projects proposed within Council's Bike Plan currently being developed, where possible, will integrate planting to shade pathways.

4.4 Planning and regulation review

Council will revise controls within the existing legislative framework focused on the expansion of healthy tree canopy and biophillic plantings within urban areas to maximise the environmental, economic, social and public health benefits of locally appropriate native trees and multi-strata vegetation to both present and future generations.

The review will include:

- *Tweed Development Control Plan 2008* with regard to:
  - vegetation removal controls and permit requirements to protect existing trees
  - landscaping and streetscaping controls and specifications within residential, commercial and subdivision developments to ensure future developments provide for local native urban mature trees and biophillic plantings.
- Council protocols and procedures regarding Council works to ensure operations across Council are in alignment with the objectives of this program.
- Council policy regarding regulation and compliance of vegetation vandalism or unauthorised removal.
- State, regional and other local planning documents to ensure best practice is undertaken and all opportunities for funding are pursued.

4.5 Address challenges

Challenges and issues are discussed in more detail elsewhere in this document. Following is a summary of the key challenges and how they can be overcome as they arise.

Short term thinking – we need to plan and act with the intention to generate benefits in 20-50 years' time. To plant trees with 5 years in mind is a waste of money and effort, and a missed opportunity.

Public safety and legal liability – risk management objectives can conflict with vegetation management objectives and there needs to be a balanced approach considering both.

Land use conflicts including views, leaf litter and space for new development – when conflicts arise, an appropriate assessment is required that values the importance of tree canopy in urban areas in the long term.

Vandalism and theft – zero tolerance. A Policy exists on this issue outlining responses for vandalism based upon the level of impact and significance and includes public education, monitoring, regulation, enforcement and site rehabilitation.

Competition for space – appropriate space needs to be planned and provided for tree canopy and root systems in both public and private domains.

Climate change, urban heat island effect – while mature trees are one defence in mitigating the effects of climate change, consideration of species selection and siting is key in growing healthy tree canopy, reducing maintenance costs and damage caused by trees during weather events.

Growing conditions and species selection – the urban tree planting sites need to be designed and established to provide ideal growing conditions while species selection is key to ensuring the nature of the tree complements the site constraints and conditions to create a healthy tree that benefits the community for generations to come.

Species selection and trends – species selection needs to consider a multitude of factors including the existing site soils site constraints such as overhead powerlines to the features of the tree species like canopy and root growth patterns, water or sun requirements and commercial plant availability. It can take years to fully appreciate the consequences of species selection.

Pests and diseases – the susceptibility of vegetation to increasing and emerging pests and diseases present an ongoing challenge.

Aging tree population – replacement planting – trees reaching the end of their safe useful life expectancy will require removal and replacement. All trees removed are to be replaced.

Managing bushfire risk – bushfire risk must be considered on a site-specific basis with considerations other including building construction materials, vegetation type, topography and proximity to continuous bushland canopy.

Measuring outcomes – although the research regarding assessment of the benefits (e.g. carbon sequestration or health benefits) is growing, data specific to the Tweed is currently limited. We may not be able to completely measure the entirety of the benefits achieved.

Community expectation and resistance to change – the primary principles behind the program are that:

- climate change impacts everyone
- there are a wide range of benefits that have been observed in individuals and communities who live in greener urban environments.

The initiative offers a pragmatic approach with the aim of starting with small wins that we then build upon together without neglecting the concerns of sectors of the community.

Planting and maintenance costs – all Council planting projects, and ongoing replacement and maintenance require funding.

While some of the planting actions outlined in this Plan are considered part of Council's ongoing budget allocation, many planting projects are subject to funding and will be prioritised in accordance with Council's Open Space Prioritisation Matrix and integrated into the Tweed Shire Open Space Strategy's Implementation Plan.

Council's Open Space Prioritisation Matrix prioritised all actions proposed for the Tweed Shire including capital works projects, giving consideration to factors such as cost, available funding, safety, community need, demand and community benefit.

4.6 Monitor and evaluate

Potential measurements of evaluation include:

- number of trees planted
- area of canopy cover within urban areas
- changes in land surface temperature
- aesthetic changes in streetscape
- community consultation feedback.

Number of trees planted

An increase in prevalence of trees in urban areas cannot occur without planting more trees. Although not the only determinant of an increase in tree canopy, the number of trees planted is a factor to monitor.

Tree canopy cover

Canopy cover is a measure of the physical coverage of the tree canopy over the land. It represents a way of expressing, as a percentage, how much of any given area is shaded by trees.

Canopy cover is an important way of measuring the character of any urban forest. It is understood that large mature trees provide up to 75% more environmental benefits than smaller trees.

The methodology utilised in determining the baseline canopy cover was as follows:

- areas within the Tweed considered 'urban' were mapped
- within the urban area, utilising LiDAR data, vegetation greater than 3m in height were identified and mapped providing indicative areas
- statistics were collated considering suburbs and land tenure.

Changes in land surface temperature

Land surface temperature data obtained from Landsat 8 satellite has been collated at a resolution of 30m, which highlights the broad differences in temperature between urban areas that has informed the prioritisation of planting projects.

Data of this nature can be valuable. However, to obtain mapping at a resolution relevant to measuring specific planting project outcomes is relatively expensive and diverts funds from the planting project itself. Also, changes may only be noticed after a substantial period of time, namely 15 to 20 years once the tree canopy is established. Council may consider investing in mapping of this nature in the future however, at present, given research being undertaken in major cities, which the Tweed can learn from, investing in data at a higher resolution this was not considered to be the best outcome.

Aesthetic changes in the streetscape

Before and after photography of the planting project sites will be undertaken to highlight amenity changes.

Community consultation feedback

As a primary goal is to increase the community awareness, understanding and appreciation of the value and benefits of trees in urban areas, community surveys will be undertaken with the intent of observing any changes in the community's attitudes and perception of trees in urban areas.

5
Appendices

5 Appendices

Appendix A – Tree Management Protocol

Appendix B – Road Reserve Vegetation in Urban Areas Policy

Appendix C – Guidelines for Road Reserve Vegetation in Urban Areas

Appendix D – Vegetation Vandalism on Public Land Policy

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Cool Towns
Tweed Shire Urban Forest Project
Planting a healthy green future