GREENER PLACES STRATEGY

A greening vision framework for the Central Coast 2021-2031

Central Coast Council

Executive summary

The Central Coast Greener Places Strategy (the Strategy) is the first urban greening strategy for the Central Coast Council since its formal declaration in 2016. The Strategy is informed by the former Council's greening strategies and the Urban Heat Island and canopy mapping technical studies that inform the greening vision for the region. The vision for greening to maximise the liveability of Central Coast is reflected within the One Central Coast -Community Strategic Plan 2018-2028 which identifies a strong desire in our community to maintain the unique environmental attributes of the Central Coast. The Central Coast Regional Plan also aims to increase the amenity of existing urban areas and to protect the region's scenic amenity (NSW Department of Planning and Environment 2016).

Whilst the Central Coast region is characterised by green ridges and surrounded by national parks, the loss of canopy cover and green corridor in urban centres and neighbourhoods need to be better managed. The region is also experiencing rapid urbanisation, demand for housing and expansion of communities. In response to the loss of canopy cover and green corridors, the Strategy provides a framework for enhancing and managing the existing urban forest and other green spaces and promotes urban greening opportunities on both public and private land through the protection and expansion of urban forests and other forms of greening where large trees and shrubs are not suitable over the next 10 years.

The Central Coast contains many unique urban ecosystems and places like Pearl Beach or Budgewoi foreshore are great examples. These places include parks that are dappled with tree cover that provide shade to residents while picnicking or swimming and reinforce the value and beauty of vegetation. Such urban forests play a vital role in the health, social wellbeing and economic sustainability of a region. Trees in our parks, streets or in our backyards provide services to us every day, improving our environment and quality of life. This Strategy acknowledges that trees often require removal, however without replacement planting nearby, a loss of the urban forest canopy cover will occur. As such, the strategy provides a strategic direction on tree, shrub and other cultivated plant management across the Central Coast, ensuring adequate removal and replacement of urban vegetation, in particular making sure that the right plant is planted in the right place. The Strategy provides a framework to implement the greening vision need to ensure an appropriate level of urban vegetation cover, in particular shade trees occur across a range of land uses.

The Strategy also acknowledges the ability of urban greening to mitigate certain urban health effects and maintain liveability in urban centres. At times this may be through encouraging alternative greening approaches such as green walls and rooftop gardens in urban centres. Maintaining functional urban ecosystems is a shared responsibility across all land tenure. Hence, more rigorous requirements on new development will be implemented in order to effectively improve landscaping and associated green infrastructure. It is important that we all work together to protect and enhance urban greenspaces. To do this, it is also proposed that community engagement programs will be developed. Importantly once implemented, the Strategy will ensure that tree canopy cover and green space is maintained in a way that improves the liveability of the Central Coast region.

Acknowledgement of Country

WE ACKNOWLEDGE THE TRADITIONAL OWNERS OF THE LAND ON WHICH WE LIVE AND PAY OUR RESPECTS TO ELDERS PAST AND PRESENT

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Introduction

Greener Places are about maximising the level of vegetation cover, in the form of trees, shrubs and other plants such as native sedges across all land tenures with the aim of improving liveability on the Central Coast for people and wildlife. Greener Places is a shared responsibility among all of us, This Strategy provides a greening vision framework to achieving these outcomes for the next decade.

Central Coast Council was formed in 2016, forming one of the largest regions in NSW with a total area of 168,000 ha. Both the former Wyong Shire Council and Gosford City Council had strong position on urban greening and maintaining the green character of the region. The need for a harmonized approach for greening the region to enhance local liveability resulted in the development of the Central Coast Greener Places Strategy (the Strategy).

Approximately 74 per cent of the region contains native vegetation wooded which comprise of National Parks, State Forest, Aboriginal lands and Council owned and managed natural areas, including the Coastal Open Space System (COSS). Despite this high level of tree canopy cover, developed coastal areas, such as on the Woy Woy peninsula and south of The Entrance contain less than 10% tree canopy cover.

The Central Coast is currently home to 325,000 people, which is expected to increase to 415,000 by 2036, placing an urgent need to meet the demand housing and employment. This will result in increased housing density, such as the construction of medium density housing in existing suburbs, along with the development of greenfield housing sites. The projected level of urban intensification and expansion requires careful planning for the development, maintenance and expansion of green infrastructure across the region

In this Strategy, greener places can occur across a variety of land uses and development types including privately owned public space such as within shopping centres, streetscapes and nature strips, parks, private backyards, and set backs on apartment blocks. These can be enhanced through planting and establishment of blue/green infrastructure such as raingardens. This strategy does not cover bushland or other natural areas or the adequacy of current open space across the Central Coast, which are covered in other current and future Strategies.

This Strategy builds on from the Greening Wyong Strategy 2016 which aimed at:

- guiding proactive management of public trees, such as those located in streets and parks,

- identifying priority planting areas and identifying detailed precinct-based objectives for street tree planting,

- developing relevant procedures and technical guidelines for tree planting along roads and identifying hazardous trees, and

- establishing the right tree in the right place.

This Strategy aligns to the NSW Government's Greener Places Policy. The Strategy provides a holistic framework for urban greening in the region and expands beyond public land to incorporate all land tenure. The specific objectives of the Strategy are to:

- Identify areas affected by Urban Heat Islands, opportunities for greening and to prioritise areas for future greening activities.

- Undertake an audit for opportunities for public tree planting in priority suburbs and all areas of open space to facilitate tree planting operational planning.

- Strengthen tree removal and replacement processes to avoid the net loss of tree canopy cover.

- Establish processes for the replacement of removed private trees wherever practicable.

- Develop operational plans for public tree planting across the key priority suburbs.

- Develop education programs to promote community involvement in greening initiatives.

- Where the planting of trees is not possible, encourage the use of smaller shrubs and groundcovers as they make significant contribution towards mitigating heat island effects and enhancing urban biodiversity

- Implement other provisions for urban greening such as community gardens, green walls and green roofs.

- Promote improved liveability through using plants in urban design. This in turn assists in mitigating Urban Heat Island Effects.

Context

What are Greener Places and how do they improve liveability?

Greener Places are spaces that do or can allow for increased amount of greening. Greening can include trees, shrubs and groundcovers in parks, along streets and in private or community gardens. Where these aren't a possibility, rooftop gardens and green walls could be developed.

Greener places can occur across any tenure or property type such as open spaces in the public domain or privately-owned gardens. These form part of the urban ecosystem or urban forest. Greener Places can be incorporated into urban design and improve the functionality of hard landscaping projects, such as shared paths and outdoor seating. This is through providing shade as well as softening the appearance of the hard landscaping, as such users of well designed public domain that feature quality landscaping may be more relaxed and receive greater enjoyment from the experience.

What is an urban ecosystem?

In recent years, it has been increasingly recognised that cities and urban areas provide habitat for plants and animals. Humans are also part of this system, commonly referred to as urban ecosystems (Alberti et al. 2008).

As shown in Figure 1, the elements of the urban ecosystems are diverse, consisting of plants, animals and humans.

An urban ecosystem can occur at a variety of scales, from that of an entire region, such as the Central Coast, to an individual suburb. At a local scale, urban ecosystems may occur as an individual shrub or tree, a group of shrubs or trees or a whole park of trees, shrubs and garden beds. Blue green infrastructure such as constructed wetlands, rain gardens and vegetated infiltrations trenches also contribute towards enhancing the urban ecosystem. The urban ecosystem also provides ecosystem services to humans such as sequestration of carbon and other pollutants, provision of shade and increased amenity which are summarised below.

What is the difference between Urban Forestry and the Urban Forest?

Urban Forestry is the establishment, care, maintenance, and renewal of trees and tree populations in an urban context, collectively considered the urban forest (Miller et al. 2015). While this Strategy aims to increasing urban greening with a variety of planting methods, the Strategy will be primarily delivered through an increased rate of planting of trees and large shrubs.

The main focus of urban forestry is ensuring suitable species are chosen and appropriately maintained in order to maximise their longevity and benefits to users of adjacent areas (Miller et al. 2015). The urban forest may consist of trees that are remnants of native vegetation which formerly occurred or native and exotic trees planted in a landscaping context. Due to the diverse range of trees and large shrubs within an

urban forest, it may contain exceptional diversity, representing several hundred species, across a range of size classes and heights (Figueroa et al. 2018). Trees that form part of the urban forest will often require removal due to disease and decay (Brack 2016). However, it's important they are replaced. Nevertheless, the urban forest is not a self-sustaining entity and as such, trees which are removed or die need to be replaced with careful consideration to the future maintenance requirements (Miller et al. 2015). Importantly in increasingly urbanising areas, planning for the urban forest of the future also needs to secure space for future planting which may be on either public or private lands.
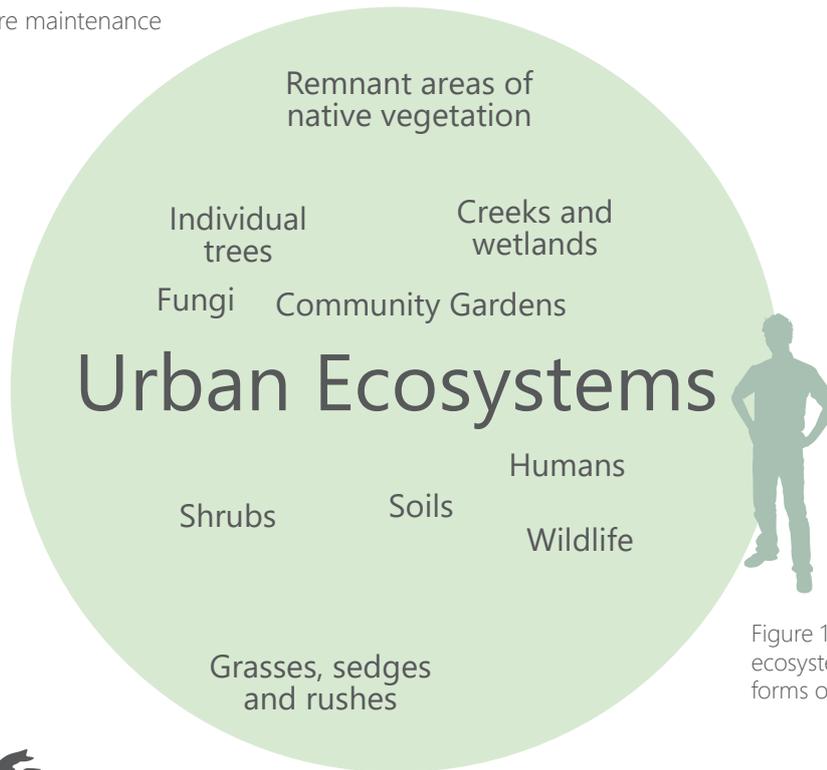
Figure 1: The elements of urban ecosystems are diverse, including all forms of life, including humans.

Figure 2: How the urban forest interacts with individual trees and what elements form part of the Urban Forest and how those interact together. Adapted from Roy et al. (2012).

Benefits of greening

While some negative effects may occur from vegetation in urban areas, primarily after storms, the benefits of urban vegetation far outweigh the negatives. Some of the benefits provided include:

Cooling effects

Urban trees provide shade to buildings, roads, along with private and public open space. This assists in reducing the impact of the Urban Heat Island Effect, explained on page 24, especially during heatwaves (Amati et al. 2013, Elmes et al. 2017). Throughout the warmer months, having tree canopy shading the walls or rooves of buildings has been shown to reduce the cost of cooling. For example, a study along a 19 km section of the Pacific Highway in Northern Sydney estimated energy savings from shade trees at over $57,000 per year (Amati et al. 2003).

Carbon sequestration

The urban forest completes carbon sequestration through storage of carbon in tree stems, branches and the soil (Nowak et al. 2013). Research on urban forests in the United States have calculated whole tree carbon storage measures of around 7.7 kg of carbon per square metre of tree cover, with an annual sequestration rate of around 0.3 kg of carbon per square metre (Nowak et al. 2013). A study along a 11 km section of Parramatta Road, Sydney estimated that urban trees stored 22,600 tonnes of carbon and sequestered a further 573 tonnes of carbon per year (Amati et al. 2003). Thus, the urban forest provides for a high level of carbon storage and is useful in combating climate change.

Absorption and storage of atmospheric pollutants

Vegetation also absorb and store atmospheric pollutants in leaves and the stem and branches, such as Volatile Organic Compounds (VOCs) and benzene originating from car exhausts (Nowak et al. 2002). A study on the Greater London Metropolitan area found that the urban canopy removed between 0.7-1.4% of very small particulate matter, referred to as PM10 emissions, which can trigger health issues such as Asthma (Tallis et al. 2011). A study of urban trees in a congested area of Naples, Italy found elevated levels of heavy metals in the leaves of sampled Oak trees, suggesting that the urban forest potentially stores heavy metals (Alfani et al. 1996). In an experiment conducted by researchers from the University of Technology Sydney on the effectiveness of a green wall at removing volatile organic compounds (VOCs) such as benzene and formaldehyde found that such a wall could effectively remove over half of the VOCs (Torpy et al. 2018). As such the maintenance of vegetation within areas of high air pollution may reduce the concentration of air pollutants in urban areas.

Crime prevention through environmental design aided by appropriate plantings

Areas with a high level of vegetation cover have been shown to have lower crime rates than areas with lower levels of vegetation cover (Troy et al. 2012). In a study of a highly urban area of Chicago in the United States, Kuo and Sullivan (2001) found that apartment buildings surrounded by trees had a lower reporting rate of crime than those that occurred in less vegetated areas. These findings are strongly linked to the principle of Crime Prevention through Environmental Design (CPTED) which argues that criminals make rational choices about crime targets, relating to the risk of being detected and the likely gain (Crowe 2000). Areas that have improved physical appearance are thought to be less likely to attract criminal elements as there is a strong perception that crime is correlated to areas that are less cared for (Crowe 2000).

Improved scenic amenity, health and wellbeing, enhancement of real estate values and consumer spending leading to improved urban amenity

Urban green spaces and vegetation can improve scenic amenity through softening vistas, which otherwise may be dominated by the built form (Orland et al. 1992). This in turn can improve real estate prices, with leafy suburbs generally selling for more than less leafy suburbs (Orland et al. 1992). A study of retail shoppers in the United States showed that having large trees adjacent to the shopping district consumers were more willing to pay for parking, visit the shopping district more often and for a longer period of time compared to areas that were devoid of trees (Wolf 2005). A study in the state of Georgia in the United States found that properties that contained mature trees sold for around 3.5-4.5% more than properties that were devoid of trees (Anderson and Cordell 1988). A study in Finland found that dwellings that had a leafy outlook were on average 4.9% more expensive than similar dwellings that did not have a leafy outlook (Tyrväinen and Miettinen 2000). In a study in Southern England, it was found that increased time spent in leafy areas decreased depression and increased social cohesion (Cox et al. 2017).

Provision of habitat for urban wildlife, including informal wildlife corridors

Urban green spaces provide habitat for a range of urban wildlife. Gardens in suburbia having been shown to provide habitat for a range of small native birds (Parsons et al. 2006) and some native mammals (Carthew et al. 2014). Urban greening provides habitat resources for wildlife such as flowering blossom, fruits and denning opportunities within tree hollows. These areas may also function as an informal wildlife corridor, providing stepping stones among patches of remnant native vegetation allowing wildlife to disperse or migrate across the region. These areas are important habitat for a range of threatened species such as the Yellow-bellied Glider and Powerful Owl. However outside of these areas, urban trees may provide habitat for other threatened species, such as the Eastern Osprey which may roost or nest in very tall Norfolk Island pines in the Blackwall area or the Grey-headed Flying Fox, Swift Parrot and Little Lorikeet which may occasionally forage on flowering Eucalypts such as Swamp Mahoganies in parks. For protected wildlife, a wide range of birds may also utilise the urban forest for foraging, such as the Brown Cuckoo Dove, Laughing Kookaburra and Rainbow Lorikeet. Urban forests may act as a stepping stone between patches of bushland, allowing wildlife to disperse or migrate across the region.

Likewise, blue-green infrastructure such as constructed wetlands and raingardens also provide habitat for local species. A study of the use of constructed wetlands by waterbirds in Melbourne found that they provided habitat for 35 species of waterbird and 91 types of phytoplankton (Murray et al. 2013). While smaller structures such as raingardens and vegetated infiltration trenches may not provide this scale of benefits to the urban ecosystem, they still provide habitat for pollinators and reduce impacts of stormwater runoff on nearby wetlands, creeks and estuaries (Asleson et al. 2009).

Blue/green infrastructure

Over the past decade there has been a greater recognition of the contribution that structures such as constructed wetlands, raingardens and vegetated infiltration trenches towards enhancing the urban ecosystem. A study of the use of constructed wetlands by waterbirds in Melbourne found that they provided habitat for 35 species of waterbird and 91 types of phytoplankton (Murray et al. 2013).

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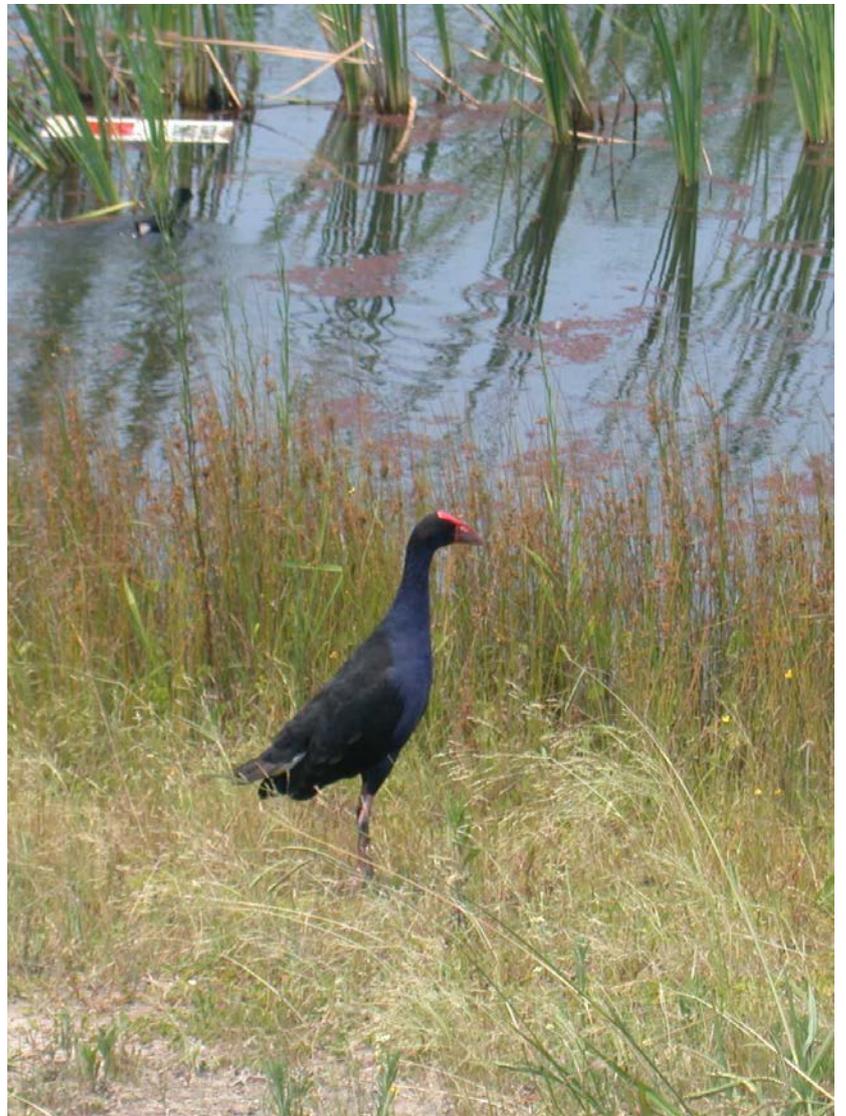
Case study: what was the value of street trees along the Pacific Highway in Sydney?

A study completed by Amati et al. (2013) along a 19km stretch of the Pacific Highway estimated 40% tree cover immediately adjacent to the road, covered by around 40,000 trees. This removed:

- 11 tonnes of pollutants per year
- Stored 71,700 tonnes of carbon across their life
- Sequestered 1220 tonnes of carbon across a year
- Produced 2110 tonnes of oxygen across a single year

This study shows the value of street trees at reducing pollution and increases the efficiency of cooling systems.

Case study: older trees have greater habitat value than younger trees in the urban forest

In the Australian environment, tree hollows are very important for wildlife, with a wide range of species such as parrots, gliders and owls all requiring hollows for breeding or denning (Gibbons and Lindenmayer 2002). However tree hollows take over 100 years to form and are found in very large trees rather than smaller trees (Gibbons and Lindenmayer 2002). Furthermore large trees generally produce more nectar than smaller trees, thus increase their value to nectar feeding wildlife such as parrots and Flying Foxes (Law and Chidel 2008). Due to these factors, old trees, in particular those that contain hollows have paramount importance in the urban forest and should be maintained and removal should only occur as a last resort. However it must also be remembered that young trees eventually become the next generation of old trees and smaller trees must also be valued and appropriately managed to ensure they are also only removed as a last resort.

Exemplar Greener Places

Melbourne's Urban Forest

The City of Melbourne's Urban Forest consists of open space areas such as the Royal Botanic Gardens and Fitzroy Gardens along with over 70,000 other public trees within road reserves and other Council managed spaces (City of Melbourne 2012). These areas are supported by the 2012-2032 City of Melbourne Urban Forest Strategy which aims to increase tree cover in the city to 40% by 2040.

Central Park, New York; an urban forest area in a metropolis

Central Park, located in Manhattan, New York is a 341 ha urban forest. It was officially opened in 1857 with almost every one of the 25,000 trees contained within being planted. Each year Central Park attracts over 37 million visitors who visit the park for walking, relaxing and attending concerts (Central Park Conservancy 2015). Central Park directly contributes to the employment of 453 people and indirectly a further 1345 full time positions associated with ancillary activities such as restaurants and other tourism operations (Central Park Conservancy 2015). From these, the value of Central Park towards the US economy has been estimated to be worth around one billion US dollars per year (Central Park Conservancy 2015).
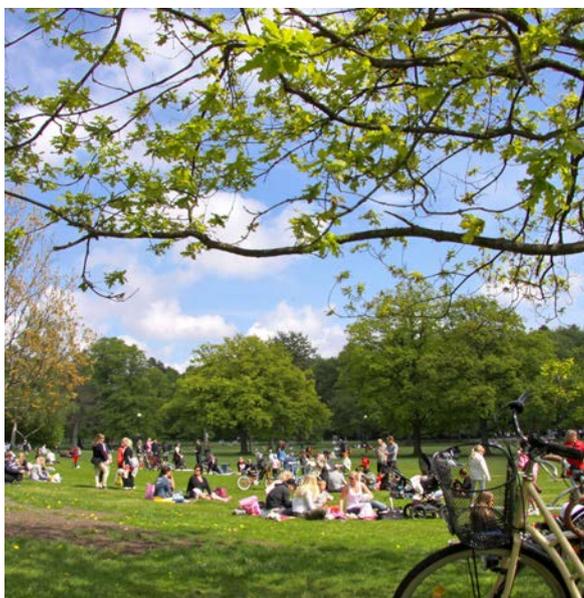
Gothenburg's Urban Forest

Gothenburg is Sweden's second largest city, home to around half a million inhabitants. Around 70% of the Gothenburg urban area is open space, with those areas containing around 50% tree cover. It also contains numerous areas of open space and supports a large urban forest, as well as street trees. Examples of open space that forms part of the Gothenburg urban forest includes Slottskogen which is a 137 ha urban forest which was officially opened in 1874. It contains mature plantings of European trees such as Oak and Beech along with numerous walking trails. On a summers day Slottskogen is a favourite among locals who use the park for picnics under shady trees.

Current status

The Central Coast contains a unique environment with a high level of tree cover. This level of tree cover contributes to several unique suburbs, such as Pearl Beach. Approximately 74% of the Central Coast consists of native vegetation, of which around half occurs in conservation areas managed as Council reserves, State Forests and National Parks that provide are important habitat for a range of threatened species such as the Yellow-bellied Glider and Powerful Owl.

A technical study was completed to determine the level of vegetation cover across 94 suburbs, being those that contained residential areas. This study also determined the level of impervious surfaces and opportunities for planting such as within areas that contain lawns was conducted in 2018 (Technical Study report Appendix 2). This process was tenure blind, meaning that the area of canopy in public compared to private ownership was not determined. One of the limitations of the suburb-based canopy mapping is that some suburbs contain large areas of National Park or State Forest which may increase the relative level of tree cover. For instance, the suburb of Woy Woy includes a large area of Brisbane Water National Park. Whilst the urban area has relatively low levels of canopy cover, the inclusion of the National Park lands gave a higher level of canopy cover for Woy Woy suburb.
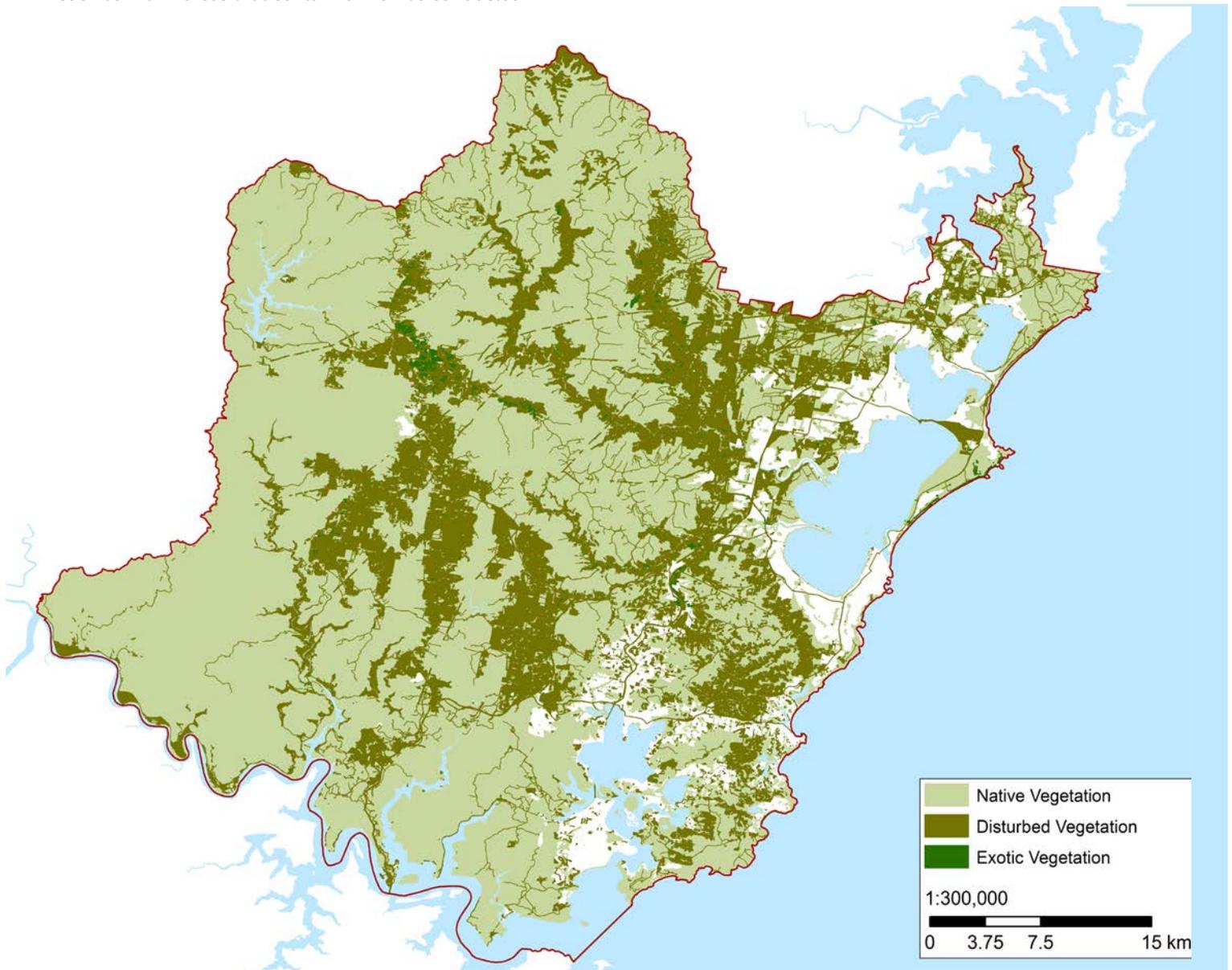

Figure 3: Distribution of native vegetation and other vegetation in the Central Coast
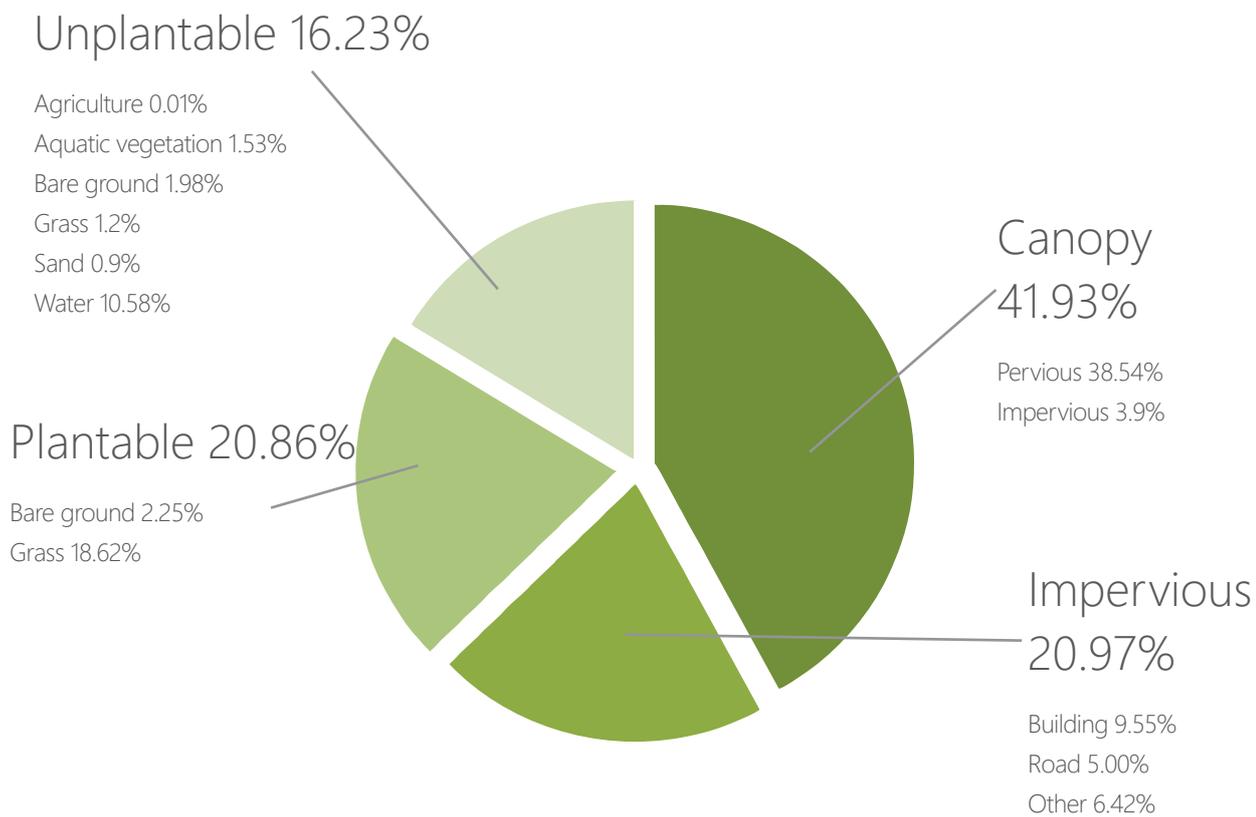
Unplantable 16.23%

Agriculture 0.01%
Aquatic vegetation 1.53%
Bare ground 1.98%
Grass 1.2%
Sand 0.9%
Water 10.58%

Plantable 20.86%

Bare ground 2.25%
Grass 18.62%

Canopy 41.93%

Pervious 38.54%
Impervious 3.9%

Impervious 20.97%

Building 9.55%
Road 5.00%
Other 6.42%

Figure 4: Overall land use breakdown for the 94 predominantly urban suburbs considered for urban canopy mapping.

Suburb scale vegetation cover

Figure 4 illustrates the findings from the technical study for the 94 suburbs considered. An overall canopy cover of 42% was determined, with a further 21% of land containing impervious surfaces. This is comparable to the national urban canopy which when assessed in 2014 had an average coverage of 39%, however is lower than northern Sydney Council areas such as Hornsby and Pittwater which recorded overall average canopy coverage of 59% (2020 Vision 2014). Overall, 21% of Central Coast suburbs contained grass or bare ground that could be planted, which may include grazing lands. Lastly 16% of the land area of these suburbs were unsuitable for planting, including around 1% that consisted of grass with other purposes such as sporting fields.

On the individual suburb scale, tree canopy cover ranged from around 7% at Booker Bay through to almost 90% at Ourimbah, however this included a large proportion of Ourimbah State Forest. A number of suburbs recorded levels of canopy cover of less than 15% including Blue Bay, Davistown, Ettalong Beach, Gorokan, Point Frederick, St Hubert's Island, The Entrance and The Entrance North. Generally, these are suburbs that are relatively established and do not contain large areas of bushland. Further information on the level of tree cover in each suburb is contained within the Appendix 2.

Case study: changes in canopy cover at Woy Woy between 2005 and 2014

An investigation occurred as to changes in tree canopy cover and number of impervious surfaces at Woy Woy between 2005 and 2014 (see Appendix 2). Over this time, canopy cover declined by 173 hectares, while the area of impervious surface increased by 84 hectares and unplantable space increased by 113 hectares (Figure 5). This effect may be difficult to counteract as the area of plantable space only increased by 24 hectares (Figure 5).
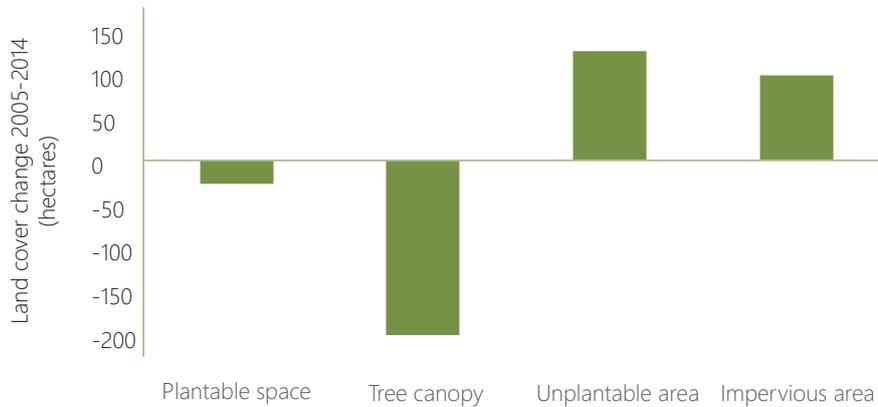

Figure 5A: change in land cover categories between 2005 and 2014 for the suburb of Woy Woy.

Figure 5B: Illustration of changes in land use in a representative area of Woy Woy between 2005 and 2014. Those marked with a red outline indicate canopy loss as a result of whole of site urban development, while the yellow outline indicate incidental canopy loss of part of site urban development.

How many public trees are there on the Central Coast?

Surveys occurred across 80 passive recreation reserves of the Central Coast, with the aim of understanding the density of trees across these areas. The surveys recorded a median tree density of 78 trees per hectare in the public recreation reserves. As Council owns 663 ha of recreation reserves, it's likely that around 50,000 trees are contained within these reserves.

The density for street trees and park trees will vary depending on the predominant purpose of the location and the type of species chosen. In general planting densities in this strategy will be at a maximum of around 150 trees per hectare, which is the density recorded in heavily vegetated parks that still maintain grass cover underneath. However, any planting program must occur through appropriate place-based planning that considers all users of the park, how tree planting will complement those uses and enhance the user experience including considering the future size of planted trees. As such, parks should be assessed on a case by case basis by relevant subject matter experts before planting commences.

Planting design will be linked to open space design and delivery programs, such as the installation of play equipment, in combination with understanding the biodiversity benefits the planting may provide in the future. This may instead translate to a planting density of between 50-100 trees per hectare or through trees, shrubs and groundcovers being planted in defined mulched planting areas with surrounding land being maintained as lawn.

Street tree planting is often constrained due to the presence of underground services, powerlines, footpath and kerb and gutter, which may allow for less than 0.5 metres of planting width. In these situations, smaller trees and large shrubs should be considered to ensure that damage to infrastructure does not occur in the future, if lines of sight are maintained (see Figures 6 & 7). Alternatively, smaller shrubs, grasses and groundcovers may be used in areas of high visual prominence where taller trees and shrubs may not be suitable and in areas where future maintenance will not be excessive.
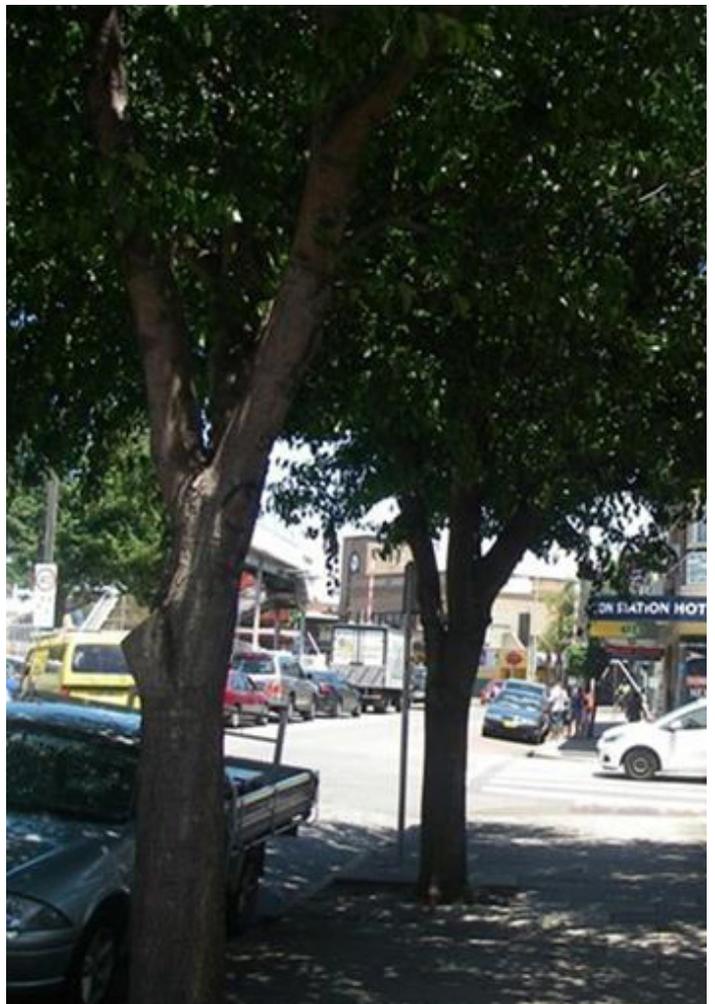
Figure 6: photo of a park that includes a high tree density which provides shade to park users.

Figure 7: smaller street trees in Hamilton near Newcastle allow for canopy establishment in a paved footpath area while also providing shade to the footpath and parked vehicles.

What is the Urban Heat Island Effect?

An Urban Heat Island occurs when the urban area is significantly warmer than the surrounding less developed areas, such as rural lands and forests (Oke 2011). Heat islands develop due to urban materials such as concrete, asphalt, tiled rooves and gravel absorbing rather than reflecting heat which occurs when the area is more heavily vegetated (Oke 2011).

The concept of the Urban Heat Island has been in existence for over 50 years (Bornstein 1968), however as society becomes more urbanised, greater emphasis needs to be placed upon the effect during urban planning. Figure 8 demonstrates the effect of development at Erina shows the heat island effect compared to surrounding vegetated areas, which were on average 3°C

hotter. This means houses and other buildings will be hotter in areas where the Heat Island Effect is operating which will translate to higher cooling costs or alternatively less comfortable conditions indoors if cooling does not occur. Furthermore, on hot days taking a walk outdoors will be much warmer than if canopy cover is present over footpaths.

Urban Heat Island mapping was conducted across the Central Coast (see the Technical Study included as Appendix). Open source Landsat imagery was used to determine differentials on a hot day in January 2018 and a hot day in March 2013. These analyses found that a number of urban and agricultural areas are more than 4°C above background levels (Figure 9). When considering change in the operation of heat islands over the past five years, the analysis found that large areas of agricultural land in the west of the Central Coast had become significantly warmer, along with some isolated areas of greenfield residential subdivision across the Central Coast (Figure 9). However,

minor warming differentials also occurred on the Woy Woy peninsula, Kariong, Gosford city and in the greenfield suburb of Woongarrah (Figure 9).

Urban Heat Island mapping has shown that on hot days, the Central Coast's 10 hottest suburbs are between 3.4 and 5.7°C above background levels (see appendix for the technical report). For example, the forest within Blackwall Mountain is more than 4°C cooler than nearby urban housing in Ettalong Beach. Between 2013 and 2018, ten suburbs became more than 1.5°C hotter compared to background levels that occurred in bushland, including an increase of 2.6°C at Ettalong Beach, 1.9°C at Blue Haven and Woongarrah, 1.8°C at East Gosford and Booker Bay and 1.72°C at Point Frederick. Over time unabated, the effects of the Urban Heat Island will continue and possibly intensify as a result of continued development intensification of the urban centres.

Figure 8: an example of the operation of the urban heat island effect at Erina where areas of vegetation are on average 3°C cooler than adjacent developed areas. Areas in red are hotter than areas that are blue.

Urban Heat Island mapping has shown that on hot days, the Central Coast's 10 hottest suburbs are between 3.4 and 5.7°C above background levels (see appendix for the technical report). For example, the forest within Blackwall Mountain is more than 4°C cooler than nearby urban housing in Ettalong Beach. Between 2013 and 2018, ten suburbs became more than 1.5°C hotter compared to background levels that occurred in bushland, including an increase of 2.6°C at Ettalong Beach, 1.9°C at Blue Haven and Woongarrah, 1.8°C at East Gosford and Booker Bay and 1.72°C at Point Frederick. Over time unabated, the effects of the Urban Heat Island will continue and possibly intensify as a result of continued development intensification of the urban centres.
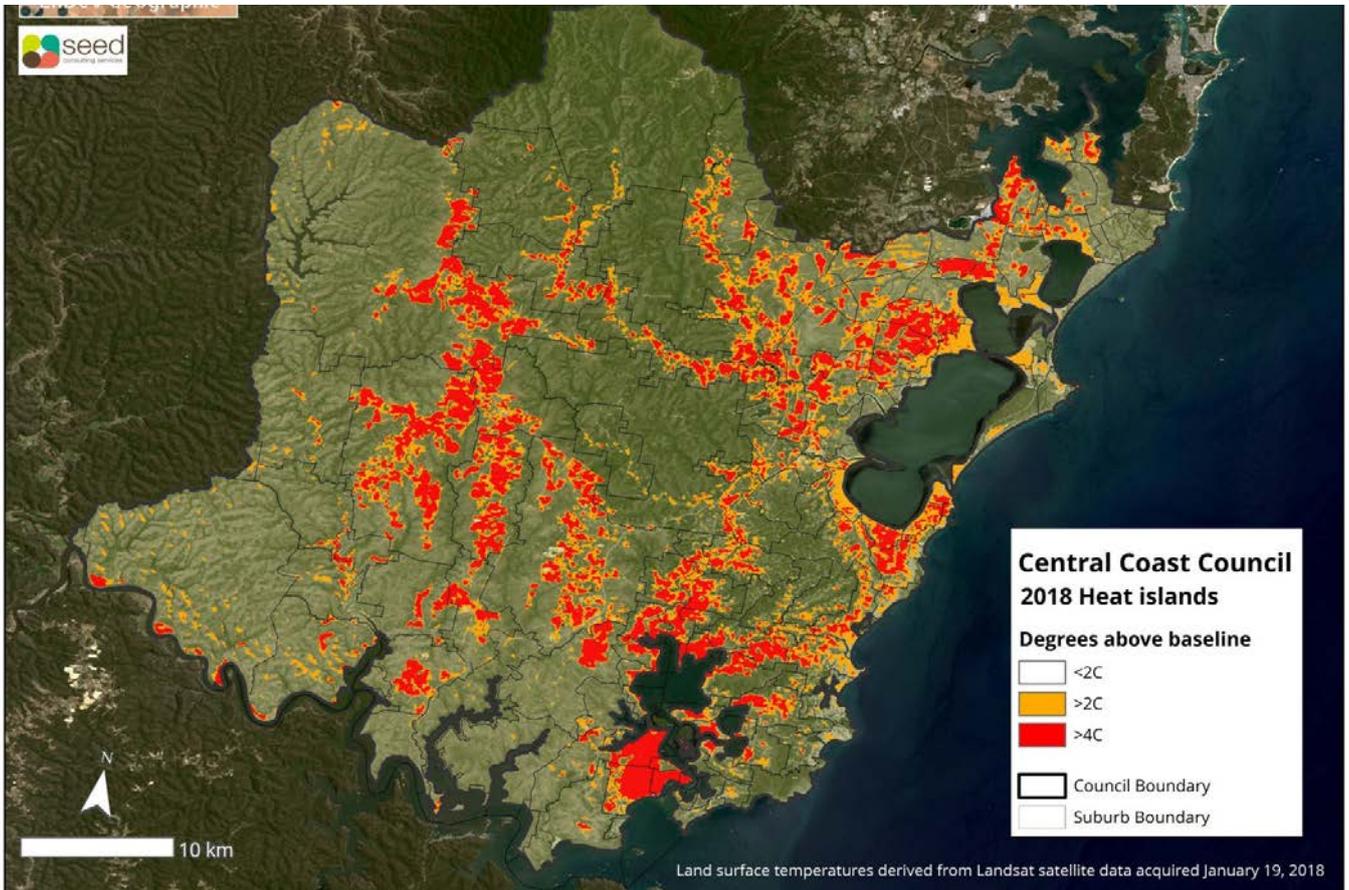
Figure 9: Areas where heat islands are more than 2°C and 4°C above baseline temperatures on a hot day in January 2018.
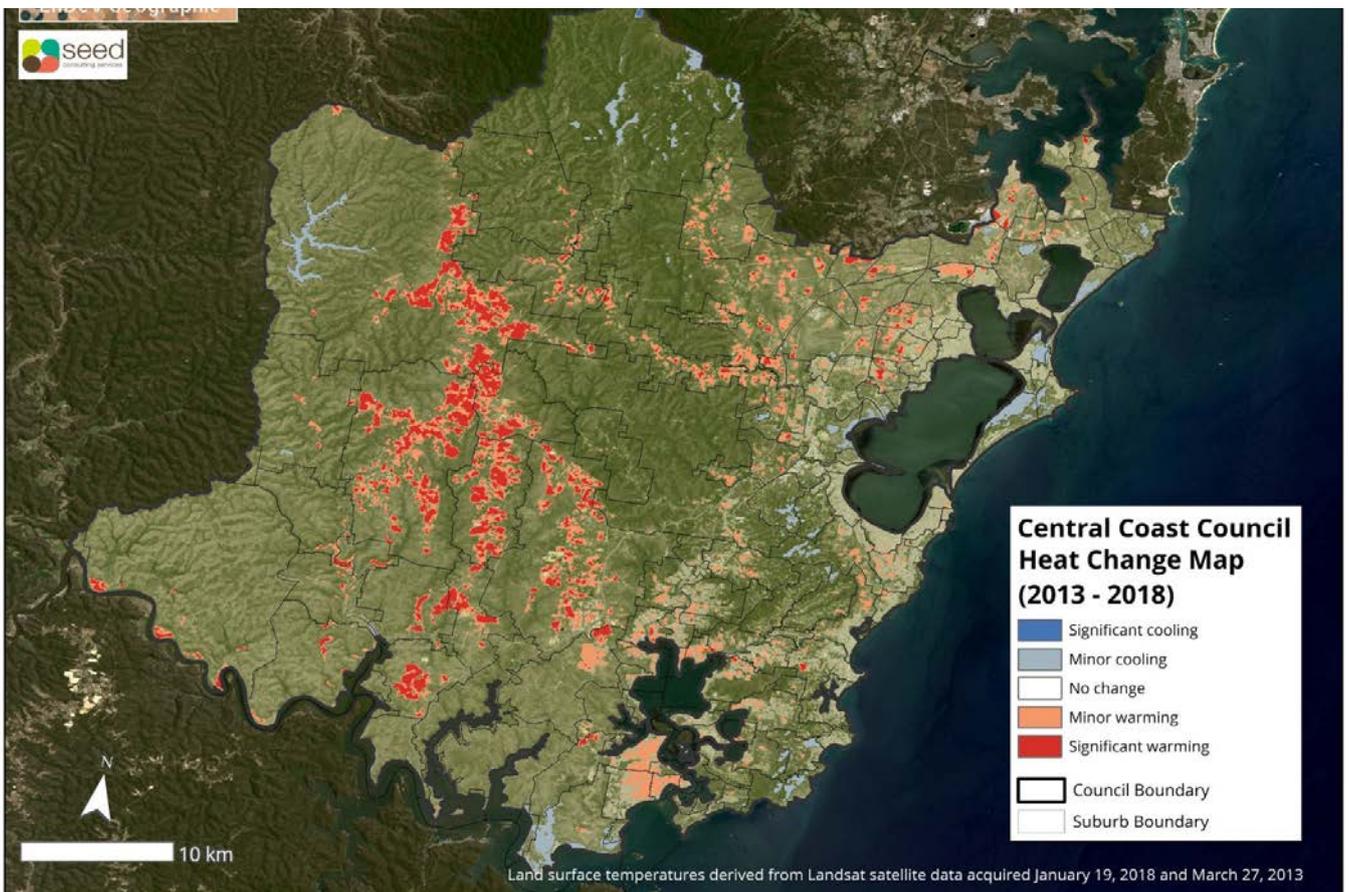

Figure 10: changes in heat islands between 2013 and 2018 for the Central Coast Local Government Area.

Mitigating Urban Heat Island Effects: priority suburbs for urban greening

The urban heat island mapping indicated 19 suburbs for priority planting to mitigate urban heat island effects. For suburbs that have low levels of tree cover, it is anticipated that an aim of an increase of canopy cover by a further 5% will occur around 30 years after the initial installation. Where suitable public locations cannot be found for the specified number of trees, alternative mechanistic approaches such as providing trees and large shrubs to schools, health facilities, private open space providers such as golf courses and private residents where their land will strategically address the urban heat island effect and a guarantee can be provided that the tree will be maintained into the future.

Bateau Bay
Blackwall
Blue Bay
Booker Bay
Davistown
Ettalong Beach
Gorokan
Kariong
Killarney Vale
Lake Haven
Long Jetty
Point Frederick
St Hubert's Island
The Entrance
The Entrance North
Toowoon Bay
Umina Beach
Woy Woy
West Gosford

Challenges facing the urban green places?

The Central Coast is currently home to 325,000 people, which is expected to increase to 415,000 by 2036, with the growth being met by increased demand for housing and employment (NSW Department of Planning and Environment 2016). This will result in housing intensification in existing areas, such as the construction of medium density housing in existing suburbs, along with the development of greenfield housing sites, in the area covered by the North Wyong Shire Structure Plan. Industrial areas of the Somersby Plateau and North Wyong will also continue to be developed. The projected level of urban intensification and expansion will require careful planning for the development, maintenance and expansion of urban green spaces. The Gosford CBD will be subject to the extensive development of residential flat blocks and other medium to high density buildings.

Both greenfield and urban infill development convert existing rural or larger lot residential areas to a more intensive landuse, including townhouse development. These types of developments often require extensive cut and fill excavation, which means existing remnant trees cannot be retained without compromising the tree protection zone or tree structural root zone. Removal of urban canopy cover increase the Urban Heat Island effect and as such, require strategic management of appropriate vegetation to reduce these effects.

Other common threats to the long-term survival of urban green vegetation include:

- An ageing urban forest: as many of the trees of the Central Coast are remnant trees from the native vegetation that formerly occurred on the site. These trees are often mature or over-mature, thus towards the end of their Safe Useful Life Expectancy (SULE).

- The impacts from insect attack and emerging diseases on residual tree populations. Urban trees may be stressed from insect attack, such as an overabundance of Psyllids that can cause severe dieback in Eucalypts (Hall et al. 2015). Pests and diseases can cause trees that are part of the urban forest to die or become severely stressed, which may require removal or significant pruning.

- The impacts of warming and heatwaves on tree death. Heatwaves are known to potentially result in tree death, especially if the tree is already stressed from drought (Choat et al. 2018).

- The impact on storms and floods on the urban forest. This includes trees failing due to wind throw, branch shear caused by strong winds. It is likely that storms will become more severe in the future as a result of climate change which will require consideration of which species are more resistant to storm events.

- Required clearance between trees and overhead services which require regular pruning. Pruning may reduce the structural integrity of trees and reduce their overall appearance. Ausgrid have been expanding the use of Aerial Bundled Cables for overhead services on the Central Coast which will reduce the level of required pruning in the future.

- The NSW Government's 10/50 Bushfire Code of Practice. This Code, on certain lands, permits the removal of canopy trees within 10 metres of approved dwellings, on bushfire prone land, unless their retention is required as part of a Plan of Management or development application Condition of Consent.

- Council's tree Development Control Plan (DCP) allowing the removal of any tree that occurs within 3 metres of an approved dwelling.

- The lack of appropriate replacement of trees removed for the above reasons, which may over time cause a decrease in the extent of the urban forest.

Purpose & Scope

The key challenges facing the urban green places across the Central Coast region are due to rapid urbanisation, planning controls that do not adequately incorporate urban greening as part of new development and inadequate support for the community in implementing urban greening on private land. In general, there is a lack of clear direction to implement the greening vision, highlighting the urgency for this Strategy.

The Strategy also fills the current gap in former Councils direction to ensure that urban greening is tenure blind, in expanding support to private individuals to assist with implementing the Greening Vision.

Scope

The strategy is developed with consideration for all existing and future strategies and plans currently in development by Council. The strategy also informs future planning controls, technical guidelines, programs and relevant project delivery (figure 11)

Purpose

The Strategy aims to provide strategic directions to:

1. Facilitate the on-ground delivery of the greening vision for the region through increased reference to urban greening within planning controls, technical guidelines and review of internal Council processes.

2. Ensure that the community values for green spaces and places is retained whilst building community capacity to support the greening vision for the region.

3. Mitigate and adapt to the changing climate and ensure that the ecological values of these green spaces are retained and enhanced.

4. Improve the urban amenity that enhance the liveability, create vibrancy and support economic opportunities across the region.

Figure 11: Integration from the Greener Places Strategy to existing and future Council strategic planning documents and operational plans.

The circular diagram shows the "Greener Places Strategy" at the center, connected to:
- Green Grid Plan
- Biodiversity Strategy and COSS Plan
- Strategic Conservation Planning
- Planning Controls (LEP / DCP)
- Active lifestyle strategy
- Greenfield Development Guidelines
- Central Coast Landscape Design Guidelines
- Spatial Plan / Corridors and Masterplans

Planning framework

A range of legislative instruments, policies and strategies referred to as guiding documents, relate directly to the Greener Places Strategy. A detailed summary of these is included in Appendix 1.

International treaties and non-binding agreements

Agenda 21 – the Rio Declaration on the Environment and Development 1992	UN Convention on Biodiversity 1992
A framework for the conservation and management of the Earth's resources, including how Government can implement these actions locally.	Parties to consider the implementation of ecological sustainable development.

Australia's Biodiversity Conservation Strategy 2010-2030

Aimed at restoring fragments landscapes and aquatic systems and provide ecological corridors to improve long term ecological resilience and reducing the impact of urban development on natural areas.

New South Wales State Government Legislative direction

NSW Environmental Planning and Assessment Act 1979	Biodiversity Conservation Act 2016	Local Government Act 1993	Roads Act 1993	Rural Fires Act 1997	Local Land Services Act 2013

Central Coastal Regional Plan 2036

Actions to protect and enhance the existing amenity of the region, namely, open space and scenic amenity. Specific actions:

Action 8.1 Protect the Central Coast Scenic Amenity by planning for development that respects the distinct qualities of different places

Action 18.4 Enhance the amenity and attractiveness of existing places

Action 18.5 Implement strategies to invest in open space, sporting and recreational infrastructure

Central Coast Council's Community Strategic Plan 2018-2028

Supports the protection of trees and vegetation, addressing climate change and ensuring ecological sustainable development (E1 F1 F2 F4 L3)

CHERISHED AND PROTECTED NATURAL BEAUTY   BALANCED AND SUSTAINABLE DEVELOPMENT   ENVIRONMENTAL RESOURCES FOR THE FUTURE

Climate Change Policy 2019	Greening Wyong Strategy	Central Coast Sustainability Strategy	Central Coast Biodiversity Strategy	Local Strategic Planning Statement	Tree & Vegetation Management Development Control Plan (DCP)

Greening vision framework for Central Coast

Vision

Improving regional liveability by maintaining and enhancing tree canopy cover and green space across the Central Coast urban areas.

The framework

The framework provides an overarching pathway integrating strategic and operational planning of the greening vision and on-ground delivery of the greening projects. The flow chart on page 34 outlines this integration, including documents that will be prepared to accompany this strategy. This includes integration with other strategic planning documents, such as the Central Coast Regional Plan and how urban greening is to be integrated with future public works, such as those completed as part of private development. The frameworks also set a clear pathway and defines the roles and responsibilities for the implementation of the vision.

The framework provides pathways for improved greening outcomes from both Council projects and from private development. This includes the relevant guiding documents, the interaction with relevant Council business units, the establishment of project steering groups and the identification and establishment of a project implementation team once the project is at the construction and/ or implementation phase. For greening projects associated with private development, this includes the detail required in landscape plans, and how these are integrated into the Development Application process.

CENTRAL COAST REGIONAL PLAN

CENTRAL COAST COMMUNITY STRATEGIC PLAN

LOCAL STRATEGIC PLANNING STATEMENT

GREENING VISION FRAMEWORK

PLANNING INSTRUMENTS [LEP & DCP]

DEVELOPMENT CONTRIBUTIONS 7.11 + 7.12

LAND USE APPROACH
1. New Urban Release
2. Infill Developments
3. Everything Else

DESIGN IMPLEMENTATION

STANDARD DRAWINGS

Civil
Drainage
Landscape
Miscellaneous [gates, bins, drinking fountains etc.]

LANDSCAPE DESIGN GUIDELINES

Engineering Guidelines SQID/ WSUD
Drainage Design
Batter and Fencing Guidelines

SITE SPECIFIC DCP'S FOR TOWN CENTRES

Streetscape Master Plans Public Domain Plans
Town Centre Strategies Town Centre Structure Plans

PROJECT DELIVERY

PROJECT SPONSOR

VISION KEEPER [CAPITAL WORKS]

DESIGN MANAGEMENT/ QUALITY CONTROL

COUNCIL LED

DEVELOPER LED

PRODUCTION OF AN REF OR EIS AS REQUIRED
Following the intial community consultation phase and prior to final Councillor endorsement for construction.

CONCEPT/ COMMUNITY & COUNCILOR ENDORSEMENT PHASE
Review initial concept. Ensure it meets Council's Design Management Toolkit and Community/ Councilor Expectations

CONSTRUCTION DOCUMENTATION PHASE
Construction Documentation

CONSTRUCTION PHASE
Construction Management

CONCEPT/ DA PHASE
Review initial concept and Pre DA proposal. Ensure it meets Council's Design Management Toolkit. To be prepared by a Level 3 certified landscape architect.

CONSTRUCTION CERTIFICATE PHASE
DA Referral/ CC Approval, Value Engineering Process

CONSTRUCTION PHASE
Construction Management

LANDSCAPE DESIGN DA REPORT

SHOULD CONTAIN
Landscape Site Analysis
Landscape Design Statement
Identification of Relevant

DCP Controls
Landscape Concept/ Master Plan
Sections and Elevations
Councils Typical Details
Plant Schedule
Materials and Finishes Schedule
Indicative Landscape Maintenance Schedule

MAINTENANCE/ HANDOVER PHASE
Council Asset Management for a period of 12 - 24 months

COUNCIL HANDOVER

The framework priorities

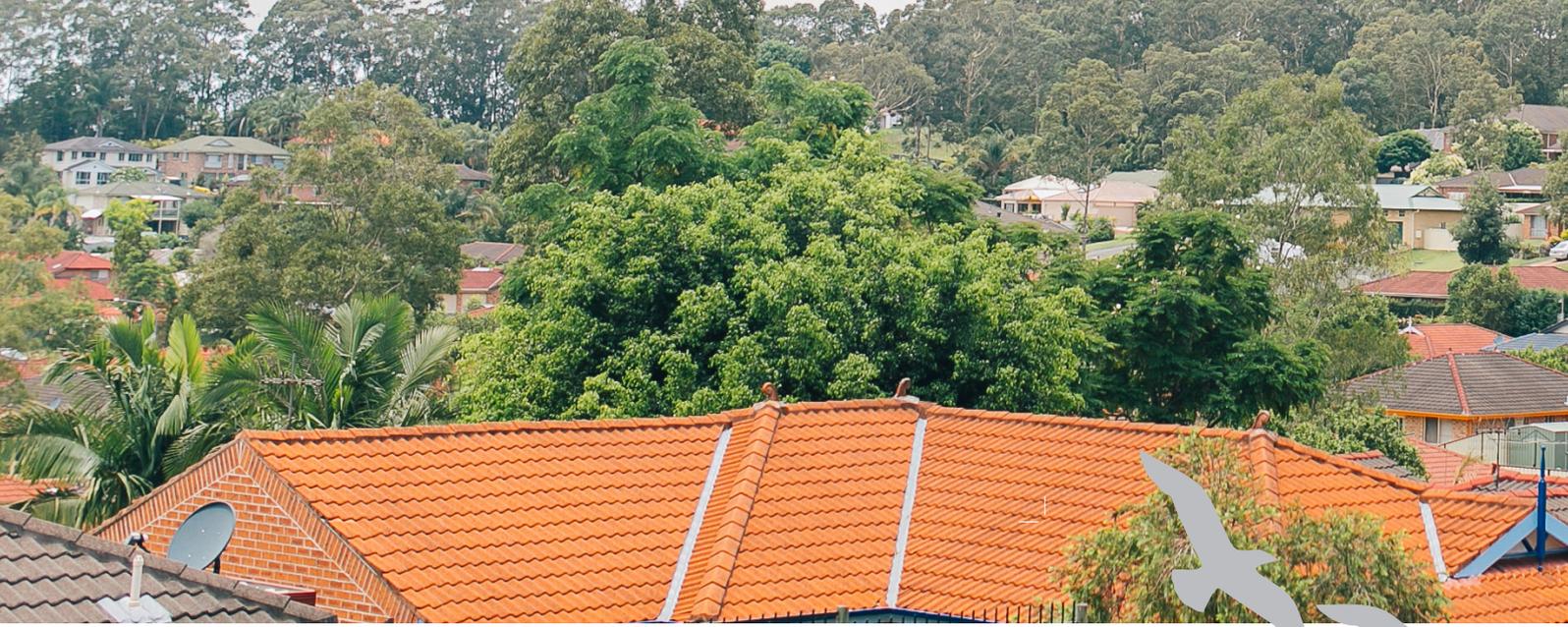| Framework Priorities			
1	**2**	**3**	**4**
Enhancing Council's capacity and capabilities to implement the greening vision across all land tenures.	Creating liveable places for people to enjoy and increase community capacity to participate in the greening vision.	Enhancing ecological resilience and responding to climate change across the region.	Improving value for money alternative transport options such as walking and riding, leading to an improvement in liveability, real estate demand and tourism potential.

The guiding principles for greening

1	Urban green spaces, in particular the urban forest on both private and public land benefits the Central Coast community through the provision of ecosystem services.
2	Public open space is enhanced by suitable plantings of trees, shrubs and ground covers and successional tree planting and replacement must be an integral part of all open space planning.
3	Existing trees, in particular large mature canopies and the space they occupy have a high replacement value and tree retention should be given precedence over removal.
4	The urban forest canopy must be maintained at the suburb scale, avoiding trees during the planning stage of individual developments and any loss to be offset through supplementary planting nearby.
5	Trees and other landscaping contribute to a particular 'sense of place' for people in individual locations or suburbs, such as Norfolk Island pines at Terrigal and The Entrance or canopy trees retained at Pearl Beach and as such, tree cover in those areas should be maintained or expanded through succession planning.
6	Native trees and shrubs provide greater habitat value to wildlife than exotic species and as such, should be favoured over exotic species.
7	Urban green spaces including pockets of shrubs and low unmanaged vegetation such as sedges and native grasses provide habitat for a range of urban wildlife and allow movement of wildlife.
8	The planting and maintenance of trees and large shrubs may not always be possible, but other urban greening such as rain gardens, green roofs and walls and median strips planted with midstorey vegetation can still contribute to the broad aims of urban forestry.
9	At times ageing or defective trees may need replacement, however their removal must be supported by appropriate expert opinion or analysis and successional planting.
10	Community play a critical role in the successful implementation of the greening vision through Landcare, community planting & Backyard Habitat programs, tree management on private and public lands

Greening Outcomes

The intended strategic outcomes in 2030 for each of the framework priorities is explored below.

Strategic Priorities	2030 Strategic outcome 1	2030 Strategic outcome 2
Enhancing Council's capacity and capabilities to implement the greening vision across all land tenures. **1**	Council is a leader in supporting the greening vision and climate resilience by implementing planting programs that address Urban Heat Island Effects, improve urban amenity and provide habitat for urban wildlife.	Planning controls are producing development that provides improved urban amenity through exemplar landscaping.
Creating liveable places for people to enjoy and increase community capacity to participate in the greening vision. **2**	Use of formal and informal open space increases and community wellbeing is improved.	Residents and school students actively participate in urban greening as observed through increased urban canopy cover.
Enhancing ecological resilience and responding to climate change across the region. **3**	Urban Heat Islands are decreasing in urban centres and along main pedestrian routes.	Increased observations of insects and birds in urban areas.
Improving value for money alternative transport options such as walking and riding, leading to an improvement in liveability, real estate demand and tourism potential. **4**	Improved perception that areas subjected to urban greening are higher value.	Increased use of shared paths and footpaths in areas subjected to urban greening.

Priorities and actions at a glance

From the four Framework Priorities, 21 Key Actions have been developed, as shown below. Actions may relate to more than one Framework Priority however have been included below in the priority that the action most aligns with. Actions are prioritised by their importances.

Framework priorities	Key Actions	Priority
Enhancing Council's capacity and capabilities to implement the greening vision across all land tenures. 1	1.3 Complete a Landscape Design Manual/ Guidelines to allow for improved greening outcomes in urban areas from both Council and private development.	Immediate priority
	1.4 Develop a Tree Planting / Replacement procedure for Council.	Immediate priority
	1.5 Review and align relevant procedures/ processes to ensure tree management compliance with relevant Australian Standards for trees.	Immediate priority
	1.6 Develop a tree management system to track the success of plantings over time.	Future low resource actions
	1.7 Complete the draft Central Coast Green Grid plan by March 2021.	Immediate priority
	1.8 For each Social Planning District, develop a Green Grid implementation plan.	Immediate priority
	1.9 Develop methodology & process to review and update local heritage significance trees in the Comprehensive Local Environmental Plan on needs basis.	Future low resource actions
	1.8 Amend planning controls to require that all new medium and high-density development to consider appropriate Urban Heat Island mitigation as part of the development.	Immediate priority
	1.9 Prepare planning controls and consider development incentives to improve tree planting and retention outcomes from development and require medium and high-density developments to propose and implement best practice green infrastructure such as green roofs.	Immediate priority

| Creating liveable places for people to enjoy and increase community capacity to participate in the greening vision.

2	2.1 Mitigate urban heat islands in the 19 priority suburbs through planting canopy trees along high activity pedestrian routes.	Future high resource actions
	2.2 Develop and promote community/School programs and events to improve regional biodiversity and tree management such as a Backyard Habitat program, Citizen Science program & support establishment of native gardens on private lands.	Future low resource actions
	2.3 Ensure all areas of open space have sufficient canopy cover and undertake successional planting in areas with an ageing canopy.	Future low resource actions
	2.4 Coordinate community street greening activities where Council is approached by six or more properties in a street.	Future low resource actions
Enhancing ecological resilience and responding to climate change across the region.

3 | 3.1 Undertake planting of suitable native species of trees, shrubs and groundcovers to act as biodiversity corridors in areas where connection between remnant bushland has been lost. | Future low resource actions |
	3.2 Review and update Council's Water Sensitive Urban Design Manual and Civil Works Specification to increase areas of non-forested habitat on both private lands and in new subdivisions.	Immediate priority
	3.3 Review and update Council's planning controls to include consideration of Urban Heat Island Effects for all future subdivision and medium and high-density development.	Immediate priority
	3.4 Audit and enhance aquatic habitat quality throughout Council's constructed and natural wetland network.	Immediate priority
	3.5 Develop partnerships with Universities to facilitate research projects that determine which species are best suited to future climate.	Immediate priority

Improving value for money alternative transport options such as walking and riding, leading to an improvement in liveability, real estate demand and tourism potential.	4.1 Partner with the development industry to investigate development models that sustain tree populations and deliver return on investment.	Future low resource actions
	4.2 Identify opportunities for community partnerships to fund and resource landscaping and streetscape improvement projects.	Future low resource actions
4	4.3 Require consideration of walkability and connected open space in all Masterplans and planning proposals.	Immediate priority

Implementation

The actions identified will be delivered over the next 15 years through operational planning and considered in the operational and capital budgets by the relevant areas of Council. This will be supplemented by grant funding where available.

The staged implementation will occur over the following pathways:

1. Embed the greening principles across Councils strategic and project planning, operational delivery and ongoing asset management or maintenance. These includes a tree management planning and maintenance regime as described on page 34.

2. Development of technical documents that ensure the correct species are selected and that urban design outcomes are met.

3. Development the Green Grid Plan for the Region identifying broad locations for urban greening.

4. Developing Operational Planting Project Plans, including for the 19 priority suburbs through Green Grid delivery plans for 17 social planning districts.

5. Implementation of projects until 2030.

6. Develop and facilitate ongoing community-based planting projects and involvement of community in planning and delivery of planting projects.

7. Partnerships with Universities to ensure greening programs are scientifically sound and consider future climate.

Important considerations for implementation

Ensuring the implementation of this Strategy does not significantly increase bush fire risk

Approximately 70% of the Central Coast is classified as bush fire prone and historically large bush fires have occurred regularly. It is important that tree management completed as part of this Strategy does not significantly increase bush fire risk to assets on the Central Coast. This will be achieved by the following practices in bush fire prone land:

• Installation of large shrubs and trees rather than ground layer vegetation in bush fire prone areas, where ground layer vegetation will be maintained through regular mowing and slashing;

• Installing canopy plantings that contain smooth, less flammable bark in bush fire prone areas;

• Ensuring a gap of at least two metres occurs between the roofline any building and likely edge of canopy plantings;

• Ensuring that planted trees reach a maximum intended canopy of less than 15% foliage cover, with spacing of at least five metres between stems.

• Priority will be given to planting non-sclerophyll species at the bushland interface with species with high moisture such as Lilly Pilly and Tuckeroo.

• Suburb specific planting plan or park successional planting plan, these will be compliance with relevant Codes of Practice such as the Rural Fire Service's Planning for Bush fire Protection.

The importance of appropriate tree selection

Historically during the planting of trees on road reserves, their future size was not always considered. This resulted in damage being caused to roads and footpaths and the requirement of regular pruning of trees planted under power lines. At other times, species selection has not considered aspects such as provision of shade, benefits to wildlife or use of species that are best suited to the space.

To ensure appropriate tree species selection, the following questions must be addressed during place based planning including:

- Are there height restrictions for the site, such as overhead power lines or nearby buildings? If so, only plants with an estimated maximum height of less than five metres should be used.

- Are underground services present? If could sedges, grasses or small shrubs be used?

- Is the site highly developed such as within a main street and as such, is a deciduous species more suitable for use than an evergreen species such as allowing additional solar access in winter.

- How large is the space? Should a species that reaches a large maximum height and spread be used rather than smaller specimens from species that reach a smaller height and spread? What planting mix would best address any heat island issues?

- How can the specimen enhance the space? For example, would a large tree with a spreading canopy enhance the space or make it feel cramped?

- In parkland situations, which specimens will enhance the passive recreational opportunities of the area? In these

- situations, one or two larger species should be used instead of multiple smaller ones?

- Are there other historical plantings in the area which future plantings need to compliment? If so, the same or similar species must be considered.

- Is the site on bushfire prone land? If so, bushfire considerations need to be met.

- Is the site adjacent to bushland? If so, only local native species should be used.

The selection of appropriate tree stock is also essential, with any trees planted as part of this Strategy being in accordance with any relevant Australian Standard regarding Tree Stock for Landscape Use. Prior to Council accepting any stock, inspections must occur to ensure root growth and growth form is consistent with the Australian Standard.

Replacement of removed public trees and maintenance of urban wildlife habitat

Each year Council removes over 1,500 public trees. To ensure that public tree canopy cover is maintained, this Strategy identifies a number of standards in which removed trees must be adequately replaced and maintained where suitable funds occur. Accordingly, the following procedures are to be followed:

- All removed trees must be replaced within 12 months of their removal by no less than two replacement trees.

- Where practicable, replacement trees should be planted within 50 metres of the site of the tree removal or alternatively within the same suburb.

- Replaced trees must be monitored for no less than two years and if they are substantially damaged or die during that time, they must be replaced.

- If removed public trees contain tree hollows, their loss must be compensated by the installation of at least two nesting boxes nearby for every hollow that is lost.

This process is captured within Council's internal systems and subject to regular internal reporting.

The importance of involving community groups in implementing this Strategy

Existing community groups are already actively involved in promoting the retention and expansion of the urban trees and green spaces. It is considered that these types of groups offer the greatest benefit in incorporating their on-ground work in parks rather than along roads due to the inherent risks along roadsides from utilities and traffic.

Street tree Planting

When suitable funds are available, street tree planting events will occur through Council coordination rather than through coordination by community groups. These events will occur where six or more properties on a street contact Council requesting street tree planting in a single application by Council staff. Council will then contact a representative of the interested residents and arrange a date for planting. The development of a community education program where tubestock will be provided to residents as part of the Backyard Habitat program will be investigated, where funds allow. It is then expected that the residents will undertake initial watering and monitoring of trees to determine if failure or damage occurs.

Backyard Habitat program

The majority of the urban trees, which make up the Central Coast Urban Forest occur on private land and as such, the involvement of the community in protecting and expanding the urban forest is paramount. To maintain and expand the urban forest on private land, a three-year trial of the Backyard Habitat program will be trialled where residents can join the program and receive free tubestock to be planted on their property along with advice and networking opportunities with other local residents.

Promoting Citizen Science

This Strategy supports the use of Citizen Science programs to quantify the value of the Central Coast urban greenspace as providing habitat for fauna, including insects, mammals and birds.

Possible Citizen Science programs that will be investigated for development through the Backyard Habitat program include:

- The development of a smartphone application which allows the community to log sightings of different vertebrate and invertebrate wildlife, including the establishment on an online community that can assist with species identification.

- Annual urban ecology "BioBlitz" events to engage the community in Citizen Science activities, where the community participate in activities to survey invertebrates and vertebrate fauna in urban parks along with quantifying diversity of plants and fungi.

- Recording the effects of shade trees on lowering air temperatures in urban areas.

Monitoring & Reporting

Monitoring, evaluation, reporting and improvement strategies for the urban greening

A Monitoring, Evaluation, Reporting and Improvement (MERI) committee will be established to guide the implementation of this Strategy. It will consist of representatives from relevant sections of Council. The committee will meet twice annually and track the progress towards meeting the identified actions and benchmarks. Once every two years the committee will undertake a review of the identified actions and determine if the actions require amendment or modification, allowing for continuous improvement of the Strategy. A full review of the Strategy will occur alongside the Integrated Planning and Reporting Framework cycle. The full review is to:

- Resurvey of tree canopy cover using the iTree application in each urban suburb.

- Resurvey of heat island mapping using Landsat 8 imagery to determine the level of change in heat mapping.

- Determine if the level of tree removal has changed over time and if so, if additional planting is required in suburbs not currently considered for broadscale planting.

- Determine if the levels of identified planting are being met and if not, what strategies can be put in place to meet the planting targets.

- Determine progress towards the 2030 Strategic Goals identified against the four framework priorities.

- Present the results of the review to the elected Council.

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