Sunshine Coast COUNCIL

Environment Levy Program

Koala Conservation Plan

Your Environment Levy in action

www.sunshinecoast.qld.gov.au
mail@sunshinecoast.qld.gov.au
T **07 5475 7272** F **07 5475 7277**
Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Acknowledgements

Council wishes to thank all contributors and stakeholders involved in the development of this document.

Acknowledgements

The Sunshine Coast Koala Conservation Plan has been prepared by Ecosure Pty Ltd on behalf of Sunshine Coast Council. Officers from Sunshine Coast Council have been integral to the development of this plan.

Work undertaken by SEQ Catchments and OWAD Environment has also provided valuable information to assist with the development of this document.

Contents

List of figures

List of tables

1 Introduction

Council's aspirational vision for the Sunshine Coast is to be Australia's most sustainable region – vibrant, green, diverse. Many people and organisations play vital roles in achieving that vision and the actions that convert that vision to reality. This Koala Conservation Plan is about more than the protection of one iconic species. It further supports existing frameworks for council and community to work in partnership to protect our unique natural environment and all the species within it.

The koala (*Phascolarctos cinereus*) is an iconic Australian marsupial. Compared with the plight of lesser known endangered and critically endangered fauna, the koala's widespread popularity and attention may seem disproportionate to its vulnerable conservation status allocated under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Nature Conservation Act 1992* (NC Act). However, actions towards the conservation of this flagship species have the potential to benefit a multitude of species which share habitat with the koala.

Koala populations in South East Queensland (SEQ) show a declining trend due to a range of threatening processes (EPA 2006; Department of Environment & Heritage Protection [EHP] 2014). Co-ordinated and strategic approaches to koala conservation are required to alleviate these impacts. This Koala Conservation Plan (KCP) is the instrument by which Sunshine Coast Council (Council) can focus their operations and resources to address threats and improve conservation outcomes for koalas.

Policy and Legislative Context

The *Sunshine Coast Council Corporate Plan 2014-2019* sets the strategic direction and priorities for Council to be Australia's most sustainable region – vibrant, green, diverse.

The *Sunshine Coast Biodiversity Strategy 2010-2020* provides a framework for managing biodiversity in the Sunshine Coast Local government area and identifies the koala as a significant species.

At a State level South East Queensland Koala Conservation State Planning Regulatory Provisions (Koala SPRP) apply in addition to local planning instruments:

In addition, the South East Queensland Regional Plan 2009-2031 aims for a net gain in koala habitat by managing conflict with urban development.

1.1 Purpose of this plan

The Biodiversity Strategy Implementation Plan 2010-2015 identifies the development of a KCP as a 'high priority action'.

This KCP will guide management actions to retain a viable koala population, and preserve and enhance suitable habitat in the Sunshine Coast Local Government Area (SCLGA). This plan is intended to provide clear, measurable and prioritised actions, based around five 'Desired Outcomes', as well as delegated responsibilities for implementation.

The overall objectives of the KCP are:

- to determine where koalas exist in the SCLGA and understand threatening processes at the local level
- to create robust scientific datasets, including koala habitat mapping, which will form the basis of management decisions
- to identify priority locations and target management actions in order to enhance the quality of core koala habitat and improve connectivity

- to ensure planning and development assessment processes support the protection of koalas and their habitat
- highlight where mitigation measures are most required and actions needed to monitor effectiveness
- Guide community involvement in programs and partnerships that increase koala habitat availability and enhance connectivity, build understanding and mitigate threats.

The implementation of the actions identified in this plan should be considered on an annual basis and be subject to available resources. The Environment Levy may provide a funding opportunity to assist with implementation. Participation of Sunshine Coast residents, businesses, industry, and community groups is integral to the success of this plan.

The KCP aims to address knowledge gaps arising from previous studies, direct managers towards urgent priorities and actions as well as provide transparency regarding the allocation of resources to achieve koala conservation.

1.2 Koala ecology

Diet

The koala is a folivorous arboreal marsupial primarily restricted to eucalypt woodlands and forests containing their preferred food tree species (Lee & Martin 1988). Within a given area only a few of the available eucalyptus species will be preferentially browsed, while others, including some non-eucalypts, may be incorporated into the diet as supplementary browse and/or utilised for other purposes (Lee & Martin 1988; Hindell & Lee 1990; Phillips 1990; Callaghan & Thompson 2000; Phillips & Callaghan 2000). Due to their highly specialised diet, food availability is thought to be a key determinant of high koala habitat quality (Moore & Foley 2000). High nutrient soils affecting palatability of the leaves (Reed, Lunney & Walker 1988), forest area and landscape configuration are also considered to be involved (McAlpine et al. 2007).

Flying-foxes are key pollinators for the persistence of eucalypt species (DECC 2008). Flying-foxes have the ability to distribute seed and cross-pollinate over significant distances during single foraging trips which is important in the context of fragmented landscapes and an example of the interdependence of these species.

Table 1 provides a list of preferred and supplementary koala food trees in the Sunshine Coast local government area (source: Australia Zoo). These species should be prioritised for ecological restoration of koala habitat, corridor enhancement or in community planting programs.

Table 1 Koala food trees in Sunshine Coast (Source: Australia Zoo 2015; Atlas of living Australia 2015 & Sunshine Coast Council)

Common name	Scientific name	Preferred soil type	Predicted importance
Queensland blue gum / forest red gum	***Eucalyptus tereticornis***	Well-drained soil types (heavy clay, clay loam, sandy loam) in alluvial locations; tolerates saline soil	Preferred
Tallowwood	***Eucalyptus microcorys***	Fertile well-drained moist soils along water courses	Preferred
Swamp mahogany	***Eucalyptus robusta***	Acidic soils in low lying near coastal areas including swampy waterlogged soils (heavy clay, sandy clay, alluvial sandy soil)	Preferred
Small-fruited grey gum	***Eucalyptus propinqua***	Moist clay-loam, well-drained acidic soils of low to medium fertility along slopes and watercourses	Preferred
Grey gum	***Eucalyptus biturbinata***	On soils of medium fertility, usually on sloping sites.	Preferred
Scribbly gum	*Eucalyptus racemosa*	Shallow infertile sandy soils over sandstone, groundwater dependent.	Supplementary
Red mahogany / red stringybark	*Eucalyptus resinifera*	Moderately to very fertile volcanic of sandy well drained soils on lower slopes	Supplementary
Flooded gum	*Eucalyptus grandis*	Lower slopes with moist well-drained deep, loamy soils of alluvial or volcanic origin	Supplementary
Sydney blue gum	*Eucalyptus saligna*	Deep clay based soils derived from shale, volcanic rock or deep alluvium	Supplementary
Spotted gum	*Corymbia maculata*	Adapts to a wide range of soils provided they are well drained	Supplementary
Narrow-leaved ironbark	*Eucalyptus crebra*	Shallow, sandy soils of medium fertility on hilly terrain at low altitudes	Supplementary
Grey ironbark	*Eucalyptus siderophloia*	Stony slopes and ridges in higher rainfall areas at low to moderate altitudes	Supplementary
Blackbutt	*Eucalyptus pilularis*	Sandy loams and loams, clays and volcanic soils with good fertility and depth	Supplementary
Orange gum	*Eucalyptus bancrofiti*	Mostly on wallum flats on sandy soils in coastal lowlands	Supplementary

Common name	Scientific name	Preferred soil type	Predicted importance
Broad-leaved white mahogany	*Eucalyptus carnea*	Shallow loamy soils on shale	Supplementary
White mahogany	*Eucalyptus acmenioides*	Sandy or stony soils	Supplementary
Tindale's stringybark	*Eucalyptus tindaliae*	Sedimentary and acid volcanic soils	Supplementary
Dunn's White Gum	*Eucalyptus dunnii*	Preferred soils are deep, fertile, moist and well drained on lower slopes of hills	Supplementary
Moreton Bay ash	*Corymbia tessellaris*	Deep soils of medium to high fertility	Supplementary
Pink bloodwood	*Corymbia intermedia*	Grows in a variety of soil types including poorly-drained clay	Supplementary

Home range

In SEQ, typical female and male home ranges have been found to be at least one to two hectares respectively, with a minimum of 4000 ha of good quality habitat required to support a viable breeding population of at least 500 individuals (McAlpine et al. 2007). Home range reflects the resource ability for required food, shelter and space for successful reproduction, hence a relative abundance of healthy large food and shelter trees would allow koalas to have smaller home ranges than would an area with less resources (Callaghan et al. 2011). As a guiding principle, when koala populations are deemed to be at demographic equilibrium, approximately 50% of otherwise suitable habitat is still likely to be unoccupied by resident aggregations (Phillips et al. submitted).

Movement

Koalas generally move very little. They occasionally change trees during the day, but are most active at night and during their breeding season (August to December).

Juveniles disperse at around 18-36 months of age, between June and December, travelling on average 3.5 km from their natal home range (Dique et al. 2004). When there are no significant barriers, average daily movements for female koalas have been found to be less than 100 m, with males moving approximately 200 m each day (McAlpine et al. 2007). Koala movement corridors should seek to be at least 100 m wide to minimise edge effects. Habitat patches that are separated by barriers and more than 10 km apart should be managed as separate populations (McAlpine et al. 2007).

1.3 Threats to koalas

In SEQ, the primary threats to koalas are associated with increasing urban landscape changes, including habitat loss and fragmentation, vehicle collisions, dog attacks (wild and domestic), and disease. The impact of these threats on koalas can vary considerably between regions and local areas, with wild dogs potentially accounting for a considerable proportion of koala mortality in one locality, while vehicle strike may be a key threat to survival in other areas. Understanding which threats, or combination of threats, are having the greatest impact on

koalas in the Sunshine Coast will be essential to guiding accurate and successful management actions.

Koala numbers have seen a 65% reduction on the Koala Coast population (comprising Brisbane City Council, Logan City Council, Redlands City Council, and former Pine Rivers Shire), from 6,246 to 2,279 during 1996-2008 (DoE 2015). Currently, little to no data exists regarding koala population trends within the Sunshine Coast local government area.

Human population growth on the Sunshine Coast is predicted to rise from 285,000 residents to 470,000 by 2036 (Queensland Government Population Projections 2013 edition). Land use planners and strategic decisions makers need to strike a balance: in accommodating urban growth and its associated infrastructure, alongside protecting habitat for koalas (and other native species). However, habitat protection alone is not enough to conserve koalas, without also minimising the effects of threatening processes.

Between 1997 and 2011 in SEQ, a total of 5,757 koala deaths were attributed to a combination of cars, dogs and/or disease (DoE 2015). Of this number, 4055 were killed by cars (QLD DERM 2011c) and at least 1,144 were killed by dogs (DoE 2015). Road-associated koala mortality is influenced by a variety of factors. Vehicle speed, high traffic volume or the breeding season may increase the probability of koalas being hit (Dique et al. 2003). Research showed 80% of koalas hit on roads with speed limits greater than 60 km/hr did not survive, however research shows survival on roads with lower speed (60 km/hr) is only marginally higher on roads with speed limits of 80 km/hr (Dique et al. 2003).

Koala admission records (n = 300) to the Australia Zoo Wildlife Hospital for the Sunshine Coast LGA between 2004 – 2014 provided the following local information:

37.0% Chlamydiosis

24.7% Vehicle strike

18.3% Sick – other

5.0% Dog attack

5.7% Orphaned/displaced

0.7% Misadventure

3.0% Unknown (mostly dead on arrival)

5.6% Injury – other

In 2014, only 23 of the 669 koalas treated at Australia Zoo Wildlife Hospital came from the Sunshine Coast LGA. Council's ongoing partnership with the Australia Zoo Wildlife Hospital through the Environment Levy Partnerships & Grants Program and the collation of mortality data will continue to help build our understanding of threats to the local koala populations.

Disease

Disease has been identified as a driver of the decline of some koala populations (Brown et al 1987; Rhodes et al 2011; Kollipara et al. 2013). Several diseases infect koalas, however the main threat is infection by bacteria of the genus Chlamydia, or Chlamydiosis, which occurs in most wild koala populations (Polkinghorne et al. 2013). Two species of Chlamydia, *C. pneumoniae* and more commonly, *C. pecorum*, have been identified in koala populations (Kollipara et al. 2013). *C. pecorum* is the most common chlamydial species associated with diseased koalas (Devereaux et al. 2003).

There is growing genetic evidence to suggest that *C. pecorum* infections in koalas may have originated from exposure to infected sheep and cattle (*C. pecorum* is also a major

pathogen of livestock; (Jelocnik et al 2013, Bachmann et al, in press)), raising questions over whether chlamydial infection and disease in koalas is a result of anthropogenic factors. This genetic evidence also suggests that this is an ongoing process and that koalas continue to be exposed to new *C. pecorum* strains that infect Australian livestock. On the other hand, genetic studies of *C. pneumoniae* the other and much less pathogenic chlamydial species infecting koalas, indicate that *C. pneumoniae* is genetically conserved, suggesting that this pathogen has infected koalas for millennia (Mitchell et al., 2010; PLoS Pathogen). The debilitating disease that is experienced by koalas as a result of their infections, compared to other hosts infected by chlamydiae, has also been used to support this hypothesis that *C. pecorum* is a relatively "recent pathogen" compared to *C. pneumonia*. However, more detailed evolutionary studies are still required.

Chlamydiosis is a debilitation disease, causing elevated rates of infertility and mortality (Hanger & Loader 2009); and is likely to be influenced when exposed to environmental stressors such as habitat loss and fragmentation (Brearley et al. 2012, Rhodes et al. 2011), and harassment by predators, nutritional and climatic stress, or overcrowding (Phillips 1997, Melzer et al. 2000, Phillips 2000, Lunney et al. 2012). Despite this, the understanding of the threat posed by disease, and its interaction with other threats, is still poorly understood.

Koala Retrovirus (KoRV) is a relatively recently discovered virus in koalas, and has been identified as a possible key driver of reduced immunity and immunodeficiency (Hanger et al., 2000), however our understanding of its potential threat to koalas is in its infancy. KoRV is considered unusual because it features both endogenous and exogenous viruses, and is also unusual because it is genetically most closely related to gibbon ape leukaemia virus (GALV), an exogenous retrovirus that has caused outbreaks of leukaemia and lymphoma in captive gibbon (Hylobates lar) colonies (Hanger et al., 2000; Simmons et al. 2012). To date, the prevalence of KoRV provirus in Queensland koalas is 100% (Meers et al. 2012).

Climate change

Climate change is also recognised as a threatening factor for koalas. Higher temperatures are associated with heat stress events, increases in fire occurrence or drought.

Recent evidence has predicted that climate change will contract current koala distributions eastwards towards the coast whereby the Sunshine Coast and its hinterland is likely to be a key area (Adams-Hosking et al. 2011). Variations in annual rainfall, including drought, is a key indicator of climate variability because it also provides a link to other changes, such as heat-waves and bushfires (Melzer et al. 2000). Unfortunately, this shift also coincides with regions typical of high human population densities and ongoing pressures from habitat loss, dog attacks and vehicle impacts (Adam-Hosking et al. 2011; Melzer et al 2000).

Mitigating the impacts of climate change is not directly considered as part of this Plan; however actions towards climate change adaption and monitoring programs are recommended within the plan and may assist with identifying impacts of climatic events as well as building resilience within koala populations.

1.4 Sunshine Coast koala population and habitat

The Sunshine Coast local government area covers an area of approximately 2,291 km^2. The Sunshine Coast Council Corporate Plan

2014-2019 outlines Council's vision to be '*Australia's most sustainable region – vibrant, green, and diverse'*. As one of Australia's most biodiverse regions, the Sunshine Coast contains 76 different regional ecosystem types supporting 1600 flora species and 700 fauna species. The koala is one of numerous threatened fauna species inhabiting the Sunshine Coast area. A recent study was undertaken (SEQ Catchments 2014a) to identify where koala habitat exists in the Sunshine Coast area based on vegetation communities and koala observation records. This desktop study suggested that 33 of the 76 regional ecosystems (REs) throughout the LGA are likely to provide suitable habitat, supporting the movement of koalas across the landscape (full list of REs provided in Appendix 2). As another early component of the KCP, a survey was undertaken to determine the presence/absence of koalas on approximately 50 Council reserves and a small number of Voluntary Conservation Agreement and Land for Wildlife[1] (LFW) properties. This study (OWAD 2014) used the Koala Rapid Assessment Method (OWAD 2014). Koala scats were recorded in the suburbs of Mapleton, Wootha, East Mount Mellum, Glenview and Buderim, and to a lesser extent Beerburrum and Glasshouse Mountains.

Council is aware of urban koala populations (i.e. Buderim and Caloundra), that may require targeted assessment and management. The actions provided in Section 2 of this KCP can be applied at a local scale to better understand these populations, their threats and the most appropriate course of management.

Determining current koala population distribution across the planning landscape is an essential pre-requisite for this management plan, and to inform landscape-scale koala population conservation in general. Furthermore, an analysis of historical koala records will also assist to inform planning decisions at the LGA level (Lunney et al. 1998; Phillips, Hopkins & Callaghan 2007; Phillips and Hopkins 2009).

Council already has a number of koala conservation initiatives. These include:

- implementing the *Sunshine Coast Biodiversity Strategy 2010-2020,* which sets the future direction for biodiversity management and identifies the koala as a significant species
- acquiring environmentally significant land, some of which has koala habitat, through the Environment Levy acquisition program
- increasing the level of protection on selected Environment Levy land to "Nature Refuge" status, thereby securing valuable koala habitat
- management of council's conservation network to protect and enhance koala habitat
- establishment of a three year environmental partnership with Australia Zoo Animal Hospital ($50,000 per annum), who treat injured koalas and assist with koala rescues
- implementation of provisions in the Sunshine Coast Planning Scheme, aimed at minimising the impacts of new development on koalas and koala habitat
- supporting Sunshine Coast land owners to manage land with high biodiversity value through Council's Land for Wildlife and Voluntary Conservation Agreement (VCA) programs
- Council's Community Nature Conservation Program, which includes over 40 community groups undertaking habitat restoration and protection, as well as participation in events such as National Tree Day

[1] LFW properties are not in protected tenure

- Coordinating and implementing a wild dog baiting program in peri-urban and rural areas through pest management programs.

1.5 Legislative context

The State government's *South East Queensland Koala Conservation State Planning Regulatory Provisions* (Koala SPRP) apply in addition to local planning instruments.

The Koala SPRP provisions apply in addition to any relevant matters applying under a local planning instrument for assess and deciding a development application.

Under section 19(1) of the *Sustainable Planning Act 2009*, if there is an inconsistency between the Koala SPRP provisions and another planning instrument, or any plan, policy or code under an Act, the Koala SPRP provisions prevail to the extent of the inconsistency.

A local planning instrument will not be inconsistent with the Koala SPRP provisions to the extent it applies additional requirements taking into consideration local koala conservation interests.

1.6 Desired outcomes for the Koala Conservation Plan

The Sunshine Coast Koala Conservation Plan sets out how Council and the community can assist to manage and protect koalas and associated habitat in the local government area. It specifies the objectives and actions to achieve five desired outcomes:

1. Building our knowledge about Sunshine Coast koala populations
2. Koala conservation incorporated into planning and policy process
3. Koala conservation through partnerships and community engagement
4. Minimise the impact of threatening processes on koala population
5. Advocate, educate and lead by example.

1.7 Potential koala habitat and perceived threats

Geographic Information Systems (GIS) is an important tool in habitat and biodiversity management and protection. GIS allows decision makers to quantify the spatial distribution of suitable habitat for a species of interest. Reliable and repeatable methods for defining and predicting the distribution of habitat is critical for planning, managing and mitigating threats to koala habitat. To be effective, habitat models must be continually updated and amended as new data, including ground-truthing surveys recommended within this KCP, becomes available.

This GIS modelling will assist Desired Outcome 1 of the KCP. The aim was to:

1. Identify and rank the distribution and location of preferred koala habitat at the landscape and patch scales throughout the Sunshine Coast local government area.
2. Identify and rank locations of perceived threats (dogs, vehicles) to koala mortality.

The methods and results of this GIS modelling exercise are summarised below; with Appendix 1 providing further detail.

Habitat quality

A habitat model is a numerical representation of a species' habitat preferences (Wintle et al. 2005). In this case, and in the absence of ground-truthing surveys, koala habitat quality was determined using the predicted abundance of preferred koala food trees (Biolink 2007). Data used in the creation of the SCLGA (landscape scale) koala habitat

quality map included:

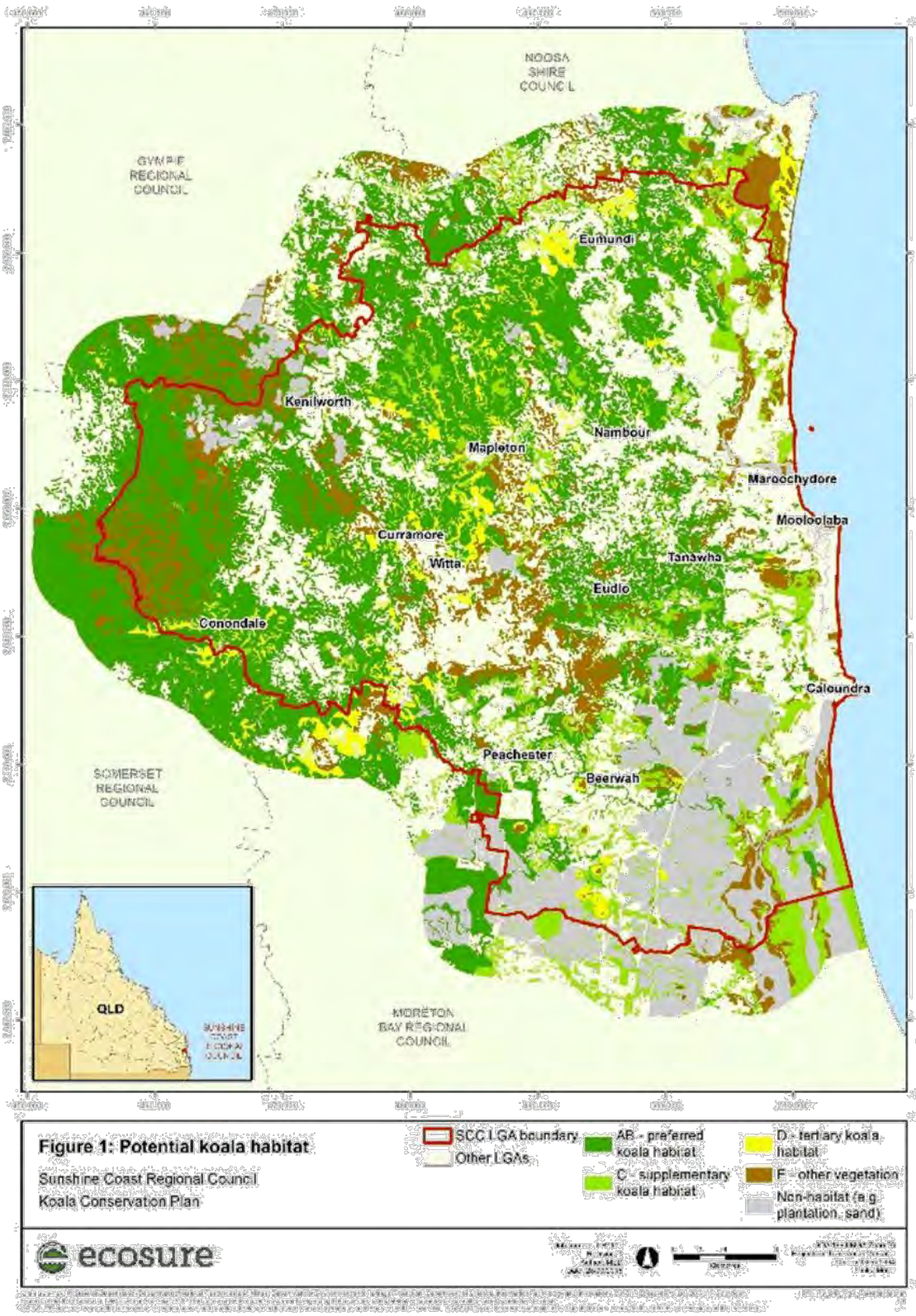
- remnant regional ecosystems (Department of Science, Information Technology and Innovation (DSITIA) 2015)
- mature regrowth vegetation (Department of Environment and Heritage Protection (EHP) 2015).

REs are distinctive vegetation communities associated with particular geology, soils and landforms. Based on the predicted abundance of PKFTs in each RE, koala habitat was categorised into 'koala habitat quality classes' (Table 2). A number of classification decision rules were also applied (see Appendix 1 for further detail).

Table 2 Koala habitat quality classes used to develop a potential koala habitat map for the SCLGA

Habitat quality class	Habitat quality class (from Biolink 2007)	Classification criteria
Preferred koala habitat	A - Primary koala habitat B - Secondary koala habitat	> 5% PKFTs
Tertiary koala habitat	C - Tertiary koala habitat	< 5% PKFTs
Supplementary koala habitat	D - Supplementary koala habitat	Eucalyptus community with no PFKTs
Other vegetation	E - Other vegetation	Non-eucalypt community

These koala habitat quality classes are illustrated in Figure 1, where Preferred, Tertiary and Supplementary koala habitat are all considered **'potential'** koala habitat.


NOOSA SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
Eumundi
Kenilworth
Mapleton
Nambour
Maroochydore
Mooloolaba
Curramore
Witta
Tanawha
Eudlo
Conondale
Caloundra
Peachester
Beerwah
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
QLD
Figure 1: Potential koala habitat
Sunshine Coast Regional Council
Koala Conservation Plan
SCC LGA boundary
Other LGAs
A - preferred koala habitat
B - secondary koala habitat
C - supplementary koala habitat
D - tertiary koala habitat
E - other vegetation
Non-habitat (e.g. plantation, sand)
ecosure

Habitat values

For this plan, koala habitat has been considered at two different scales, the landscape scale (100-1000s ha) and the patch scale (1-100s ha), which covers the entire SCLGA.

Landscape scale (100-1000s ha)

To conserve a landscape that contains a sufficient amount of habitat to sustain a viable koala population, McAlpine et al. (2007) recommends maintaining at least 40 – 50% of the landscape as primary and secondary koala habitat. The protection of preferred koala habitat (Table 2) is considered high priority. As detailed ground-truthed surveys have not been carried out, this threshold is recommended to be set at 50 – 60% where koalas are known to occur in preferred koala habitat (McAlpine et al. 2007).

Habitat values rank indicates a predicted low, medium and high value for koala conservation within a 5 km^2 landscape grid are illustrated in Figure 2.

Patch scale (1-100s ha)

Patches of potential koala habitat (Preferred, Supplementary and Tertiary) illustrated in Figure 1 were ranked according to their value for sustaining viable koala populations (McAlpine et al. 2007). Patch size and shape were assessed based on decision rules provided in McAlpine et al. (2007), and subsequently their habitat value ranks were combined to provide an overall patch habitat value (Table 3, Figure 3).

Table 3 Koala habitat value ranking according to the combined ranks of patch shape and patch size.

Habitat values	Combined rank
High	2 or 3
Medium	4 or 5
Low	6 or 7

This is to be applied in the development assessment process when proposed development impinges on mapped koala habitat. The KCP recommends incorporating preferred koala habitat mapping and habitat values mapping into the SCC planning scheme (Desired Outcome 2), to facilitate transparent and defensible decision making regarding conditions for development approval in or near koala habitat.

Furthermore, a more manageable relationship between koala habitat patches and the corridors linking them can be appreciated at the grid scale. 'Habitat rank' may assist managers in identifying locations for habitat restoration or other conservation programs (Desired Outcome 3).

Habitat patch size

Conservation priority should be given to patches larger than 50-100 ha in size, with patches smaller than 2 ha given lowest priority unless they are a part of a cluster of highly connected patches that are no more than 100-200 m apart (Table 4).

Table 4 Koala habitat values ranking according to patch size decision rules

Contiguous patch size	Habitat values rank	Description
≥ 100 ha	1 - Very high	Viable patch size, low risk of local extirpation
≥ 50 and < 100 ha	2 - High	Priority for restoration and revegetation
≥ 2 ha and < 50 ha	3 - Medium	High priority for restoration and revegetation, high risk for koala mortality
< 2 ha	4 - Low	Area not considered large enough to support a koala population, but can function as a 'stepping stone' within a corridor

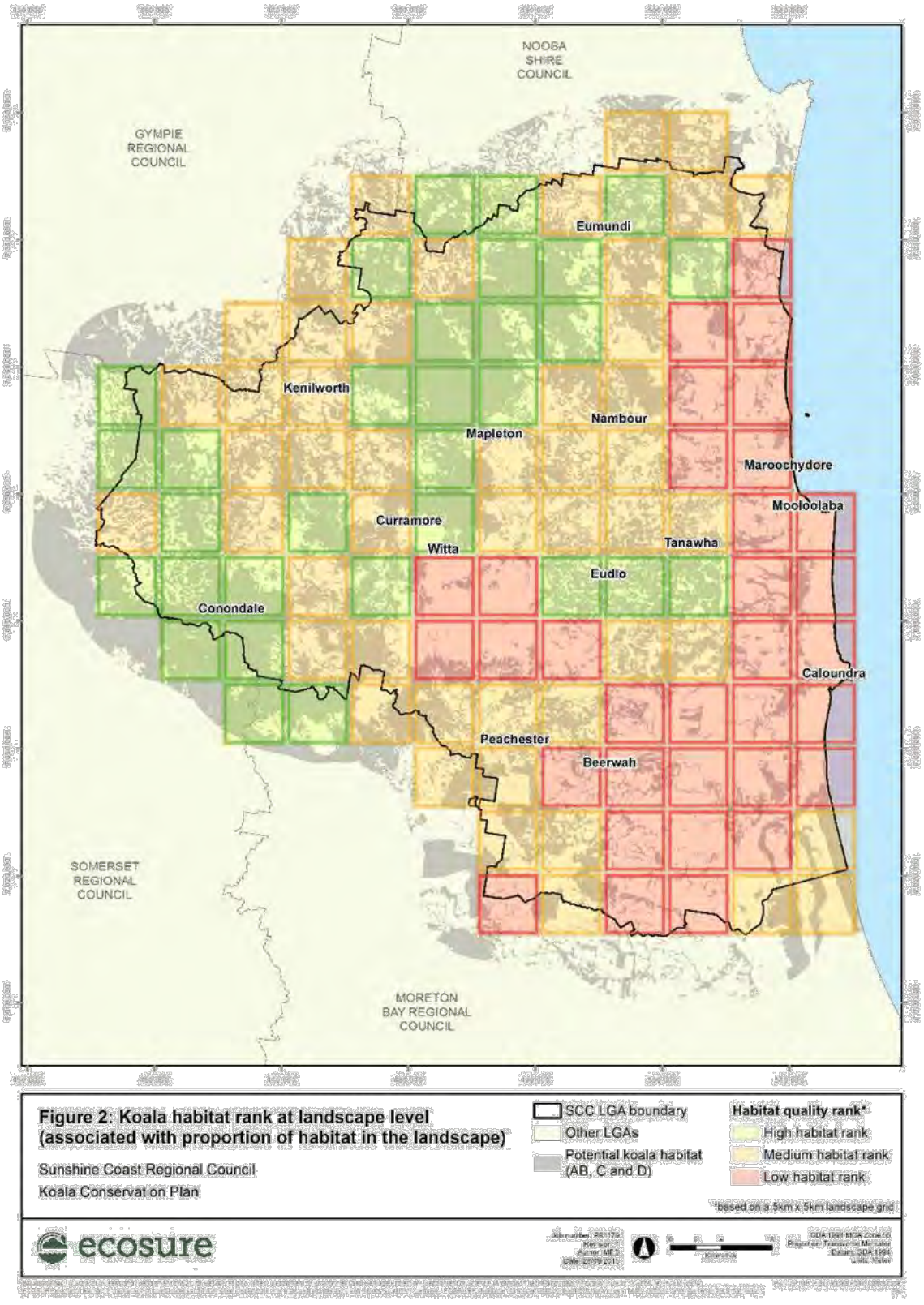
Habitat patch shape

To maintain and restore a landscape that contains patches of koala habitat, these patches should be more circular than linear so as to minimise edge effects. A perimeter: area ratio was calculated for each patch of potential koala habitat. Patches were classified according to the following criteria in Table 5.

Table 5 Koala habitat values ranking according to patch shape decision rules

Perimeter: area ratio	Habitat value rank
≤ 0.025	1 - High
>0.025 – 0.03	2 - Medium
>0.03	3 - Low

Patches flagged as low to medium rank in terms of shape should be the focus of rehabilitation programs aiming to widen the patch. Rehabilitation should involve planting local eucalypt species (see Section 1.2) and other local native species consistent with the pre-existing RE type and the koala's preferred food tree species for the area.


NOOSA SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
Eumundi
Kenilworth
Mapleton
Nambour
Maroochydore
Mooloolaba
Curramore
Witta
Tanawha
Eudlo
Conondale
Caloundra
Peachester
Beerwah
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
Figure 2: Koala habitat rank at landscape level (associated with proportion of habitat in the landscape)
Sunshine Coast Regional Council
Koala Conservation Plan
SCC LGA boundary
Other LGAs
Potential koala habitat (AB, C and D)
Habitat quality rank*
High habitat rank
Medium habitat rank
Low habitat rank
*based on a 5km x 5km landscape grid
ecosure

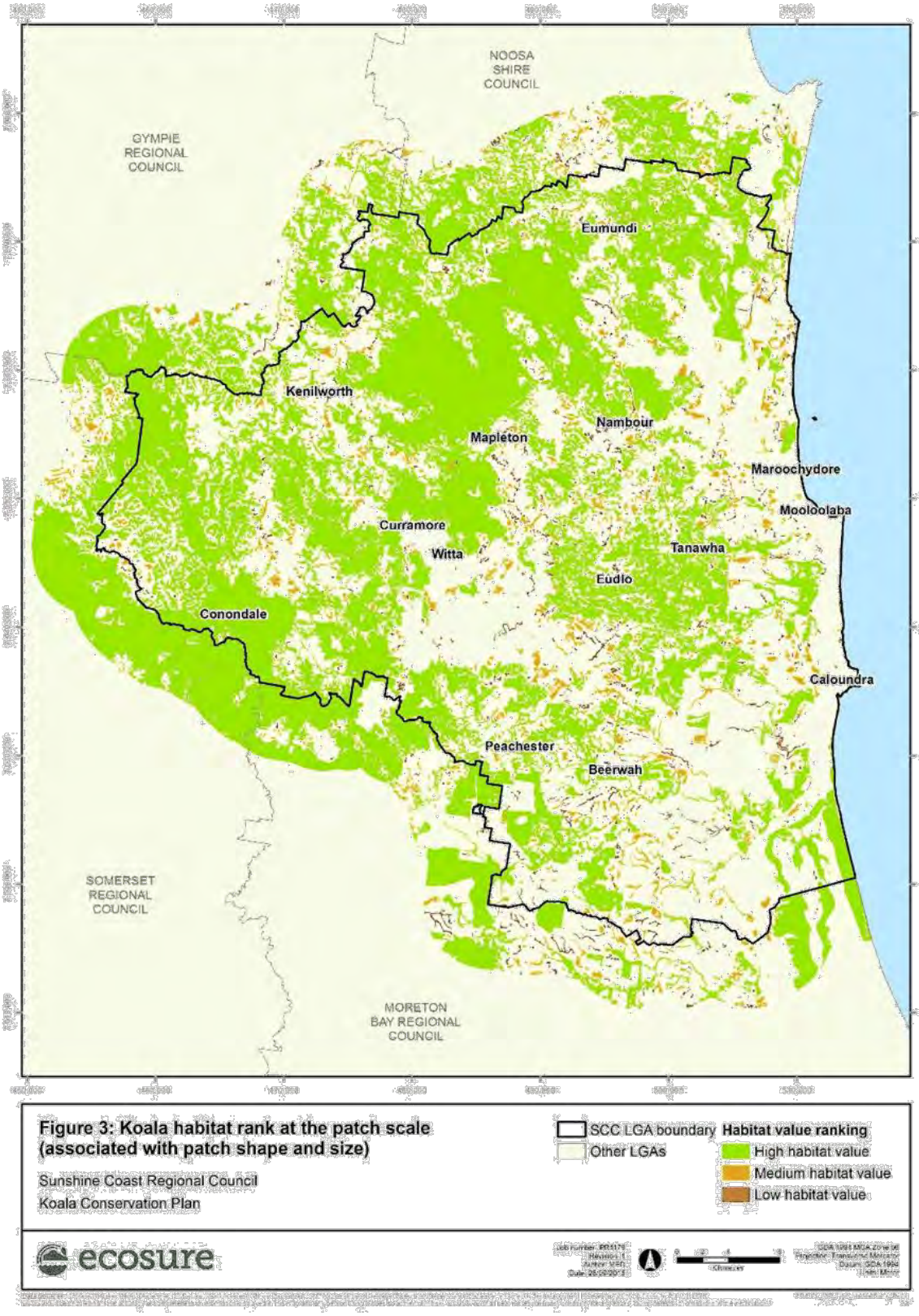


Figure 3: Koala habitat rank at the patch scale (associated with patch shape and size)

Sunshine Coast Regional Council
Koala Conservation Plan

Perceived threats

Vehicle strike and dogs are acknowledged as two of the major threats to koalas in southeast Queensland (DoE 2015, Dique et al. 2003). Data used to rank each 5 km^2 according to the perceived threat to koalas (Figure 3) included:

- constructed roads (SCC 2015)
- speed zones (SCC 2015)
- property boundaries (DNPRSR 2015)
- registered animals (SCRC 2015).

Council believe dog registration within SCLGA to be around 70% of all dogs owned. This shortfall may be partially due to the fact that primary producers are not required to register working dogs. Figure 4 illustrates the number of dog registrations adjacent to, or within 100 m of potential koala habitat (expressed as density of dogs/km^2) (further explained in Appendix 1).

The level of perceived threat associated with roads was determined by calculating the length of existing roads with speed limits in excess of 50 km/h that cross, or are directly adjacent to potential koala habitat (further explained in Appendix 1).

It is important to note, that without surveys to ground-truth mapping and historical mortality records to substantiate locations of risks to koalas, threats can only be considered as 'perceived'. Collating mortality data and investigation of domestic dog management and road safety measures are recommended to minimise the impact of these key threatening processes on koala populations (Desired Outcome 4).

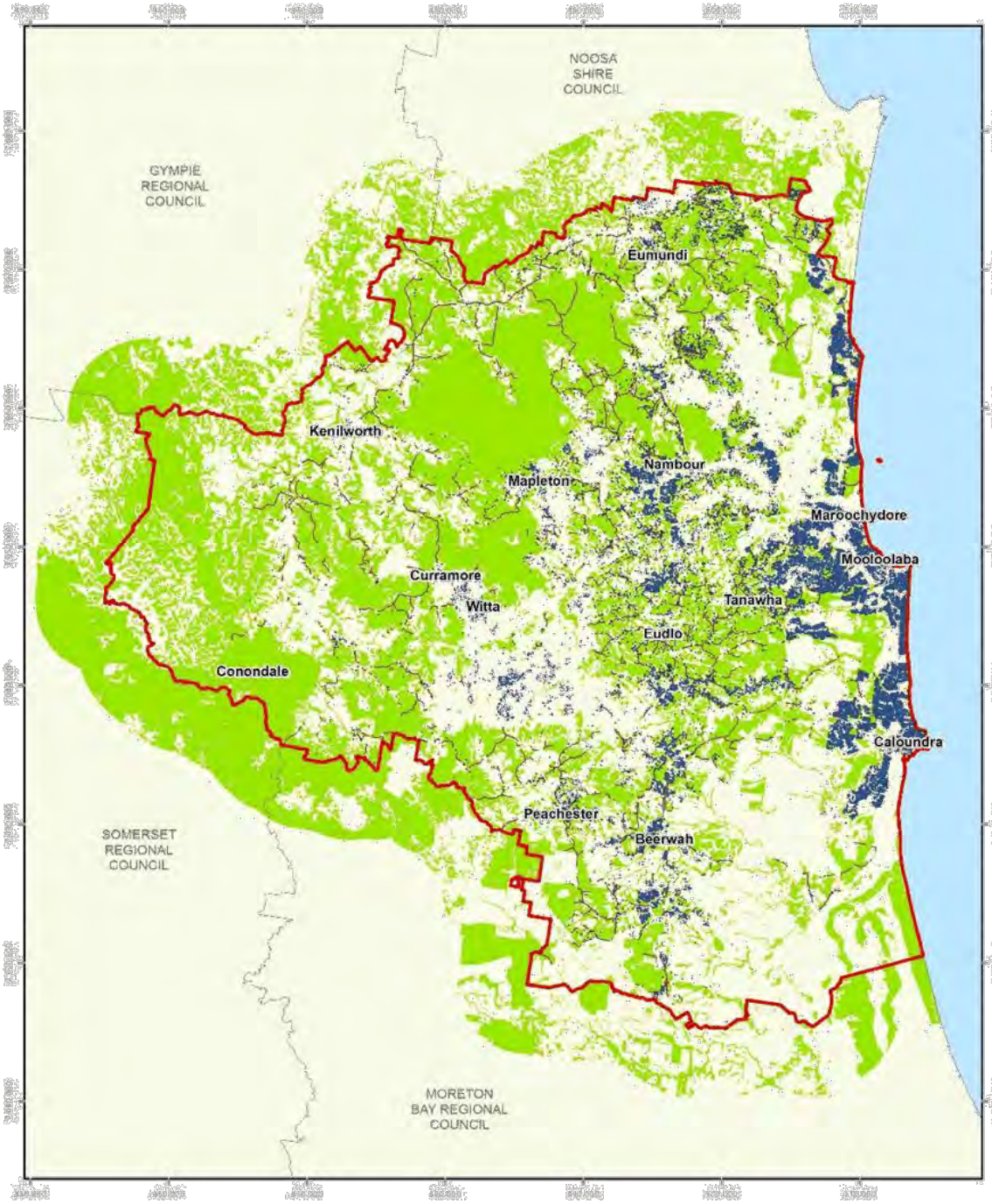


Figure 4: Perceived threats to koalas

Sunshine Coast Regional Council
Koala Conservation Plan

2 Action plan

Actions are themed around the five desired outcomes (see Section 1.6). Actions within this plan will be implemented over short, medium or long term timeframes (Table 6) to guide Council's priority for management through the most effective and efficient means. Actions that are already underway or that will occur throughout the life of the KCP are described as on-going. These priorities should not be seen as a measure of an action's scale, cost, or productivity, rather, its role in a sequence of many important actions to conserve the longevity of koalas on the Sunshine Coast. Thirty-four (34) management actions are presented below, and are also summarised in Appendix 2.

Table 6 Priority & indicative cost definitions

Implementation	Definition
Timeframe	
On-going	Actions that will continue to be undertaken in the life of the KCP
Short	Actions that will commence within the next 12 months
Medium	Actions that will commence within the next two years
Long	Actions that will commence within the next five years
Cost	
High	Over $100,000
Medium	$10,000 - $100,000
Low	Below $10,000

Roles and responsibilities

The successful implementation of actions within the KCP requires support from all levels of council and the community. The branch primarily responsible for the administration of the KCP is Environmental Operations (EO), within the Infrastructure Services Department.

The Council branch or department responsible for delivering each action will be required to report and monitor their progress. As the KCP is designed to be a five year plan, actions should aim to be 'complete' or 'on-going' upon reaching the end of the management period. Council branches are responsible for the delivery of KCP actions within five years (Table 7).

Table 7 Acronyms for responsible branches of Sunshine Coast Council

Department	Branches	Acronym
Infrastructure Services Department	Environmental Operations	EO
	Parks and Gardens	P&G
	Transport Infrastructure Management	TIM
Regional Strategy and Planning Department	Major Urban Development	MUD
	Strategic planning	SP
	Transportation and Infrastructure Policy	TIP
	Environment and Sustainability Policy	ESP
Community Services Department	Healthy Places	CS

2.1 Desired outcome 1: Building our knowledge about Sunshine Coast koala populations

Objective: To develop a robust understanding of koala population dynamics and habitat on the Sunshine Coast in order to inform and strengthen koala conservation planning

Actions

Table 8 Actions to achieve Desired Outcome 1

	Action	Timeframe	Responsibility	Description[2]
1.1	Develop a longitudinal monitoring program	Long	EO	A longitudinal koala monitoring program will be a crucial component of this KCP to inform and guide conservation outcomes. These include: • ongoing recovery plans and management programs for koala conservation and habitat protection • better design of ameliorative measures associated with the development of infrastructure • better understanding of the constraints and benefits associated with management measures • understanding of key threatening process at population level This monitoring program should be based on the baseline survey Regularised Grid design. This will allow a robust assessment of koala populations throughout the Sunshine Coast, and act as a 'warning' system for koala decline and also monitor the success of management actions.
1.2	Collate data on koala observations, injury and mortality over time	Current & On-going	EO	To build on current data, and to create a more robust dataset for future use as in 1.2 and 1.3.
1.3	Support a consistent method of data recording and collection to be used across Council. Look for opportunities to gather incidental records from other programs (e.g. pest monitoring).	Short	EO	

[2] Descriptions are relevant to Desired Outcome 1 only. Descriptions reference literature and processes underpinning the KCP in order to achieving subsequent outcomes.

	Action	Timeframe	Responsibility	Description[2]
1.4	Undertake field surveys in mapped koala habitat using peer reviewed methodology to determine koala presence, aggregations, and population density	Long	EO	Should be designed at a resolution sufficient to provide a robust model of koala activity using the Regularised Grid-based SAT sampling technique described by Phillips et al. (submitted). This is an unbiased survey technique whereby regularly spaced grid cell intersection points are used to sample for koala activity in areas of otherwise suitable habitat (i.e. areas of forest/woodland containing *Eucalyptus* spp.). The position of koala aggregations in the landscape is a dynamic phenomenon which changes over ecological time as a consequence of stochasticity, recruitment and dispersal processes. Therefore, this baseline survey can form the basis for longitudinal monitoring to assess changes in koala populations in the Sunshine Coast LGA, as well as accurately guide conservation efforts.
1.5	Undertake analysis of historical sightings data to inform population studies	Short	EO	A desktop analysis of historical records will allow an assessment of generational persistence and help identify trends over time within the Sunshine Coast LGA. This assessment is important to prioritise areas for conservation and/or mitigation measures.
1.6	Continue to undertake analysis of mortality data to inform threat mitigation management	Short & Ongoing	EO	Understanding mortality data for the Sunshine Coast koala population will enable priority areas to be identified for mitigation actions. Without mortality data, only perceived risks can be identified and could therefore misdirect management efforts.
1.7	Ground-truth koala habitat mapping (Section 1.4)	Medium & On-going	EO	Point-based sampling from 1.1 will provide an assessment and ground-truthing of koala habitat mapped throughout the Sunshine Coast as part of this KCP. This will enable an accuracy measure of current mapping, and guide any potential habitat management.
1.8	Refine koala habitat mapping using Council's fine scale vegetation layer and the 2014 foliage cover	Short	EO	

	Action	Timeframe	Responsibility	Description[2]
	model to capture non-remnant vegetation			
1.9	Research and guide the use and implementation of mitigation measures (such as fencing, signage, fauna crossing structures) to most effectively minimise the impacts of threatening processes.	Short & On-going	EO/CS	To be undertaken once all baseline data is collected so that mitigation measures can be targeted accurately.
1.10	Train Council staff in methods to assist with longitudinal monitoring	Long	EO	Only required if deemed necessary by Council to reduce ongoing costs.

2.2 Desired outcome 2: Koala conservation incorporated into planning and policy process

Objective: To maintain a landscape that contains sufficient habitat to support the long-term population viability of koalas on the Sunshine Coast, giving due consideration to quantity, connectivity, integrity and condition of habitat.

Actions

Table 9 Actions to achieve Desired Outcome 2

	Action	Timeframe	Responsibility
2.1	Investigate opportunities to include refined koala habitat mapping in future amendments to the Planning Scheme.	On-going	DS/ESP/EO
2.2	Report yearly on impacts and mitigation actions that occurred associated with development and related koala conservation outcomes – e.g. koala-friendly fencing, koala safe road signage, dog free estates etc.	Short & On-going	DS/ESP/EO
2.3	Enhance existing koala habitat by incorporating koala food trees into landscape rehabilitation plans and ecological restoration activities where appropriate.	On-going	EO
2.4	Develop a spatial layer that identifies potential offset receiving sites on council or private land that would establish new koala habitat.	Short & on-going	DS

2.3 Desired outcome 3: Koala conservation through partnerships and community engagement

Objective: To connect community, government and research bodies in a collaborative approach to koala conservation

Table 10 Actions to achieve Desired Outcome 3

	Actions	Timeframe	Responsibility
3.1	Determine priority locations to focus existing tools such as VCA, LFW, and other partnerships, with the intent to increase available koala habitat, connectivity or to provide buffering of core habitat or linkages	On-going	EO
3.2	Continue to maintain partnerships with wildlife hospitals (e.g. Australia Zoo), and local wildlife care groups.	On-going	EO/ESP
3.3	Continue to deliver a range of programs to support community stewardship of koalas - VCA, LFW.	Current & On-going	EO/ESP
3.4	Implement opportunities to encourage planting of koala food trees on private properties (i.e. beginning with LFW in known koala areas), e.g. additional component to LFW Incentives program.	Short & On-going	EO
3.5	Continue to liaise with local, state and federal government and support opportunities for regional scale actions.	Short & On-going	EO/ESP
3.6	Partner with research organisations to investigate koala ecology and disease in the Sunshine Coast population.	Short	EO

2.4 Desired outcome 4: Minimise the impact of threatening processes on koala population

Objective: To undertake on ground works that reduce koala mortality, and protect and enhance koala populations and their habitat.

Table 11 Actions to achieve Desired Outcome 4

	Action	Timeframe	Responsibility
4.1	Undertake analysis of mortality data to prioritise areas for mitigation measures, in order to reduce the impact of vehicle strikes and dog attacks	Short & On-going	EO
4.2	Collate baseline datasets (field survey, historical and mortality) to identify and target the most appropriate mitigation measures	Medium & On-going	EO
4.3	Conserve and maintain the integrity of highly connected core koala habitat patches giving priority to patches larger than 50 ha or a cluster of patches larger than 100 ha (Guideline 2.1 and 2.2 McAlpine 2007)	On-going	EO/ESP
4.4	Continue to maintain revegetation/regeneration on council land identified in koala mapping that support core habitat or movement corridors through reserve management and the CNCP Program.	On-going	EO
4.5	Identify koala habitat that contain feral dogs / continue to implement wild dog control program (this may also involve dog scat analysis)	On-going	CS
4.6	Investigate and implement suitable koala road safety measures, including signage, traffic speed mitigation, lighting, road verge maintenance, wildlife fencing and underpasses in identified koala habitat areas where vehicle strikes are shown to be a major threat (see also Actions 4.1 and 4.2).	Medium & On-going	TIM/EO
4.7	Implement an education program focussing on dog ownership and off-leash dog areas, to raise awareness of the threat posed by domestic dogs (see also Actions 4.1 and 4.2)	Medium	TIM/EO
4.8	Initiate discussions with the State Government to identify and mitigate key threat areas, through fencing on highways or motorways	Medium	EO/TIM/ESP
4.9	Investigate potential location/s for a refuge or sanctuary for translocated, injured or convalescing koalas	Medium	EO
4.10	Identify how to adaptively manage and enhance koala habitat for climate resilience by partnering with state government and research institutions	Short	EO

2.5 Desired outcome 5: Advocate, educate and lead by example

Objective: To increase understanding and ownership of koala conservation actions across all sectors of the community

Table 12 Actions to achieve Desired Outcome 5

	Action	Timeframe	Responsibility
5.1	Deliver a range of community education programs on status of koala and importance of maintaining good quality koala habitat and corridors	On-going	EO/ESP
5.2	Participate in forums and seminars regarding koala conservation	On-going	EO/ESP
5.3	Develop interpretive and promotional material (e.g. fact sheets) on koala ecology (including preferred food trees, habitat, relationship with indigenous culture and threatening processes) at council centres such as Maroochy Regional Bushland Botanic Garden.	Short	EO
5.4	Explore opportunities for community involvement in koala research and/or monitoring projects, as well as building the communities role in data collection	Short	EO

3 Reporting, monitoring and Plan review

The branch responsible for monitoring the actions within the Plan is Environmental Operations (EO).

Environmental Operations will track progress of the action plan annually and identify opportunities for improvement.

The broader Koala Conservation Plan will be reviewed after five years.

References

Adams-Hosking, C, Grantham, HS, Rhodes, JR, McAlpine, C & Moss, PT 2011, 'Modelling climate-change-induced shifts in the distribution of the koala', *Wildlife Research*, vol. 38, pp. 122-130.

Bachmann, N, Sullivan, M, Jelocnik, M, Myers, G, Timms, P, Polkinghorne, A, in press, "Culture-independent genome sequencing of clinical samples reveals an unexpected heterogeneity of infections by *Chlamydia pecorum*.

Biolink 2007, *Conserving koalas in the Coomera-Pimpama Koala Habitat Area: a view to the future*, Report prepared for Gold Coast City Council, Available: http://www.goldcoast.qld.gov.au/documents/bf/koala_conservation_strategy.pdf (accessed 23/02/2015).

Biolink 2007a, *Koala habitat and population assessment for Gold Coast City LGA*, final report to Gold Coast City Council.

Brearley, G, Rhodes, JR, Bradley, A, Baxter, GS, Seabrook, L, Lunney, D, Liu, Y & McAlpine, C 2013, 'Wildlife disease prevalence in human-modified landscapes: a review', *Biological Reviews*, vol. 88, pp. 427-442.

Brown, AS, Girjes, AA, Lavin, MF, Timms, P & Woolcock, JB 1987, 'Chlamydial disease in koalas', Australian Veterinary Journal, vol. 64, pp. 346-350.

Burel, F & Baudry, J 2003, *Landscape Ecology: concepts, methods and applications*, Science Publishers, New Hampshire, USA.

Devereaux, LN, Polkinghorne, A, Meijer, A & Timms, P 2003, 'Molecular evidence for novel chlamydial infections in the koala (*Phascolarctos cinereus*)', *Systems of Applied Microbiology*, vol. 26, no. 245-253.

Dique, D, Thompson, J, Preece, H, Penfold, G, de Villiers, D & Leslie, R 2003, 'Koala mortality on roads in south-east Queensland: the koala speed zone trial', *Wildlife Research*, vol. 30, pp. 419-426.

DoE 2015, *Species Profile and Threats Database: Phascolarctos cinereus (combined populations of Qld, NSW and ACT)*, Department of the Environment, viewed 19th February 2015, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104.

EHP 2013, *Koala threats*, Department of Environment and Heritage, Queensland, viewed 19th February 2015, https://www.ehp.qld.gov.au/wildlife/koalas/koala-threats.html.

Hanger, JJ, Bromham, LD, McKee, JJ, O'Brien, TM & Robinson, WF 2000, 'The nucleotide sequence of koala (*Phascolarctos cinereus*) retrovirus: a novel type C endogenous virus related to gibbon ape leukemia virus', *Journal of Virology*, vol. 74, pp. 4264-4272.

Hanger, J & Loader, J 2009, 'Infectious disease in koalas: implications for conservation', in Koala Conservation Conference, Friends of the Koala, Lismore.

Hilty, JA, Lidicker Jnr, WZ, & Merenlener, AM 2006, *Corridor Ecology: the science and practice of linking landscapes for biodiversity conservation*, Island Press, Washington.

Hindell, MA, & Lee, AK 1990, 'Tree preferences of the koala', in Lee, AK, Handasyde, KA & Sanson, G (Eds), *Biology of the Koala*, Surrey Beatty and Sons, Sydney, pp. 117-121

Jelocnik, M, Frentiu, F, D, Timms, P, Polkinghorne, A, 2013, "Multilocus sequence analysis provides insights into molecular epidemiology of *Chlamydia pecorum* infections in Australian sheep, cattle and koalas", *Journal of Clinical Microbiology*, vol. 51 pp2625-2632.

Kollipara, A, Polkinghorne, A, Wan, C, Kanyoka, P, Hanger, J, Loader, J, Callaghan, J,

Bell, A, Ellis, W, Fitzgibbon, S, Melzer, A, Beagley, K & Timms, P 2013, 'Genetic diversity of *Chlamydia pecorum* strains in wild koala locations across Australia and the implications for a recombinant *C. pecorum* major outer membrane protein based vaccine', Veterinary Microbiology, vol. 167, pp. 513-522.

Lee, AK, & Martin, R 1988, *The Koala – A Natural History*, University of NSW Press, Sydney, NSW.

Lunney, D, Crowther, MS, Wallis, I, Foley, WJ, Lemon, J, Wheeler, R, Madani, G, Orscheg, C, Griffith, JE, Krockenberger, M, Retamales, M & Stalenberg, E 2012, 'Koalas and climate change: a case study on the Liverpool Plains, north-west NSW', in Lunney, D & Hutchings, P (eds), *Wildlife and Climate Change: Towards Robust Conservation Strategies for Australian Fauna*, Royal Zoological Society of New South Wales, Mosman, in press.

McAlpine, C, Rhodes, J, Peterson, A, Possingham, H, Callaghan, J, Curran, T, Mitchell, D & Lunney, D 2007, *Planning Guidelines for Koala Conservation and Recovery: A guide to best planning practice*, Australian Koala Foundation and The University of Queensland, Brisbane, Australia

McIntyre, S & Hobbs, R 1999, 'A framework for conceptualizing human effects on landscapes and its relevance to management and research models', *Conservation Biology*, vol. 13, pp. 1282–1292.

Melzer, A, Carrick, F, Menkhorst, P, Lunney, D & St. John, B 2000, 'Overview, critical assessment, and conservation implications of koala distribution and abundance', *Conservation Biology*, vol. 14, no. 3, pp. 619–628.

Meers, J, Simmons, G, Jones, K, Clarke, DTW & Young, PR 2014, 'Koala retrovirus in free-ranging populations – prevalence', Technical Reports of the Australian Museum, Online – ISSN 1835-4211, No. 24, pp. 15-17

Mitchell, M, Hovis, K, Bavoil, P, Myers, G, Carrasco, J, Timms, P 2010, "Comparison of koala LPCoLN and human strains of *Chlamydia pneumonia* highlights extended genetic diversity in the species". BMC Genomics, Vol. 11: 442

Foreman, R, Sperling, D, Bissonette, J, Clevenger, A, Cutshall, C, Dale, V, Fahring, L, France, R, Goldman, C, Heanue, K, Jones, J, Swanson, F, Turrentine, T & Winter, T 2003, *Road Ecology: Science and solutions*, Island Press.

OWAD 2014, *Sunshine Coast Council Koala Survey*, prepared for Sunshine Coast Council.

Phillips, S 1997, 'Some issues associated with the relocation of koalas *Phascolarctos cinereus*', In Tribe, A (ed.), *Challenging the Boundaries – Proceedings of the Annual Conference of the Australian Association of Veterinary Conservation Biologists*, Australian Veterinary Association, Brisbane, Pp. 187–193.

Phillips, SS, 2000, 'Population trends and the koala conservation debate', *Conservation Biology*, vol. 14, no. 3, pp. 650–659.

Phillips, S. & J. Callaghan, 2011, 'The Spot Assessment technique: a tool for determining localised levels of habitat use by Koalas; *Phascolarctos cinereus', Australian Zoologi*st, vol. 35, no. 3, p. 774-780.

Phillips, S, Hopkins, M & Warnken, J submitted, 'Spline in the sand: modelling metapopulation structure across heterogeneous landscapes to provide greater planning certainty for an arboreal marsupial (koala *Phascolarctos cinereus* Goldfuss), *Landscape and Urban Planning*.

Polkinghorne, A, Hanger, J & Timms, P 2013, *Recent advances in understanding the biology, epidemiology and control of chlamydial infections in koalas*, Silo climate data. Silo climate data http://www.longpaddock.qld.gov.au/silo/ppd/index.php.

Rhodes, JR, Ng, CF, de Villiers, DL, Preece, HJ, McAlpine, CA & Possingham, HP 2011, 'Using integrated population modelling to quantify the implications of multiple threatening processes for a rapidly declining population', *Biological Conservation,* vol. 144, pp. 1081-1088.

SEQ Catchments 2014a, *Koala habitat mapping for the Sunshine Coast Council: Mapping Methodology Report*, prepared for Sunshine Coast Council.

SEQ Catchments 2014b, *Management Response for Koala Habitat Threats on the Sunshine Coast: Mapping Methodology Report*, prepared for Sunshine Coast Council.

SCC 2014, *Sunshine Coast Biodiversity Strategy 2010-2020*, viewed 19th February 2015, http://www.sunshinecoast.qld.gov.au/addfiles/documents/opof/biodiversity/executive_summary_and_background.pdf.

Simmonds, GS, Young, PR, Hanger, JJ, Jones, K, Clarke, D, McKee, JJ & Meers, J 2012, 'Prevalence of koala retrovirus in geographically diverse populations in Australia', *Australian Veterinary Journal*, vol. 90, no. 10, pp. 404-409.

Wintle, B, Elith, J & Potts, J 2005, 'Fauna habitat modelling and mapping: A review and case study in the Lower Hunter Central Coast region of NSW', *Austral Ecology*, vol. 30, pp.719-738.

.

Glossary, acronyms and abbreviations

Connectivity
The degree to which habitat patches are linked by corridors (McAlpine et al. 2007)

Corridor
Any space that improves the ability of a koala to move among patches of suitable habitat (Hilty et al. 2006)

Dispersal
Movement of an individual away from its natal home range.

DoE
Department of the Environment

EPBC Act
Environment Protection and Biodiversity Conservation Act 1999

GIS
Geographic information system

Home range
The area of an animal's home that is used for feeding and other activities (McAlpine et al. 2007)

KCP
Koala Conservation Plan

LGA
Local government area

LFW
Land for Wildlife program.

NC Act
Nature Conservation Act 1994.

Patch
Continuous spaces in which a population finds all the resources needed for its survival (Burel & Baudry 2003)

Preferred koala habitat
> 5% PKFTs

Tertiary koala habitat
< 5% PKFTs.

Supplementary koala habitat
Eucalypt community with no PKFTs.

PKFT
Preferred koala food tree: eucalyptus species preferred by koalas

RE
Regional ecosystem

SAT
Spot Assessment Technique.

SCC
Sunshine Coast Council

SCLGA
Sunshine Coast local government area

SEQ
South East Queensland.

Stepping stone
Habitat not physically connected, but which is used by species while dispersing or migrating.

Stochasticity
The quality of lacking any predictable order or plan

VCA
Voluntary Conservation Agreement

Viable population
A population which has adequate numbers and distribution of reproductive individuals to ensure its continued existence with minimal impact from dogs, vehicles and disease (McAlpine et al. 2007).

Appendix 1 GIS methods

List of figures (appendix)

List of tables (appendix)

Spatial data layers

For the purposes of guiding the decision making process, a series of spatial data layers were created using ESRI ArcGIS version 10.2.2 to identify potentially important koala habitat utilisation areas based on the location of preferred food trees, priority habitat areas based on patch size and the location of perceived threats to koala. Spatial data layers used for this purpose are listed in Appendix table 1.

Appendix table 1 List of spatial data layers used in all GIS analyses

GIS Layer Name	Source	Reference
Biodiversity status of pre-clear remnant regional ecosystems – SE Queensland (RE11)	Queensland Spatial Information Services	DSITIA (2015)
Environmental Protection Act 1994 - mature regrowth	Queensland Spatial Information Services	EHP (2015)
Protected areas of Queensland - boundaries	Queensland Spatial Information Services	DNPRSR (2015)
Constructed Roads	SCC	SCC (2015)
Speed Zones	SCC	SCC (2015)
EnvvecOpenspace	SCC	SCC (2015)
PlanvecCovenant	SCC	SCC (2015)
PlanGENvecT1RegisteredAnimals	SCC	SCC (2015)

Koala habitat quality layer

The development of a koala habitat layer was developed based on the guidelines described by McAlpine et al. (2007) and criteria for koala habitat quality classification in Biolink (2007). In order to define the quality of koala habitat, it is essential to accurately determine preferred koala food tree species. In the absence of detailed field surveys to identify these preferred food tree species, the seven species of preferred koala food trees (PKFTs) identified by the Australian Koala Foundation (2015) for the Sunshine Coast were used to classify koala habitat quality. Based on the predicted abundance of PKFTs in each RE, koala habitat quality could be classified according to the criteria set out in Biolink (2007) (see section 1.2, table 1, for tree list). These classes are defined as follows (from Biolink 2007):

(A) Primary koala habitat – REs wherein PKFTs are dominant or co-dominant (>35%)

(B) Secondary koala habitat – REs wherein PKFTs are sub-dominant (<35% but >5%)

(C) Tertiary koala habitat – REs wherein PKFTs are uncommon or rare (<5%)

(D) Supplementary koala habitat – Eucalypt forest or woodland wherein PKFTs are absent

(E) Other vegetation – REs not containing eucalypt species

Based on these class definitions, the RE classes within the regional ecosystem remnant (DSITIA 2015) and mature regrowth (EHP 2015) layers were categorised into Koala Habitat Quality Classes, using the RE descriptions provided (EHP 2015). However, because RE descriptions do not contain information pertaining to the proportional abundance of individual species within communities, it was not possible to confidently distinguish between primary and secondary koala habitat. For this reason, the primary and secondary koala habitat classes were combined into one class (Appendix table 2).

Appendix table 2 Criteria for classifying koala habitat quality for each RE based on predicted abundance of Preferred Koala Food Trees (PKFTs)

Habitat quality class	Classification criteria
AB	> 5% PKFTs
C	< 5% PKFTs
D	Eucalypt community with no PKFTs
E	Non-eucalypt community

The following set of decision rules was established to guide the process of assigning habitat categories to REs, especially in the case of heterogeneous REs:

- If the AB class makes up 50% or more of the RE, it becomes AB. Similarly, if C is 50:50 with D or E, then it becomes C. If D is 50:50 with E, then it becomes D.
- When AB is not the majority class:
  - If AB comprises ≥20 and <50%, then class is C (which is defined by low abundance (<5%) of PKFT)
  - If AB comprises <20% of the RE, then the RE is classified according to the dominant class. If C or D are equal in dominance to E, then make the class C or D accordingly.

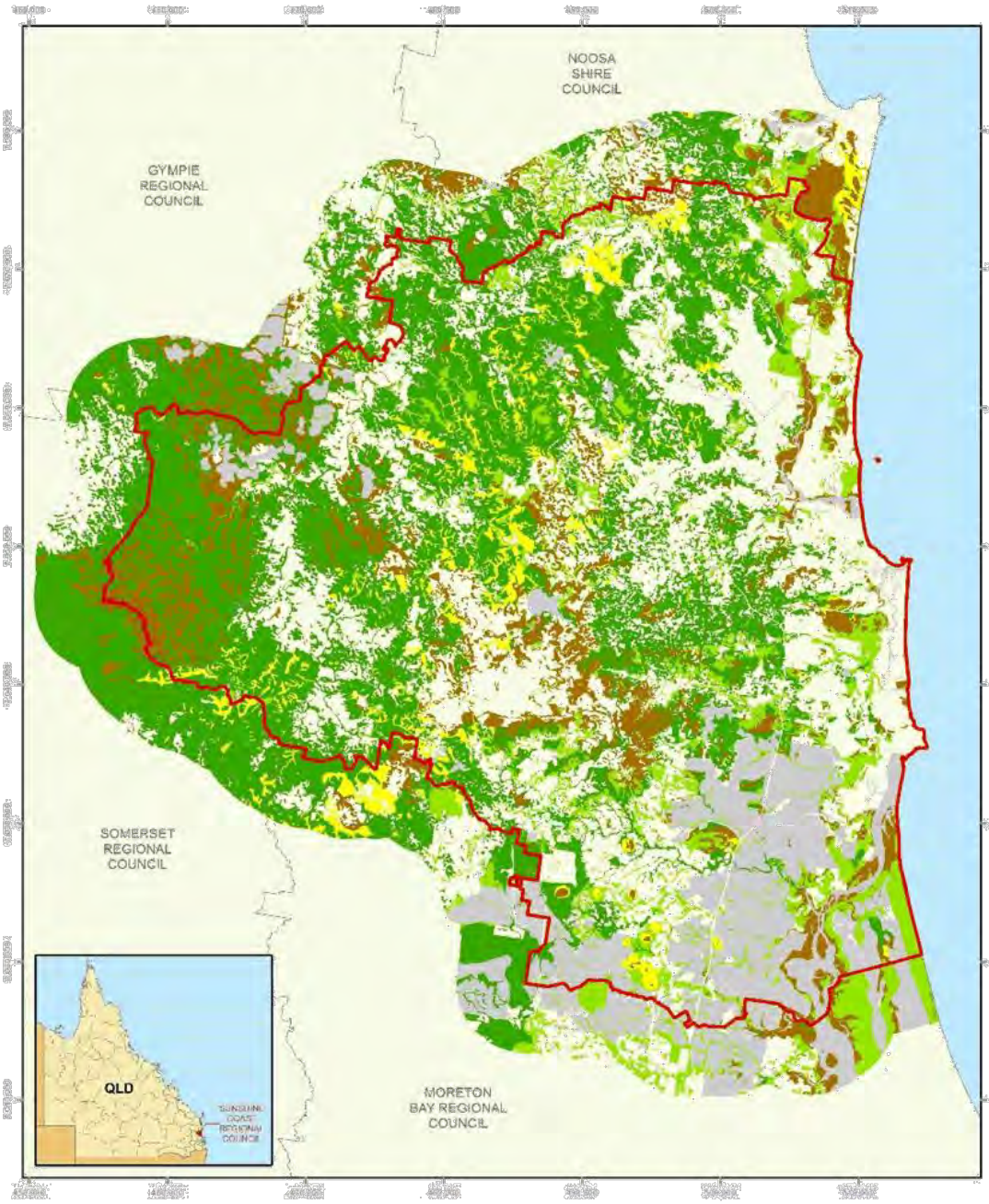
The koala habitat quality map for the Sunshine Coast was generated with a 5 km buffer extending into neighbouring LGAs to enable the identification of habitat connectivity with habitat patches in adjacent council areas. A distance of 5 km was chosen because it incorporates the estimated typical dispersal distances of koala up to 3-4 km (McAlpine et al. 2007).

To ensure that the resultant potential koala habitat quality layer reflected current cleared vegetation areas, it was compared against the Queensland SLATS data and buffered roads were erased from the layer. The Bruce Motorway was buffered to 70 m and other major roads were buffered to 10 m, based on measurements taken from aerial imagery.

The resultant Potential Koala Habitat Quality layer was intersected with Queensland state protected areas, state forest areas, SCRC open spaces (environmental operations), Land for Wildlife and Covenant properties in order to determine the level of representation koala habitat has in these areas (Appendix table 3). In total, 28.6% of potential koala habitat receives some level of protection.

Appendix table 3 Potential koala habitat under protected conservation status

Type	AREA of Potential Koala Habitat	National parks (ha)	State forest (ha)	SCRC Open Spaces (ha) Env. Operations	LFW (ha)	Covenants (ha)	TOTAL (ha)	% Habitat Extent
ab	109477.7	22509.3	2991.7	1751.8	1319.4	866.0	29438.3	26.9
c	28352.4	5024.6	1565.6	1766.5	163.5	173.4	8693.6	30.7
d	11227.7	3844.1	86.5	271.9	200.7	121.1	4524.4	40.3
e	32449.6	7898.6	1462.6	1188.1	323.4	242.2	11114.8	34.3
abcd	149058	31378	4644	3790	1684	1161	42656	28.6


NOOSA SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
QLD
SUNSHINE COAST REGIONAL COUNCIL
Figure A: Potential koala habitat
Sunshine Coast Regional Council
Koala Conservation Plan
SCC LGA boundary
Other LGAs
AB - preferred koala habitat
C - supplementary koala habitat
D - tertiary koala habitat
E - other vegetation
Non-habitat (e.g. plantation, sand)
ecosure

Habitat Buffers

According to McAlpine et al. (2007), habitat buffers can contribute to the long-term survival of koalas in high quality primary and secondary (class AB) koala habitat by ensuring that incompatible land-uses, developments or activities do not occur on immediately adjacent lands.

McAlpine et al. (2007) recommends that a minimum buffer width of 50 m be applied to areas of preferred koala habitat. However, a larger buffer of 100 m is recommended where adjoining development is likely to pose significant threats to koalas, such as medium to high density residential development where domestic dog ownership is prevalent or where traffic speeds in excess of 40 km/h are permitted. Because the majority of roads within the SCLGA have speed limits in excess of 40 km/h, a buffer of 100 m was applied to all preferred koala habitat.

Habitat buffers include land that may present threats to koalas that need to be managed through effective planning and design strategies. Some land uses that are particularly suited to buffer areas are open space and passive recreation. Habitat buffers warrant protection and management and should be considered a priority for habitat restoration projects where feasible.

Delineating habitat value in the landscape

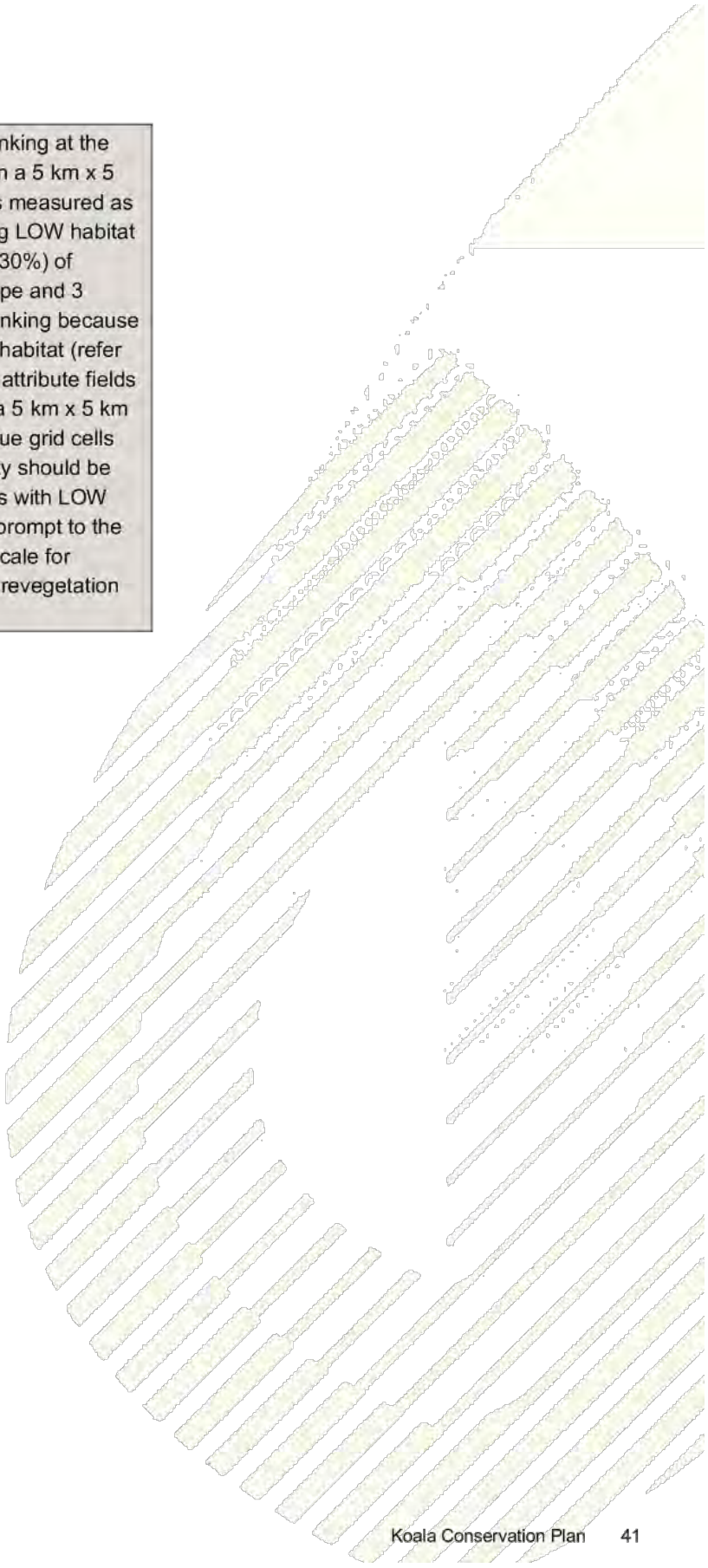
For the purposes of this study, to assist with identifying habitat values and risks at a landscape-scale quickly and easily, a 5km x 5km grid was created covering the entire LGA. Relative ranking scores were calculated for certain potential habitat quality features and perceived threats (outlined below) within each of the 5km by 5km grid cells. These scores are then displayed as a colour coded map grid to highlight potential high priority concerns relating to koala conservation in the landscape. The intention is for these ranked grid cells to trigger closer investigation at a local scale.

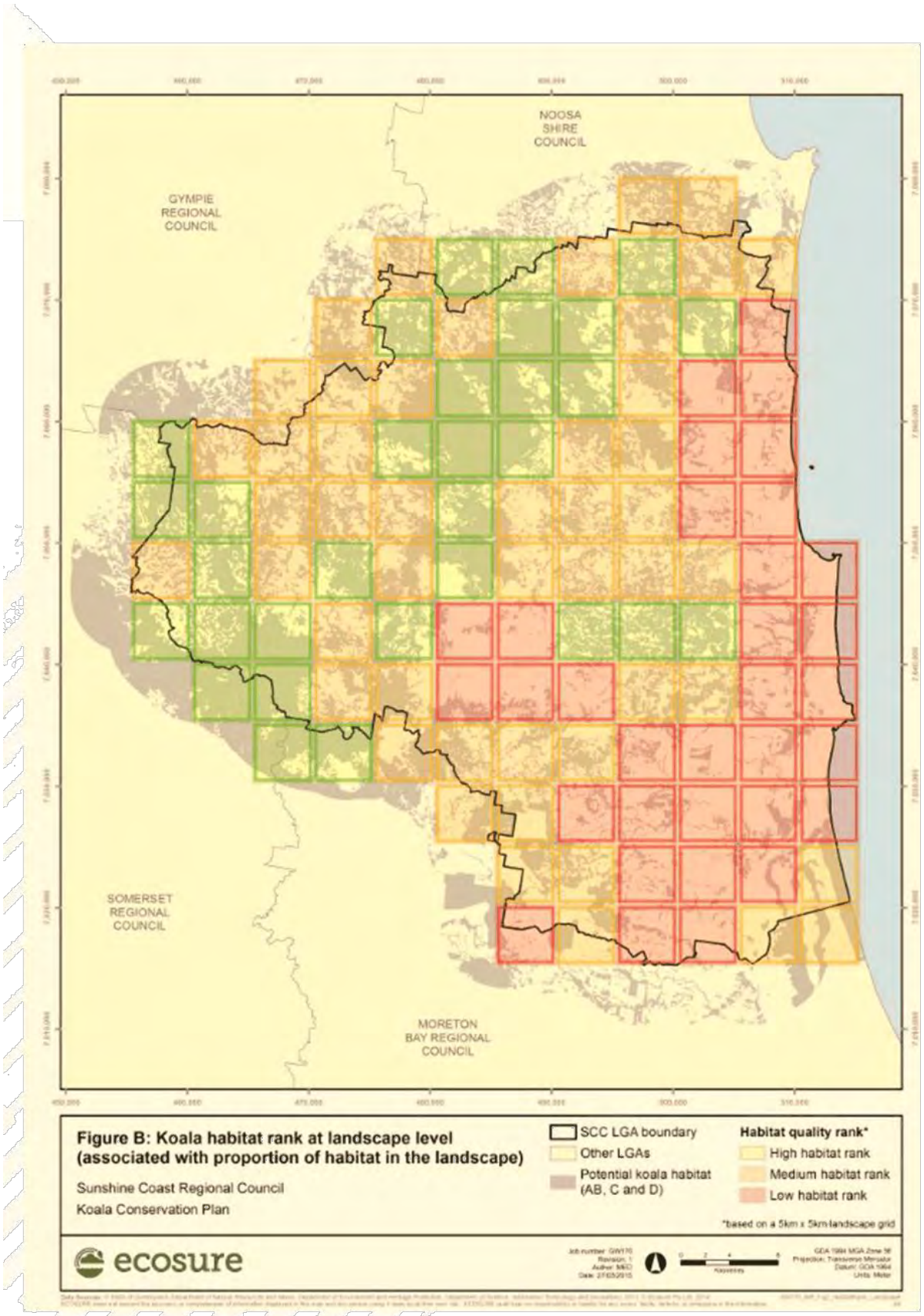
Habitat patch extent

To maintain and conserve a landscape that contains a sufficient amount of habitat to sustain a viable koala population, McAlpine et al. (2007) recommends maintaining at least 40 – 50% of the landscape as primary and secondary koala habitat around where koalas occur. The protection of primary and secondary (Class AB) habitats is considered top priority

In this study, areas where ≥60% of the habitat is still intact are ranked as High habitat quality and are considered high priority for conservation and low priority for threat. Areas with ≥30% and <60% are ranked Medium habitat quality and are classified as being under a medium level of threat. Where <30% of preferred koala habitat remains, areas are ranked as Low habitat quality and therefore flagged high priority for threat. Landscapes with proportionally <10% of the native habitat remaining are considered relictual landscapes and are unlikely to provide the ecological processes to sustain koala populations (McIntyre and Hobbs 1999).

Figure B shows habitat value ranking at the landscape scale displayed within a 5 km x 5 km grid. Habitat value ranking is measured as a score of 1 to 3 with 1 indicating LOW habitat value due to a low proportion (<30%) of habitat remaining in the landscape and 3 indicating HIGH habitat value ranking because ≥60% of the landscape is koala habitat (refer to metadata provided to identify attribute fields to use). When displayed within a 5 km x 5 km grid, Medium to High habitat value grid cells indicate areas where high priority should be given for conservation. Grid cells with LOW habitat value ranking provide a prompt to the viewer to investigate at a local scale for possible habitat restoration and revegetation projects.





42 Koala Conservation Plan

Delineating habitat value at the patch scale

Patches of potential koala habitat illustrated in patch size and shape were assessed based on decision rules provided in McAlpine et al. (2007), and subsequently their habitat value ranks were combined to provide an overall patch habitat value.

Patch size and shape operate together to determine the integrity and resilience a habitat patch might have to change due to edge effects and die-back. Furthermore, larger, rounder patches are able to provide more effective protection to koala. For this reason, scores for patch size and shape are combined to provide an overall score of patch integrity.

Figure C displays the koala habitat value ranking associated with patch size and shape combined. Ranking scores calculated for patch size and patch shape were combined to achieve a score for overall patch integrity. Patches were ranked as High (scores ≤ 3), Medium (scores 4-5) and Low (scores ≥6) habitat value. Low to Medium quality ranking should prompt further investigation at a local scale to identify appropriate actions relating to possible habitat restoration and revegetation. Separate size and shape scores can be consulted to determine the cause of the Low overall score (i.e. whether it was due to size, shape or both).

Figure C: Koala habitat rank at the patch scale (associated with patch shape and size)

Sunshine Coast Regional Council
Koala Conservation Plan

SCC LGA boundary
Other LGAs

Habitat value ranking
High habitat value
Medium habitat value
Low habitat value

ecosure

Appendix table 4 Koala habitat value ranking according to the combined ranks of patch shape and patch size

Habitat values	Combined habitat value rank*
High	2 or 3
Medium	4 or 5
Low	6 or 7

*based on patch size and patch shape value ranks.

Habitat patch size

Primary and secondary koala habitat patches should be larger than 50 – 100 ha in size, unless they are part of a cluster of highly connected patches, in which case the whole connected patch should be larger than 100 ha and the internal component patches separated by less than 100 – 200 m (McAlpine et al. 2007).

Patches of potential koala habitat (with classes AB, C and D seamlessly combined) were ranked according to size and classified into the following classes (Appendix table 5):

Appendix table 5 Habitat value rank based on patch size

Contiguous patch size	Habitat value rank	Description
≥100 ha	1 - Very high	Viable patch size, low risk of local extirpation
≥50 ha and <100 ha	2 - High	Priority for restoration and revegetation
≥2 ha and <50 ha	3 - Medium	High priority for restoration and revegetation, high risk of koala mortality
<2 ha	4 - Low	Area not considered large enough to support a koala population, but can function as a 'stepping stone' within a corridor

Conservation priority should be given to patches larger than 50 - 100 ha in size, while lower conservation priority should be given to very small (<2 ha) habitat patches, unless they are part of a cluster of highly connected patches (i.e. patches that are no more than 100 – 200m apart). Restoration priorities should be given to revegetating habitat patches 10 - 50 ha with the aim of increasing their size. Revegetation or rehabilitation should involve planting local eucalypt species and other local native species consistent with the pre-existing forest type and the koala's preferred food tree species for the area.

Habitat patch shape

To maintain and restore a landscape that contains patches of koala habitat with shapes that minimise edge effects, koala habitat patches should be more circular than linear in shape so as to minimise edge effects.

A perimeter:area ratio was calculated for each patch of potential koala habitat. Values ranged from 0.002 to 28.2 - high values imply long thin shapes while low values imply more irregular, rounder shapes. Patches were classified according to the following criteria (Appendix table 6):

Appendix table 6 Habitat value rank based on patch shape

Perimeter:area ratio	Habitat value rank	Risk class
≤ 0.025	1 - High	Low risk
>0.025 – 0.03	2 - Medium	Medium risk
>0.03	3 - Low	High risk

Patches flagged as Low to Medium value in terms of shape should be the focus of rehabilitation programs aiming to widen the patch. As mentioned above, rehabilitation should involve planting local eucalypt species and other local native species consistent with the pre-existing forest type and the koala's preferred food tree species for the area.

Perceived threats

Domestic dogs

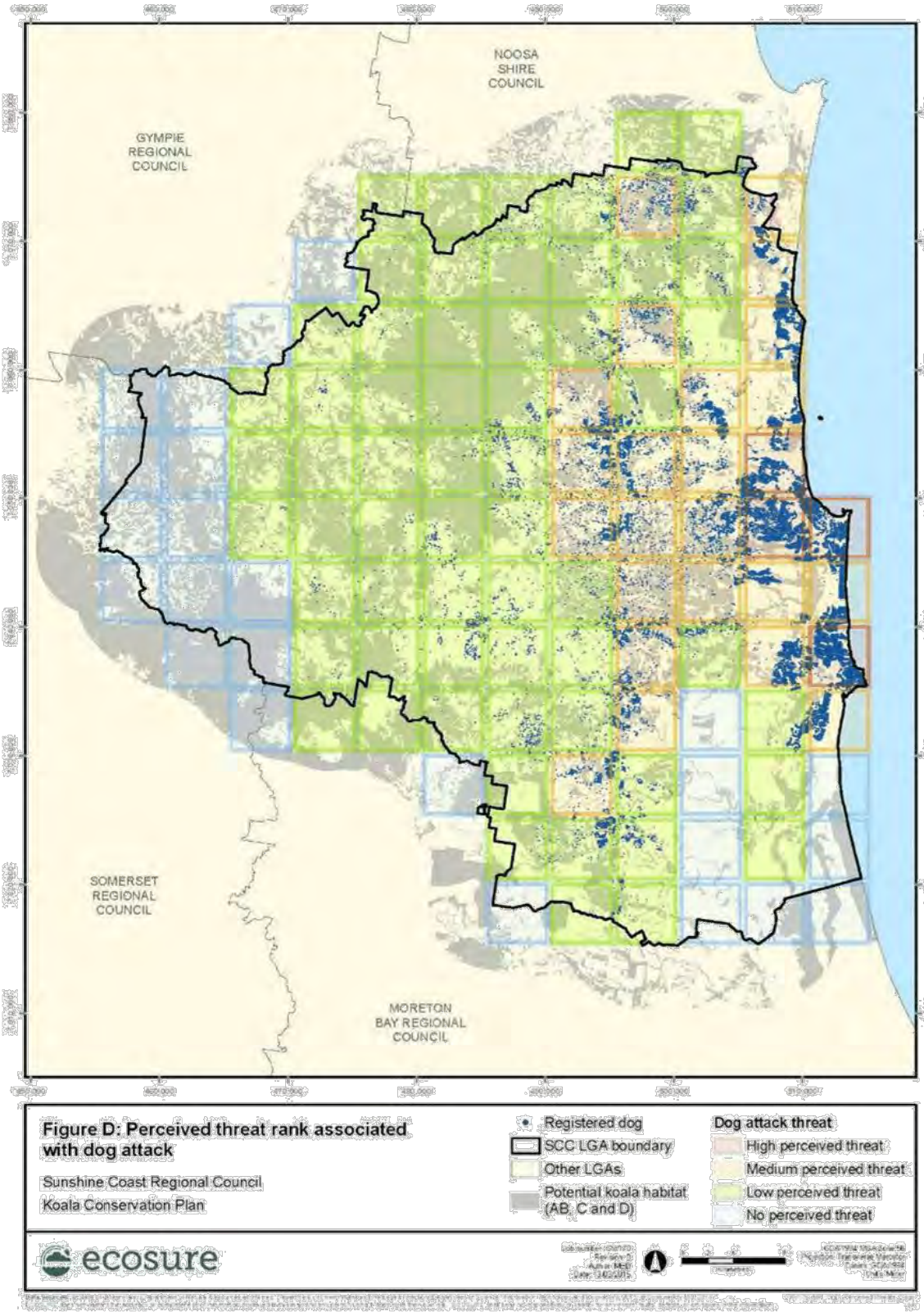
To minimise predation on koalas by domestic dogs, requires minimising potential contact between the dogs and koalas. Even small dogs can be capable of inflicting serious or fatal injuries to koalas. It is therefore important to identify areas where existing high dog ownership densities coincide with, or are adjacent to potential koala habitat, in order to direct appropriate actions on the ground to minimise dog attacks on koalas.

At a landscape scale, identifying the aforementioned areas was achieved by intersecting the spatial locations (property boundaries) of the SCRC Registered Dog Ownership database with a buffered potential koala habitat layer (100 m buffer). The number of dog registrations adjacent to, or within 100 m of potential habitat was then used to calculate the density of dogs/km^2 within a 5 km x 5 km area. Density values ranged from 0 to 107 dogs/km^2. Risk was assigned on the following basis (Appendix table 7):

Appendix table 7 Threat score indicating perceived mortality risk from domestic dogs

Dogs / km2	Threat Score	Risk Class
≥50	3	Very high risk of koala mortality due to dog attack
>15 and <50	2	Moderate to high risk
≤15	1	Low risk

Figure D indicates the location of low, medium and high levels of perceived threat to koala survival based on dog ownership densities within each 5 km x 5 km grid cell. Within potential koala areas it is recommended that measures are implemented to effectively reduce the incidence of roaming domestic dogs, especially at night. High risk areas should be prioritised. Measures might include increased policing of dog control and registration requirements, education programs for dog owners, prohibiting dog ownership in new residential areas adjacent to koala habitat, impounding roaming dogs, requiring dogs to be kept within an enclosure or inside dwellings at night, and provision of additional off-leash dog exercise areas away from koala habitat (McAlpine et al. 2007). Carrying out fields surveys to identify the location of existing koala populations will help direct actions on the ground.


NOOSA SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
Figure D: Perceived threat rank associated with dog attack
Sunshine Coast Regional Council
Koala Conservation Plan
Registered dog
SCC LGA boundary
Other LGAs
Potential koala habitat (AB, C and D)
Dog attack threat
High perceived threat
Medium perceived threat
Low perceived threat
No perceived threat
ecosure

Roads (vehicle strike)

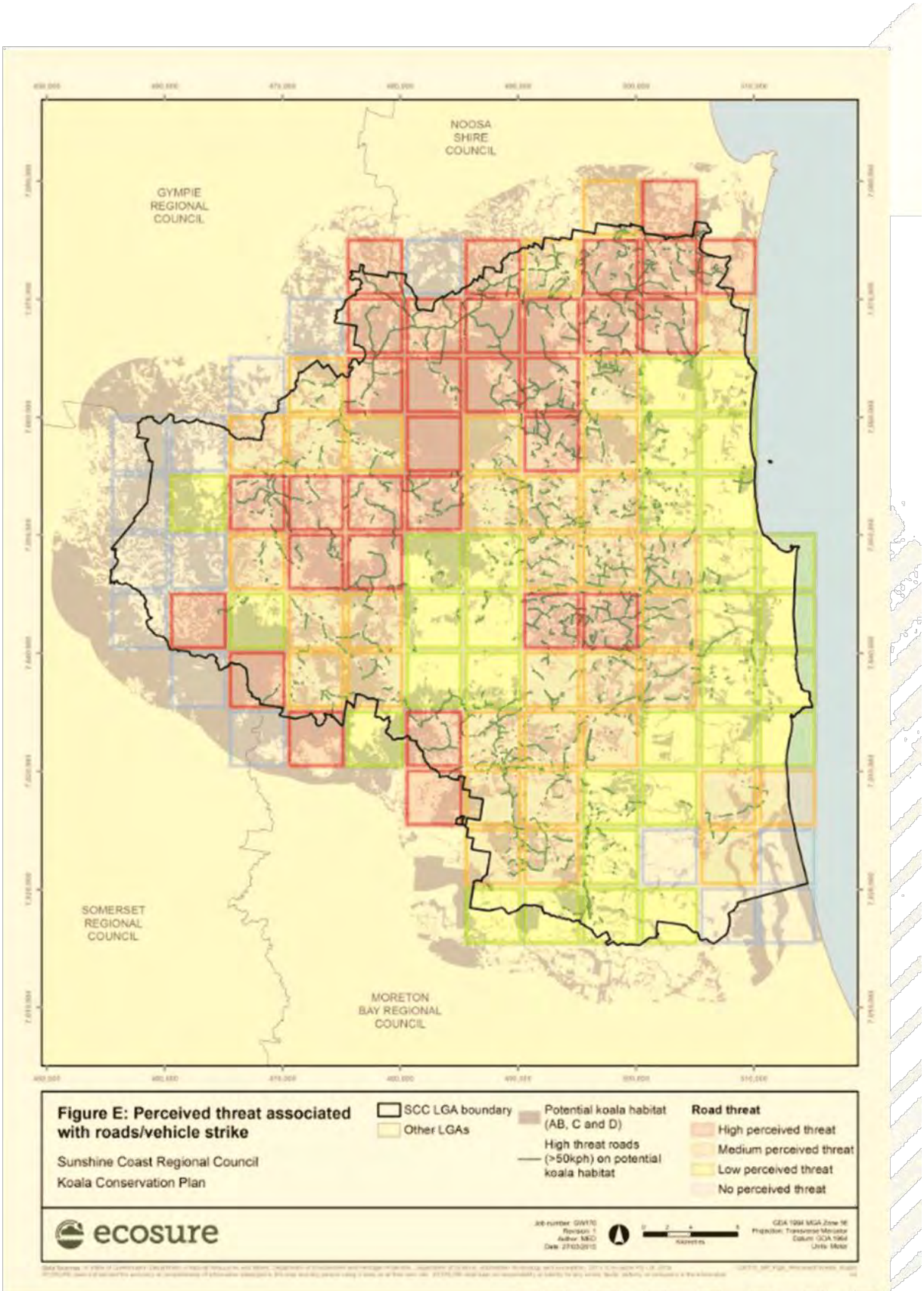
Vehicle strike is a major contributor to koala mortality. Existing roads in close proximity to koala habitat or adjacent to blocks of koala habitat are particularly at risk. Potential high risk areas should be identified in order to implement appropriate mitigation measures.

At a landscape scale, levels of threat associated with the proximity of roads to potential koala habitat were determined by calculating the length of roads with speed limits in excess of 50 kph that cross or are directly adjacent to potential koala habitat areas in relation to the total road length within each 5 km x 5 km grid area. In this way, grid cells with a high proportion of roads within or close to koala habitat are classified with a high level of threat (see Appendix table 8).

Appendix table 8 Threat score indicating perceived mortality risk from vehicle strike

Proportion of Roads	Threat Score	Risk Class
≥60 %	3	Very high risk of koala mortality due to car strike
≥30 %	2	Moderate to high risk
<30 %	1	Low risk

Figure E shows the location of risk classes associated with likelihood of vehicle strike incidences occurring. Moderate to high risk areas should be investigated further at a local scale.


NOOSA SHIRE COUNCIL
GYMPIE REGIONAL COUNCIL
SOMERSET REGIONAL COUNCIL
MORETON BAY REGIONAL COUNCIL
Figure E: Perceived threat associated with roads/vehicle strike
Sunshine Coast Regional Council
Koala Conservation Plan
SCC LGA boundary
Other LGAs
Potential koala habitat (AB, C and D)
High threat roads (>50kph) on potential koala habitat
Road threat
High perceived threat
Medium perceived threat
Low perceived threat
No perceived threat
ecosure

Construction of new roads should be avoided within koala habitat patches, especially if this habitat contains high proportions of primary and secondary habitat. Similarly, new road construction and increased traffic volumes should be avoided within adjoining koala habitat especially if it forms part of a movement corridor for koalas.

Blackspot-analysis should be conducted to identify road segments with high rates of koala mortality. Blackspots often equate to roads with high traffic volumes, high speed limits, and/or poor roadside visibility (McAlpine et al. 2007).

Linkage

Defining habitat connecting or linking areas may provide opportunities for the successful movement of koalas (e.g. dispersal or recruitment of sub-adults) between breeding populations or into areas of vacant preferred koala habitat. A corridor or linkage area can be considered any vegetated area spanning a distance of 3-4 km or less which connects two koala populations or large habitat blocks. Corridors need not comprise solid blocks of habitat but can consist of connected clusters of habitat patches which are no more than 100-200m apart. Even habitat patches less than 2 ha can act as 'stepping stones' of connectivity as long as they are close enough to each other and are safe to access by koala.

For proper mapping of movement corridors, it is strongly advised that detailed field surveys are carried out to determine where large koala populations exist in the landscape, in addition to studies which monitor the movement of the koala between the main habitat blocks.

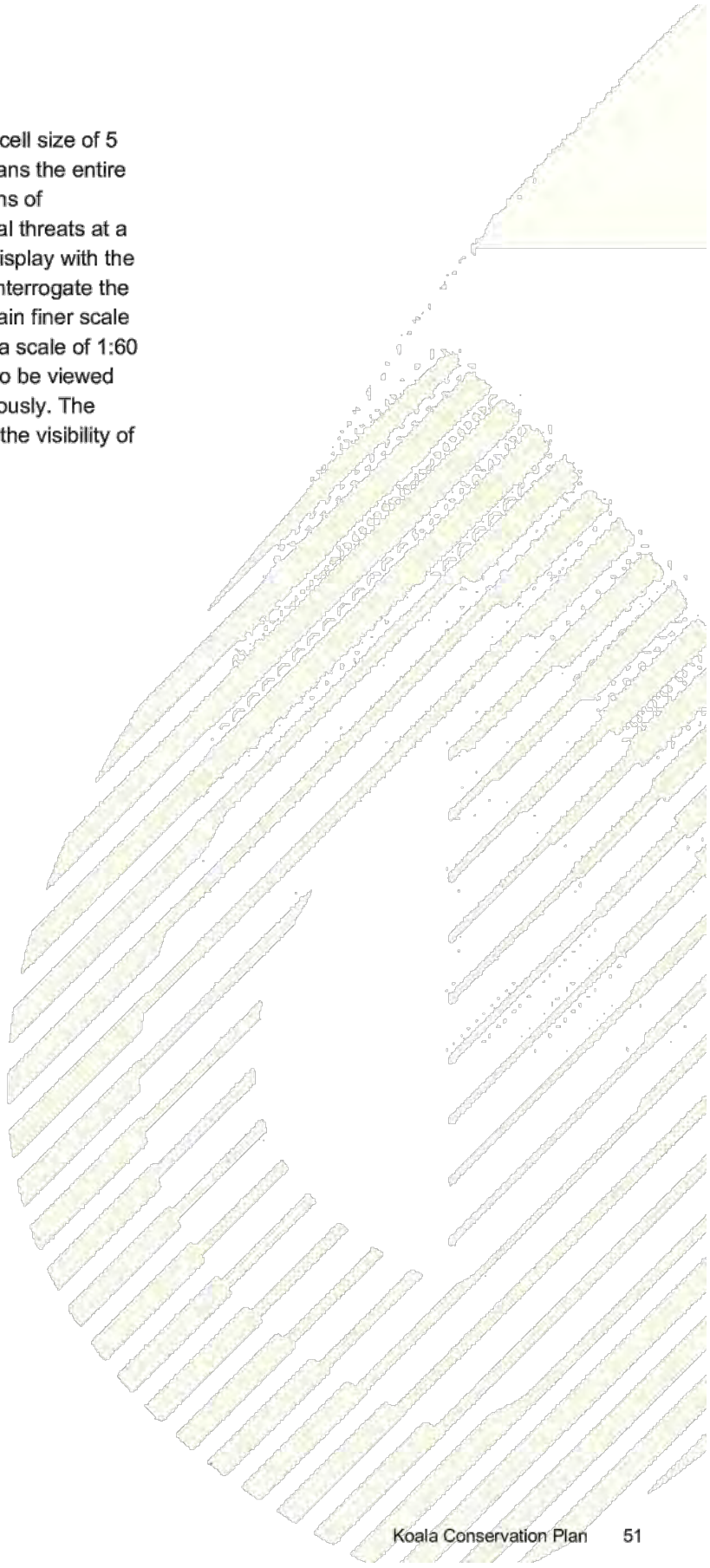
However, in the interim, in the absence of this empirical data, it is prudent to follow a precautionary principle and treat all potential corridor areas as if they are being utilised by koala. The guidelines for maintaining the quality of koala habitat linkage areas in this report are based on McAlpine et al. (2007), which are as follows:

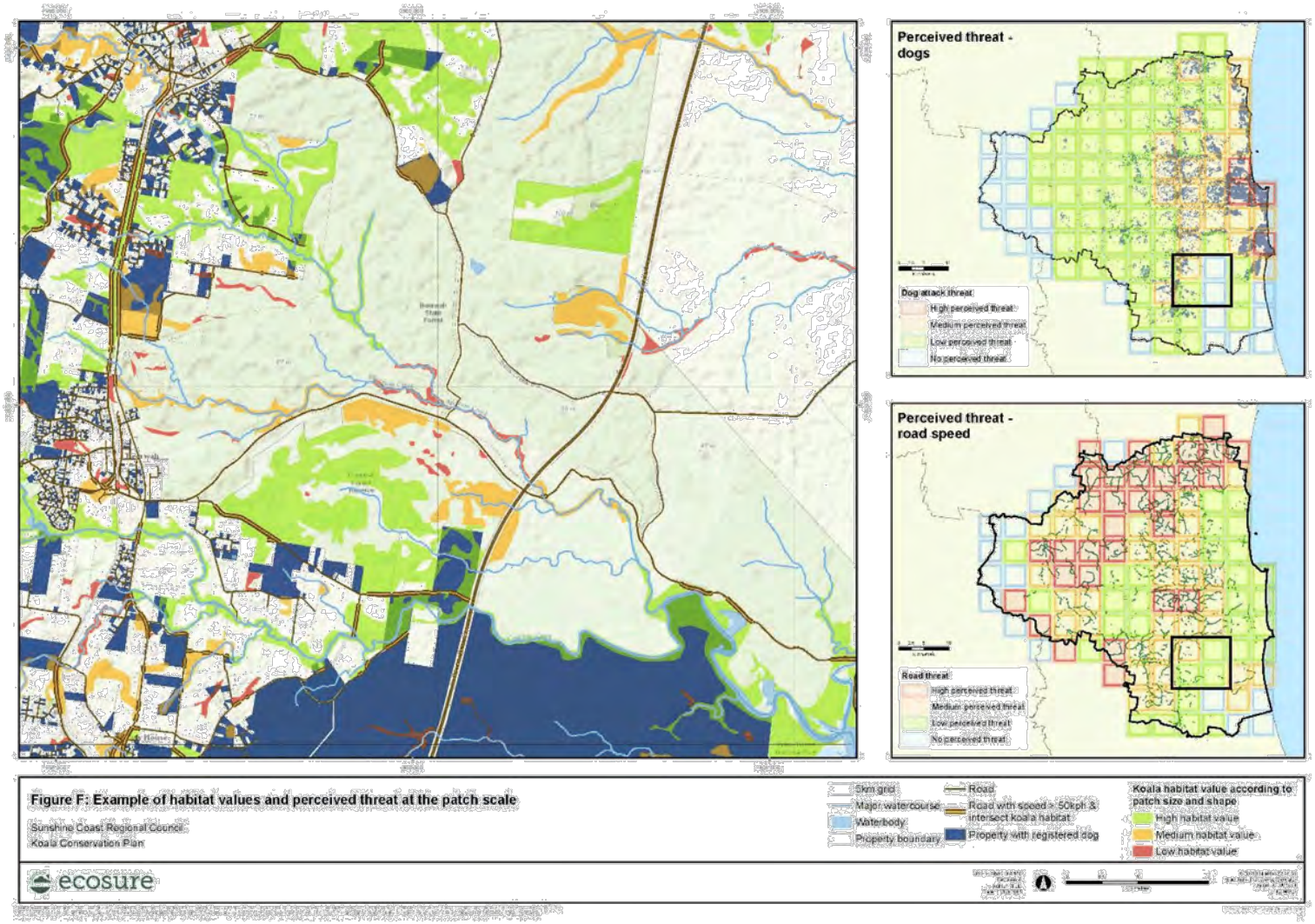
- Maintain sufficient proportions of mature preferred koala food tree species (i.e. greater than 30%) within koala patches or corridors. This can be achieved by keeping these areas in as natural state as possible and avoiding the removal of preferred koala food tree species and other tree species used by koala. In patches where proportions of food trees are low, consideration should be given to planting additional food trees within these linkage areas.
- To avoid internal fragmentation of koala habitat patches and linkages, it is suggested that the construction of roads and barriers, such as walls and fences within the linkage area be avoided. The clearing and thinning of trees within potential linkage areas should be avoided. Preferably maintain a distance of less than 20 – 30 m between mature trees.
- An effort should be made to maintain the structural and species diversity of trees within the linkage area. Any actions resulting in a decline in the number and age distribution of tree species should be avoided. If possible, a variety of tree age classes should be retained.
- Blocks of koala habitat separated by more than 10 km, or by significant barriers to koala movement, should be managed as separate populations.

A multi-scale decision-making framework

The purpose of the maps employed in this Plan are to guide decision makers from a landscape scale context towards high priority areas for threat mitigation programs, land acquisition, conservation management and habitat restoration. As a means to assist with managing potential koala habitat at multiple scales in the landscape, an ArcGIS geodatabase has been constructed which displays the potential koala habitat layer with its 100m habitat buffer, and perceived threat layers.

A systematic fishnet grid with a cell size of 5 km x 5 km is provided which spans the entire LGA area. This provides a means of identifying the locality of potential threats at a landscape scale via the GRID display with the intention to prompt the user to interrogate the landscape at local scales to obtain finer scale detail (Figure F). Zooming in to a scale of 1:60 000 allows up to four grid cells to be viewed within the data frame simultaneously. The larger view scale also activates the visibility of additional spatial information.




Perceived threat - dogs
Dog attack threat
High perceived threat
Medium perceived threat
Low perceived threat
No perceived threat
Perceived threat - road speed
Road threat
High perceived threat
Medium perceived threat
Low perceived threat
No perceived threat
Figure F: Example of habitat values and perceived threat at the patch scale
Sunshine Coast Regional Council
Koala Conservation Plan
5km grid
Major watercourse
Waterbody
Property boundary
Road
Road with speed > 50kph & intersect koala habitat
Property with registered dog
Koala habitat value according to patch size and shape
High habitat value
Medium habitat value
Low habitat value
ecosure

Because the geodatabase uses SCRC data in its base map, it would be necessary to map the data source of these layers to the SCRC server. The advantage of a geodatabase is that information layers displayed within the context of koala conservation planning and that they are updated automatically as data are updated on the server. Additional relevant koala data can be added to the database as it becomes available.

This page has been intentionally left blank

Appendix 2 Actions summary table

No.	ACTION	Timeframe	Estimated Cost	Funding source	Status	Responsibility
1.1	Develop a longitudinal monitoring program	Long	Low	Environment Levy	Future	EO
1.2	Collate data on koala observations, injury and mortality over time	Short and On-going	Low	Operational	Underway	EO
1.3	Support a consistent method of data recording and collection to be used across Council. Look for opportunities to gather incidental records from other programs (i.e. pest animal monitoring).	Short	Low	Operational	Future	EO
1.4	Undertake field surveys in mapped koala habitat using peer reviewed methodology to determine koala presence, aggregations, and population density	Long	High	Operational	Future	EHP/EO
1.5	Undertake analysis of historical sightings data to inform population studies	Short	Low	Operational	Future	EO
1.6	Continue to undertake analysis of mortality data to inform threat mitigation management	Short & on-going	Low	Operational	Underway	EO
1.7	Ground-truth and update koala mapping (Section 1.4)	Medium & On-going	Medium	Operational	Future	EO
1.8	Refine koala habitat mapping using Council's fine scale vegetation layer and the 2014 foliage cover model to capture non-remnant vegetation	Short	Low	Operational	Future	EO
1.9	Research and guide the use and implementation of mitigation measures to effectively minimise the impacts of threatening processes.	Short & on-going	Low	Operational	Future	EO/CS
1.10	Train Council staff in methods to assist with longitudinal monitoring	Long	Low	Operational	Future	EO
2.1	Investigate opportunities to include refined koala habitat mapping in future amendments to the Planning Scheme.	On-going	Low	Operational	Future	DS/ESP/EO
2.2	Report yearly on impacts and mitigation actions that occurred associated with development and related koala conservation outcomes - e.g. koala friendly fencing, koala safe road design, dog-free estates	Short & On-going	Low	Operational	Future	DS/ESP/EO
2.3	Enhance existing koala habitat by incoroporating koala food trees into landscape rehabilitation plans and ecological restoration activities where appropriate.	On-going	Low	Operational	Future	DS/P&G/EO
2.4	Develop a spatial layer that identifies potential offset receiving sites on council or private land that would establish new koala habitat.	Short & on-going	Low	Operational	Underway	EO
3.1	Determine priority locations to focus existing tools such as VCA, LFW, and other partnerships, with the intent to increase available koala habitat, connectivity or to provide buffering of core habitat or linkages	On-going	Medium	Operational and Environment Levy	Underway	EO
3.2	Continue to maintain partnerships with wildlife hospitals (e.g. Australia Zoo), and local wildlife care groups	On-going	High	Operational and Environment Levy	Underway	EO/ESP
3.3	Continue to deliver a range of programs to support community stewardship of koalas and revegetation/regeneration on private land - VCA, LFW	Short and On-going	High	Operational and Environment Levy	Underway	EO/ESP
3.4	Implement opportunities to encourage planting of koala food trees on private properties (i.e. beginning with LFW in known koala areas), e.g. additional component to LFW Incentives program.	Short & on-going	Low	Environment Levy	Underway	EO
3.5	Continue to liaise with local, state and federal government and support opportunities for regional scale actions	Short & on-going	Low	Operational	Future	EO/ESP
3.6	Partner with research organisations to investigate koala ecology and disease in the Sunshine Coast population	Short	Medium	Operational	Underway	EO/USC
4.1	Undertake analysis of mortality data to prioritise areas for mitigation measures to reduce the impact of vehicle strikes and dog attacks	Short & On-going	Low	Operational	Underway	EO
4.2	Collate baseline datasets (field survey, historical and mortality) to identify specific mitigation measures in pilot areas.	Medium & On-going	Low	Operational	Underway	EO
4.3	Conserve and maintain the integrity of highly connected core koala habitat patches giving priority to patches larger than 50 ha or a cluster of patches larger than 100 ha (Guideline 2.2 McAlpine 2007)	On-going	High	Operational and Environment Levy	Underway	EO/ESP
4.4	Continue to maintain revegetation /regeneration on council land identified in koala mapping that support core habitat or movement corridors through reserve management and the CNCP Program.	On-going	High	Operational, Offset Revenue and Environment Levy	Underway	EO
4.5	Identify koala habitat that contain feral dogs /continue to implement wild dog control program (this may also involve dog scat analysis)	On-going	Medium	Operational and Environment Levy	Underway	EO/CS
4.6	Investigate and implement suitable koala road safety measures, including signage, traffic speed mitigation, lighting, road verge maintenance, wildlife fencing and underpasses in identified koala habitat areas where vehicle strikes are shown to be a major threat (see also Actions 4.1 and 4.2)	Medium & On-going	Medium to High	Operational, Capital and/or Environment Levy	Underway	TIM/EO
4.7	Implement an education program focussing on dog ownership and off-leash dog areas, to raise awareness of the threat posed by domestic dogs (see also Actions 4.1 and 4.2)	Medium	Low	Operational	Future	CS/EO
4.8	Initiate discussions with the state government to identify and mitigate key threat areas through fencing on highways or motorways	On-going	Low	Operational	Future	EO/TIM/ESP/EHP
4.9	Investigate potential location/s for a refuge or sanctuary for translocated, injured or convalescing koalas	Medium	Low	Operational	Future	EO
4.10	Identify how to adaptively manage and enhance koala habitats for climate resilience by partnering with state government and research institutions	Short	Low	Operational	Future	EO
5.1	Deliver a range of community education programs on status of koala and importance of maintaining good quality koala habitat and corridors	On-going	Low	Operational	Future	EO/ESP
5.2	Participate in forums, seminars regarding koala conservation	On-going	Low	Operational	Underway	EO/ESP
5.3	Develop interpretive and promotional material (e.g. fact sheets) on koala ecology (including preferred food tres), habitat, relationship with indigenous culture and threatening processes), at council centres such as Maroochy Regional Bushland Botanic Garden.	Short	Low	Operational	Underway	EO
5.4	Explore opportunities for community and council involvement in koala research and/or monitoring projects, as well as building the community's role in data collection	Short	Low	Operational	Underway	EO

Implementation	Definition
Timeframe	
On-going	Actions that will continue to be undertaken in the life of the KCP
Short	Actions that will commence within the next 12 months
Medium	Actions that will commence within the next two years
Long	Actions that will commence within the next five years
Cost	
High	Over $100,000
Medium	$10,000 - $100,000
Low	Below $10,000

Department	Branches	Acronym
Infrastructure Services Department	Environmental Operations	EO
	Parks and Gardens	P&G
	Transport Infrastructure Management	TIM
Regional Strategy and Planning Department	Environment and Sustainability Policy	ESP
Community Services Department	Healthy Places	HP
Department of Environment and Heritage Protection	Department of Environment and Heritage Protection	EHP
University of the Sunshine Coast	Faculty of Science, Health, Education and Engineering	USC

This page has been intentionally left blank

Appendix 3 Regional ecosystems

Regional ecosystem	Short description
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics ± interbedded volcanics
12.11.2	*Eucalyptus saligna* or *E. grandis, E. microcorys, Lophostemon confertus* tall open forest on metamorphics ± interbedded volcanics
12.11.3 12.11.3a 12.11.3b 12.11.5j	*Eucalyptus siderophloia, E. propinqua* ± *E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics ± interbedded volcanics
12.11.9	*Eucalyptus tereticornis* open forest on metamorphics ± interbedded volcanics. Usually higher altitudes
12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra* ± *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks
12.12.15 12.12.15a 12.12.15b	*Corymbia intermedia* ± *Eucalyptus propinqua, E. siderophloia, E. microcorys, Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks
12.12.2 12.12.2a	*Eucalyptus pilularis* tall open forest on Mesozoic to Proterozoic igneous rocks especially granite
12.12.23	*Eucalyptus tereticornis* ± E. *eugenioides* woodland on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks
12.2.7c	
12.3.11 12.3.11a	*Eucalyptus tereticornis* ± *Eucalyptus siderophloia, Corymbia intermedia* open forest on alluvial plains usually near coast
12.3.2	*Eucalyptus grandis* tall open forest on alluvial plains
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana* ± *Melaleuca spp.* fringing woodland
12.5.2 12.5.2a	*Corymbia intermedia, Eucalyptus tereticornis* open forest on remnant Tertiary surfaces, usually near coast. Usually deep red soils
12.5.6 12.5.6a	*Eucalyptus siderophloia, E. propinqua, E. microcorys* and/or *E. pilularis* open forest on remnant Tertiary surfaces. Usually deep red soils
12.8.14	*Eucalyptus eugenioides, E. biturbinata, E. melliodora* ± *E. tereticornis, Corymbia intermedia* woodland on Cainozoic igneous rocks
12.8.8a	
12.9-10.1	Tall open forest often with *Eucalyptus resinifera, E. grandis, E. robusta, Corymbia intermedia* on sedimentary rocks. Coastal
12.9-10.14	*Eucalyptus pilularis* tall open forest on sedimentary rocks
12.9-10.4	*Eucalyptus racemosa subsp.* racemosa woodland on sedimentary rocks
12.9-10.7a	
12.11.18	*Eucalyptus moluccana* woodland on metamorphics ± interbedded volcanics
12.11.5e	
12.8.16	*Eucalyptus crebra* ± *E. melliodora, E. tereticornis* woodland on Cainozoic igneous rocks
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia* ± *Corymbia citriodora subsp. variegata* woodland on sedimentary rocks

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	13/03/2015	Sunshine Coast Council Koala Conservation Plan - draft	Emily Hatfield, Ecologist	Grant Brearley, Senior Ecologist	Beth Kramer Senior Environmental Scientist
01	27/03/2015	Incorporating comments on the draft by Council officers	Emily Hatfield, Ecologist	Grant Brearley, Senior Ecologist	Beth Kramer Senior Environmental Scientist
02	22/09/2015	Incorporating comments from public consultation	Emily Hatfield, Ecologist	Grant Brearley, Senior Ecologist	Beth Kramer Senior Environmental Scientist
03	29/09/2015	Minor amendments	Emily Hatfield, Ecologist	Grant Brearley, Senior Ecologist	
04	12/10/2015	Minor amendments	Beth Kramer Senior Environmental Scientist		

Distribution List

Copy #	Date	Type	Issued to	Name
1	12/10/2015	Electronic	Sunshine Coast Council	Julie O'Connor
2	12/10/2015	Electronic	Ecosure	Administration

Citation: Ecosure (2015), Koala Conservation Plan, Report to Sunshine Coast Council Publication Location – Burleigh Heads

Report compiled by Ecosure Pty Ltd

ABN: 63 106 067 976

admin@ecosure.com.au www.ecosure.com.au

PR1179-RE.Koala Conservation Plan.FI R3

Adelaide
PO Box 145
Pooraka SA 5095
P 1300 112 021
M 0407 295 766

Brisbane
PO Box 675
Fortitude Valley QLD 4006
P 07 3606 1030

Gold Coast
PO Box 404
West Burleigh QLD 4219
P 07 5508 2046
F 07 5508 2544

Rockhampton
PO Box 235
Rockhampton QLD 4700
P 07 4994 1000
F 07 4994 1012

Sydney
PO Box 880
Surry Hills NSW 2010
P 02 9437 6919


Sunshine Coast
COUNCIL
Your Environment
Levy in action
www.sunshinecoast.qld.gov.au
mail@sunshinecoast.qld.gov.au
T 07 5475 7272 F 07 5475 7277
Locked Bag 72 Sunshine Coast Mail Centre Qld 4560
50794 02/2015