

NSW koala population case studies

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1 NSW KOALA CASE STUDIES

The 2011 Commonwealth Senate inquiry into the status of the koala across Australia (Environment and Communications References Committee, 2011) recognized and was surprised by the complexity of koala conservation. Case studies can highlight this complexity while at the same time focusing on particular aspects of koala conservation. Four case studies are presented in this document (Table 1.1, Figure 1.1). These four examples are spread across the state, include populations that are declining, increasing and stable and that are subject to a range of threats. These four case studies were identified as important locations to research and manage in the NSW 2008 Koala Recovery Plan (Department of Environment and Climate Change, 2008), which in turn encouraged the sustained effort to understand both the local differences and the common themes. The four case studies all include data that can be considered relatively recent (e.g. data are included from 2011 for Coffs Harbour and 2014 for the Pilliga Forests). However in terms of koala population trends, the patterns discussed in the case studies should only be taken to reflect what was thought to be occurring at the time that the studies were completed: It is well recognised that koala population trends can change within a relatively short period of time.

Table 1.1: NSW koala case studies

Case study	Location	Koala population trend	What the example highlights
Coffs Harbour LGA	Mid north coast	Stable	<ul style="list-style-type: none"> Long term and repeat surveys are important in determining the pattern of population change
Pilliga Forests, Liverpool Plains and Gunnedah	Central west	Declining	<ul style="list-style-type: none"> Population threats are not consistent across the state Populations once thought to be secure, can rapidly decline
Campbelltown LGA	Sydney Basin	Increasing	<ul style="list-style-type: none"> Low density populations can survive and their role in koala conservation is not well understood.
South Coast	South coast	Declining	<ul style="list-style-type: none"> Climate change is a current threat that is already affecting koala populations

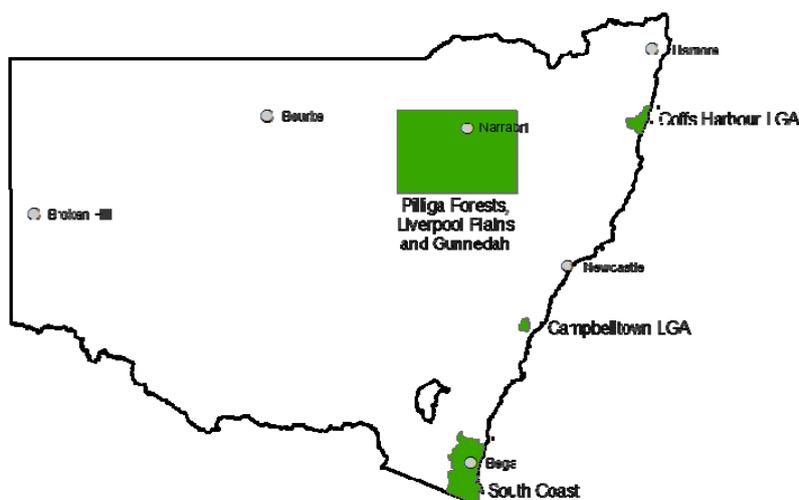


Figure 1.1: The location of the four koala case studies within NSW.

While individual case studies can point the reader towards a particular thesis or principle, the comparison and contrast of multiple case studies can also highlight common themes. From the four case studies presented in this document, it emerges that:

- it is only through long term and repeat studies of koala populations that we start to understand the patterns of population change
- koala populations are subject to a range of threats across the state, some of which are common, others that are localised
- low density populations are possibly more common than we once thought and that low density does not necessarily equate with a population in peril
- despite the multiple levels of legislative and policy protection afforded the koala, we still have populations in decline
- the level of information available on koala populations is variable across the state and there is no mechanism in place to collect consistent data
- koala populations and their population trends can change rapidly and a lack of consistent and regular monitoring means we are not in a position to promptly identify these changes.

2 COFFS HARBOUR – AN APPARENTLY STABLE COASTAL KOALA POPULATION

Coffs Harbour local government area (LGA), on the mid north coast of NSW, covers an area of 117,371 ha, including 21,354 ha in the north added in 2005 (note: this case study looks at the pre-2005 LGA boundary to allow comparisons of surveys). The Coffs Harbour koala population was identified as an important population in the NSW Koala Recovery plan (Department of Environment and Climate Change, 2008). Bongil Bongil National Park and Pine Creek State Forest in particular have been noted as key areas of Koala habitat (Smith, 2004). Coffs Harbour is part of the area proposed for the ‘Great Koala National Park’ (Love and Sweeney, 2015).

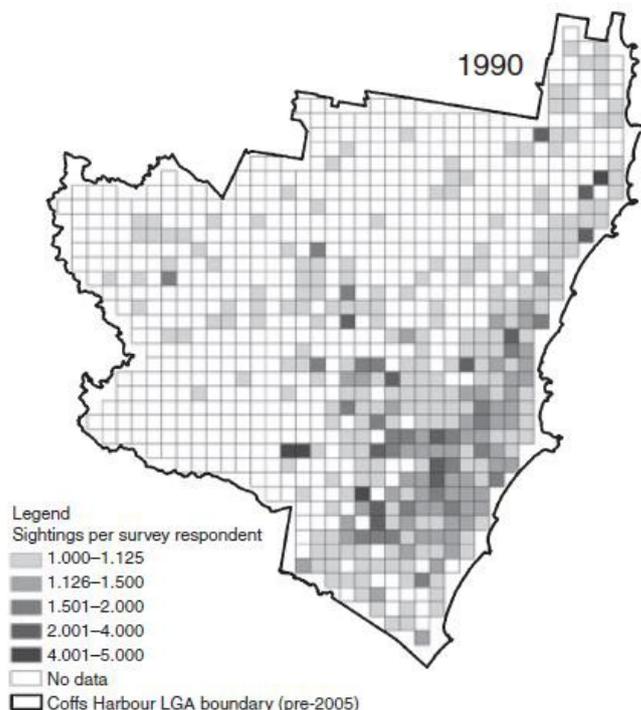
2.1 THE CURRENT KOALA POPULATION

There is no current estimate of the size of the koala population within Coffs Harbour based on field survey. A regional summary of koala populations in the upper mid-north coast of NSW (Scotts, 2013) estimated the population to be greater than 1000 in the coastal Coffs Harbour and northern Bellingen area and between 500 and 1000 in the Coffs Harbour Hinterland. Scotts (2013) suggests that the Coffs Harbour-north Bellingen population is:

‘the most critically important Koala regional population in this region and perhaps one of the most important in the nation’.

A study of the koalas of Pine Creek State Forest (now forming part of Bongil Bongil National Park) in the south of the LGA (Smith, 2004) estimated the population of the

forests as being between 350 and 450 individuals. Bongil Bongil National Park is one of the few remaining coastal blocks of koala habitat (Smith, 2004), and is recognised as a potential source area for dispersers to adjoining subpopulations (Scotts, 2013).



The koala population is not distributed evenly throughout the LGA, with a higher density of records and koalas in the south-east of the LGA (Figure 2.1) (Lunney, Predavec, Miller, Shannon, et al., 2016). A similar distribution is seen in koala habitat (Figure 2.2) (Lunney, Moon, Matthews, and Turbill, 1999a).

Figure 2.1: The distribution of sightings of koalas in a 1990 community survey.

From Lunney, Predavec, et al. (2016)

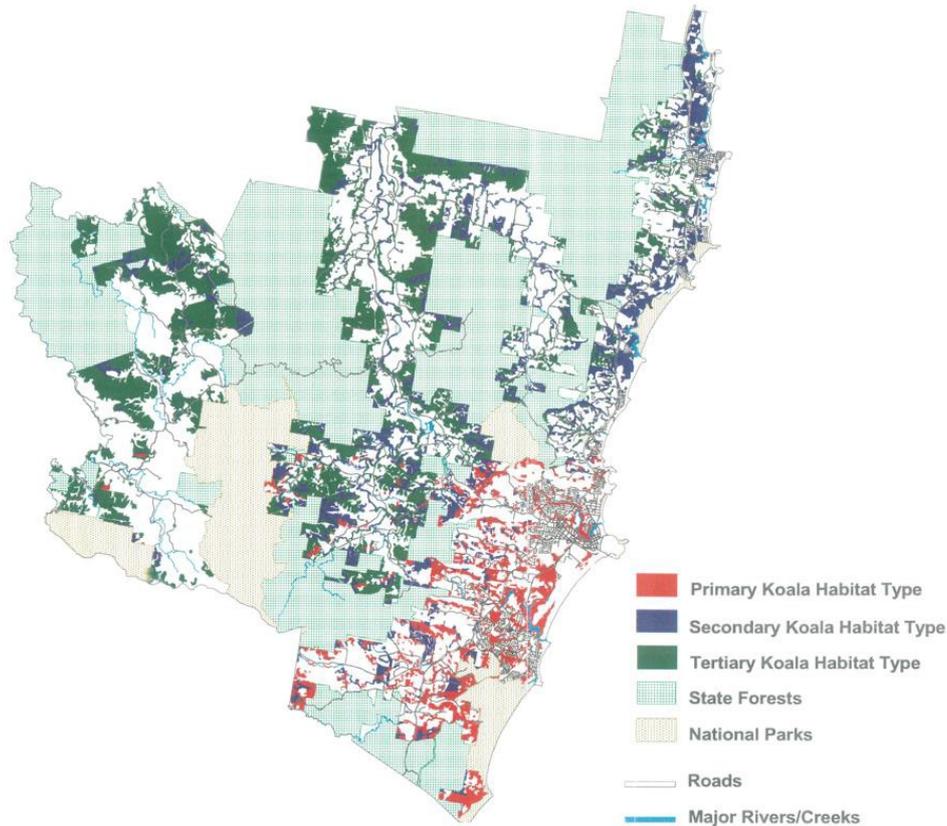


Figure 2.2: The distribution of koala habitat within Coffs Harbour LGA.

Data from Lunney et al. (1999a).

2.2 RECENT POPULATION TRENDS

Extensive surveys of koalas within Coffs Harbour LGA were completed as part of the preparation of the Comprehensive Koala Plan of Management in the 1990s (Lunney, Moon, Matthews, and Turbill, 1999b). This included two independent methods recording the location of koalas: community surveys (citizen science) recording the location of koala sightings and field surveys recording the location of koala scats. The community surveys were repeated in 2006 as part of a state wide wildlife survey (Lunney, Crowther, Shannon, and Bryant, 2009) and the field surveys were repeated in 2011 (Lunney, Predavec, Miller, Shannon, et al., 2016). These data allowed comparison of the distribution and a measure of abundance (koala activity) between 1990 and 2011. Analyses of these data led to the conclusion that, following a perceived population decline in the 1980s, the koala population of Coffs Harbour has endured between 1990 and 2011, showing no evidence of a precipitous decline during this period. Rather, the population change is best characterised as stable to slowly declining. This pattern appears to contradict a common view of recent koala population declines on the north coast of New South Wales (Scotts, 2013). There are four possible explanations for the population's apparent stability: that conservation efforts and planning regulations, such as the Coffs Harbour Comprehensive Koala Plan of Management (Lunney et al., 1999a), have been effective; that surviving adults are persisting in existing home ranges in remnant habitat; that the broader Coffs Harbour population is operating as a 'source and sink' metapopulation; and/or that the standard survey methods employed are not sufficiently sensitive to detect small population changes (Lunney, Predavec, Miller, Shannon, et al., 2016).

2.3 HISTORICAL POPULATION TRENDS

An ecological history of the koala from European settlement to 2000 has been compiled through review of media analysis, complemented by local histories, reports and annual reviews of fur/skin brokers, historical photographs, and oral histories (Lunney, Wells, and Miller, 2016). This history concluded that the koala population of Coffs Harbour was widespread but never abundant, and that habitat loss has been ongoing since European settlement. The conclusion regarding the low abundance of koalas is based largely on the absence of a significant fur trade from the region at the end of the 19th century during a period when koala skins were attracting a high price and trade was significant in other parts of the state. Initial habitat loss in Coffs Harbour was the result of clearing for agriculture and logging from the 1880s to the early 1900s. A second wave of clearing arose with the expansion of human settlements starting in the 1960s (Lunney, Wells, et al., 2016).

2.4 LIKELY THREATS

The Coffs Harbour Comprehensive Koala Plan of Management list the local threats to koalas, including: habitat loss, vehicle collision, dogs, disease, forestry practices and fire (Lunney et al., 1999a). Analysis of the temporal and spatial distribution of three recognised threats (dogs, disease and cars) (Figure 2.3) indicates that the threats are not distributed evenly across the LGA. These data highlight a key problem with koala management in coastal populations: namely that koala and human habitat overlap, thereby increasing the potential for conflict. Given the spatial distribution of koalas within Coffs Harbour it is likely that future urbanisation, and the associated threats of vehicle strike and dogs, will have an increased impact on the koala population in the future.

2.5 CURRENT MANAGEMENT ACTIVITIES

Coffs Harbour was the first LGA to implement a Comprehensive Koala Plan of Management (CKPoM) under State Environmental Planning Policy No. 44 (SEPP 44)(Lunney et al., 1999a, 1999b). The plan was completed and placed on public exhibition in 1998, adopted by Coffs Harbour City Council in 1999 and approved by the Minister for Planning in 2000 as part of the Local Environment Plan (LEP) for the LGA. The primary aim of the plan, as stated in 1999, is to:

‘provide a framework for the conservation and management of koala habitat, and the management of threats to koalas, to ensure permanent free-living populations over their present range in Coffs Harbour LGA, and reverse the current trend of koala population decline’ (Lunney et al., 1999a).

However, several points suggest that the CKPoM may not be the (only) driving force behind the stable koala population. First, the plan was implemented in 2000, almost halfway through the stable population period identified in the study of Lunney, Predavec et al (2016). The population study demonstrated that the stable pattern seen in the Coffs Harbour koala population was occurring both before and after the CKPoM was endorsed. Second, a review of implementation of the CKPoM (EcoLogical Australia, 2006) concluded that the plan had been only partially implemented by Council. For example, of the 245 ha of koala habitat that was cleared in Coffs Harbour between 2000 and 2005, 30 ha were primary koala habitat (EcoLogical Australia, 2006). Finally, three of the threats that are significant to koalas (dogs, cars and disease) appeared to be stable or increasing during the time that the plan has been operating. Within a stable koala population, this supports the idea that threats have also remained stable and that the plan has not been effective in managing or reducing their impact. However, it is noted that the CKPoM is a planning instrument guiding land use decisions, and it is not a wildlife management plan. While the relationship between the CKPoM and the koala population is not directly clear, the plan and the associated works

have raised the profile of the koala in the LGA within the broad community, and this would certainly be important in any conservation effort.

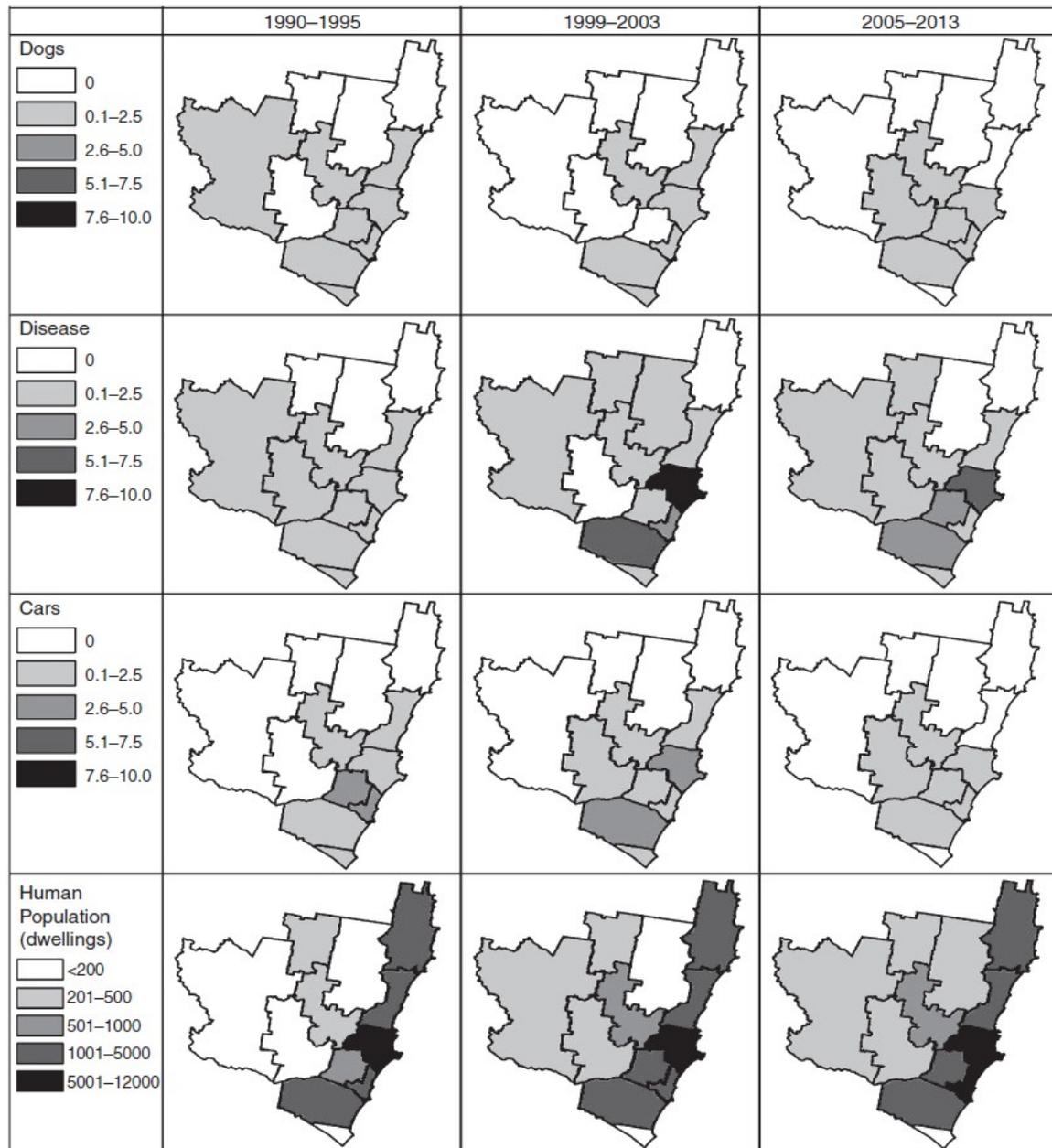


Figure 2.3: Spatial distribution of koalas reported to WIRES over three periods as a result of three recognised threats: dogs, cars and disease.

Data are expressed as the number of koalas per year across 12 local areas within the Coffs Harbour LGA. The spatial distribution of the human population is provided for reference. From Lunney et al. (2016)

The CKPoM applies only to freehold lands and those under the control of the local Council. Approximately 36% of the LGA is State Forest and the management of these lands falls under the Integrated Forestry Operations Agreement (NSW National Parks and Wildlife Service, 1999), which is currently being remade. Approximately 8% of the LGA is National Park and management falls under National Parks and Wildlife Service. Within freehold land clearing of koala habitat for the purpose of private native forestry falls under the provisions of the Private Native Forestry Code of Practice (Department of Environment and Climate Change NSW, 2008) administered by the NSW Environment Protection Authority. Between

2007 and 2013, 114 vegetation management agreements were approved within Coffs Harbour LGA for private native forestry. The Pacific Highway run through Coffs Harbour LGA and is under the management of the NSW Roads and Maritime Services. Koalas have been extensively studied as part of the environmental approvals for the upgrade of the Pacific highway in this region (Australian Museum Business Services, 2012; Lassau et al., 2008) and mitigation measures targeting koalas have been put in place including fauna floppy-top fencing, underpasses and a fauna overpass.

2.6 DATA REQUIREMENTS/GAPS

Despite the length of time that management actions focused on koalas have been in place in Coffs Harbour LGA, key information remains lacking. Lunney, Predavec et al. (2016) suggested that these data gaps include the following along with the proposed works:

- Information on the impact of various threats on the population structure (e.g. differential mortality of sex and age classes)
- The effectiveness of mitigation measures in protecting koala populations
- Movement patterns of koalas within the LGA and how this plays a role in population dynamics. In particular this relates to the movement of koalas within the urban matrix and the interaction with surrounding patches of koala habitat (e.g. Bongil Bongil National park)
- The importance of the apparently low density koala population within the hinterlands of the LGA.
- Filling these data gaps requires a new study method for the LGA, but one that is well-tried, namely a radio-tracking study of individual koalas accompanied by detailed health checks and obtaining genetic materials when the koalas are caught and the radio-tracking collars attached and removed, as well as pathology reports on any diseased or dead koalas.

3 PILLIGA FORESTS, LIVERPOOL PLAINS AND GUNNEDAH – DECLINING POPULATIONS WEST OF THE GREAT DIVIDING RANGE

The area that this case study focusses on is large, covering an area of approximately 40,000 km². It includes:

- The Pilliga forests in the west. Covering 535,000 ha, the Pilliga Forests comprise the single largest remaining tract of native forest and woodland in NSW west of the Great Dividing Range.
- Gunnedah LGA in the east, which has promoted itself as the ‘Koala Capital of the World’.
- The Liverpool Plains in the south and centre. This area consists of extensive agricultural lands that are now the subject of controversy with the proposed development of coal mines (Barlass, 2015) and coal seam gas projects (Thomas, 2016).

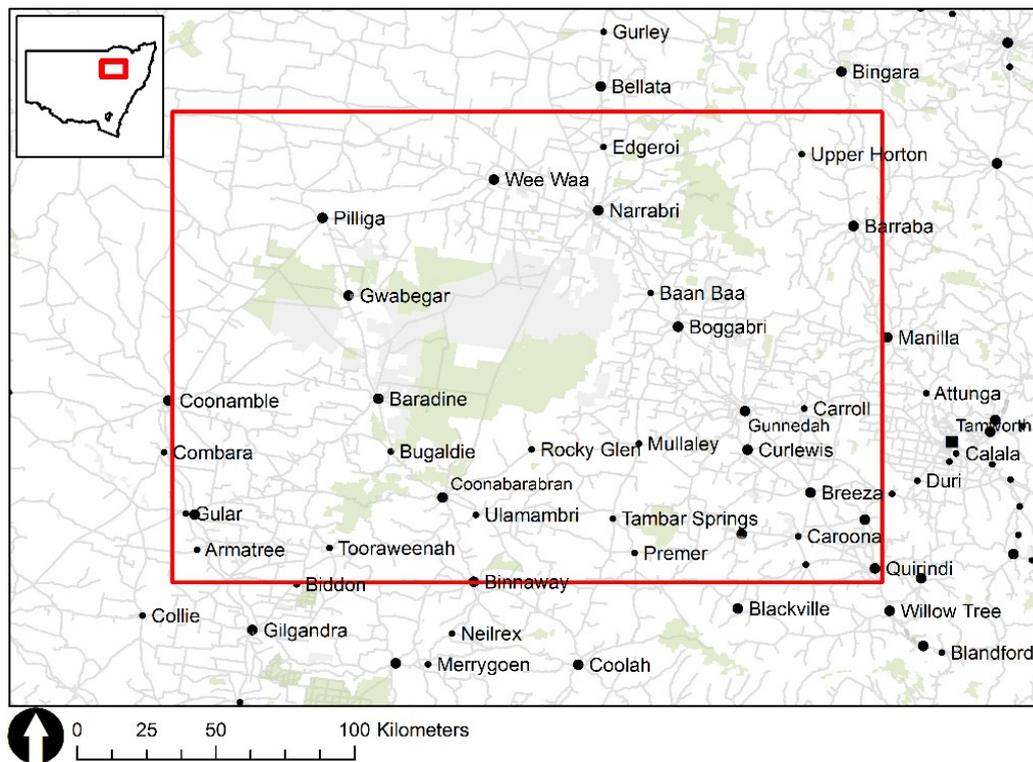


Figure 3.1: The area covered by the Pilliga Forests, Liverpool Plains and Gunnedah case study

There is debate about whether the koalas in this broad area form a single population, a series of smaller populations that interact as a metapopulation, or if they should be considered as separate and isolated populations. However, there is sufficient consistency in patterns of population trends across this region for the koalas of the area to be considered together, and the scale is such that it is realistic to expect koalas to interact over multiple generations.

3.1 THE CURRENT KOALA POPULATION

While there is no current estimate of the size of the koala population within the case study area, a number of smaller-scale studies have estimated population sizes, highlighting the importance of this area for koalas. Surveys of the Pilliga forests in the 1990s suggested that the forests were carrying the largest population of koalas west of the Great Dividing Range in NSW, with the numbers estimated at approximately 15,000 (Kavanagh and Barrott, 2001). While this estimate is subject to debate (Department of Environment and Climate Change, 2008), the population within the Pilliga has declined dramatically since the 1990s (see Section 3.2). More recent studies within the Gunnedah LGA estimated the local koala population numbered approximately 12,700 animals (Gunnedah Shire Council, 2015), but as with the Pilliga Forests, it appears that the Gunnedah population has more recently declined. Despite the changes in numbers, the koala population(s) of the Pilliga Forests and Gunnedah must be considered significant at the state scale and of particular importance west of the Great Dividing Range.

3.2 RECENT POPULATION TRENDS

Recent studies within the broad area have suggested a dramatic decline in koala populations. A combined series of repeat surveys for koalas within the Pilliga forests showed a decline of over 80% in both the distribution and activity of koalas within the forests (Lunney, Predavec, Miller, Kavanagh, et al., 2016). Although koalas remain within the forests, they were found in the later surveys to be restricted to moister areas adjacent to creek lines. The decline of koalas was found to be consistent across the forests and it was only high initial population densities in the moister areas that saw the koalas persisting in these habitat types (Lunney, Predavec, Miller, Kavanagh, et al., 2016).

A 2014 community (citizen science) survey across the entire case study region asked residents for the location of koala sightings and their perception of population trends (D. Lunney, unpublished data), allowing comparison with data from a state-wide survey in 2006 (Lunney et al., 2009). Comparison of the two surveys (each covering two periods) showed a decline in koala sightings relative to eight other species covered in the survey (Figure 3.2).

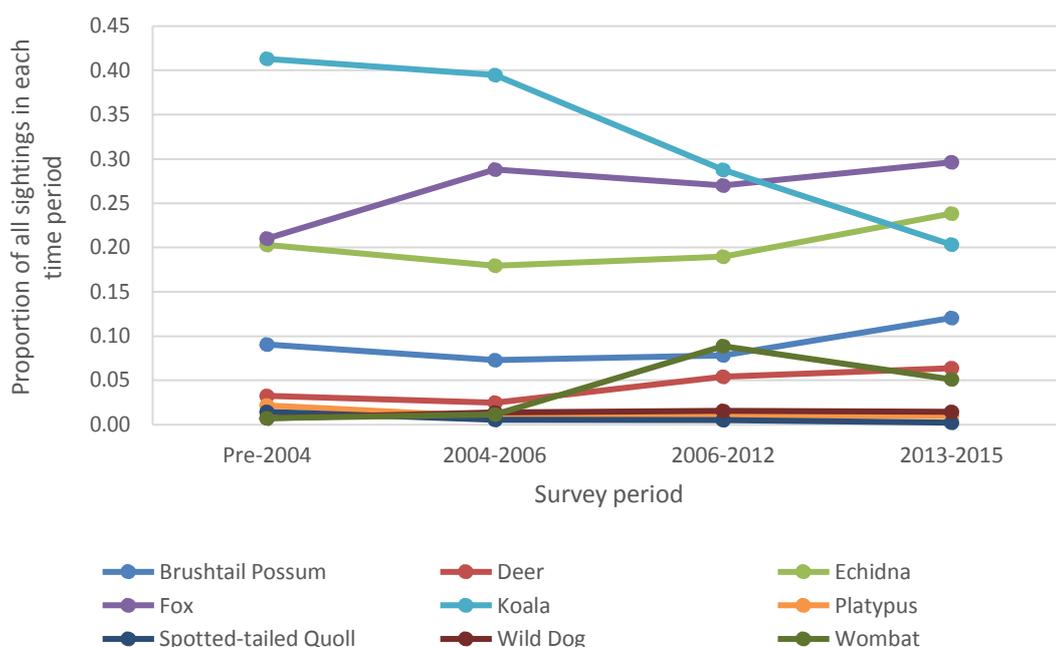


Figure 3.2: The proportion of sightings in each of four time periods covered by two community surveys.

Data from D. Lunney (unpublished data).

The decline in koala post 2006 coincides with a significant heatwave experienced in the region in 2009. This extreme weather event saw above average temperatures in the region, and importantly the high temperatures occurred over strings of successive days rather than simply isolated days. The weather event saw an estimated 25% of the koala population of the Gunnedah region die and an increase in the expression of symptoms of *Chlamydia* infection (Lunney et al., 2012).

3.3 HISTORICAL POPULATION TRENDS

There is no long-term ecological history for the region. However there are perceptions of long term trends and studies that point to a stable or increasing population prior to the recent declines described in Section 3.2. The 2006 state-wide community survey highlighted the Gunnedah region as the only area of NSW with an increasing koala population (Lunney et al., 2009). A similar result was found in the studies informing the Gunnedah Koala Strategy, with current occupancy rates of available habitat being approximately 50% compared to approximately 15% estimated through historical koala records (Gunnedah Shire Council, 2015). Within the Pilliga Forests, the high population estimate in the 1990s was thought to have followed a population increase and the 1990s population was thought to be at the highest level in over 70 years (Kavanagh and Barrott, 2001). In Warrumbungle National Park, south of the Pilliga forests, koalas were at sufficiently low numbers in the 1960s that they were thought extinct in the park (Fox, 1996). Plans were proposed to re-colonise the park with koalas translocated from Victoria and progressed to the point of a plantation of Manna Gums (*Eucalyptus viminalis*) being planted in the park. Koalas were discovered in the park soon after the planting and the translocation plans were abandoned (Fox, 1996). Until the 2013 fires within the park, koalas were considered abundant, although numbers had declined markedly in the years preceding the 2013 fire, most likely from the millennium drought.

3.4 LIKELY THREATS

Many of the threats experienced by koalas within this broad case study area will be similar to those experienced by koalas throughout their range. For example, the Gunnedah koala Strategy (Gunnedah Shire Council, 2015) lists the full range of threats that would be found in coastal strategies or plans of management, including habitat loss, vehicle collision, predation by dogs and fires. However, west of the Great Dividing Range, koalas will also be affected by drought and extreme heatwaves as was seen in the 2009 heatwaves (Lunney et al., 2012). The impact of these extreme weather events on koalas is likely to increase with predicted climate change (Lunney et al., 2012) and may also exacerbate other recognised threats such as disease.

The interaction of threats can be seen in the decline of koalas within the Pilliga Forests. The magnitude and pattern of decline seen in the Pilliga forests is similar to that seen in other semi-arid regions such as south-west Queensland (Seabrook et al., 2011). These population contractions are likely to have occurred in the past in the Pilliga with koala populations retreating to moister creek lines with either available free water or a higher moisture content in the leaves of their food trees. However, since the early 1900s, creeks within the Pilliga forests have sanded up as a result of land clearing within and on the periphery of the forests and from road building within the forests (Hesse and Humphreys, 2001). The scale of the disturbance in the Pilliga is such that disturbed channels appear to be 'normal' (Hesse and Humphreys, 2001). Habitats that would have once likely functioned as refugia for koalas during times of drought, are now highly disturbed and are unlikely to provide the required level of protection for the species in the region (Lunney, Predavec, Miller, Kavanagh, et al., 2016).

3.5 CURRENT MANAGEMENT ACTIVITIES

Given the size of the case study area, it is not surprising that a variety of different management activities are in play. Gunnedah Shire Council prepared a draft Comprehensive Koala Plan of Management (CKPoM) for an area covering approximately 2,172 km² occupying the central portion of the LGA and encompassing the main extent of the koala population within the LGA. Following exhibition of the draft CKPoM and discussions with the NSW Department of Planning, Gunnedah Council resolved to prepare instead a Koala Strategy that applies to the entire LGA (Gunnedah Shire Council, 2015). The strategy maps koala habitat within the LGA and suggests planning controls that should be followed for any land use planning or development application to Council.

Other significant koala populations are under the management of State Forests (Pilliga State Forests) or National Parks (Pilliga National Park, Warrumbungle National Park).

Although not initially aimed at conserving koalas, an extensive revegetation program initiated in the 1990s to curb salinity on agricultural lands near Gunnedah has had a positive impact on koalas. A comparison of the distribution of koalas in 1990 and then again in 2006 showed an increase in the distribution of koalas (Ellis, Rhind, Smith, and Lunney, 2016) and that koalas were using planted trees (Rhind, Ellis, Smith, and Lunney, 2014).

The Namoi Valley Independent has instigated “Gunnedah’s Koala Project” (<http://www.nvi.com.au/news/project-koala/>), a community-based project aimed at planting koala feed trees, providing watering points as a trial and fundraising for appropriate projects. The North West Local Land Services has recently produced a video highlighting aspects of the problem (<https://www.youtube.com/watch?v=sbF4IOIXtQA>).

3.6 DATA REQUIREMENTS/GAPS

Key missing information relating to the koalas over the broad case study area includes:

- Movement patterns of koalas through the landscape. This is particularly important when local populations become extinct and koalas recolonise.
- The ecological history of koalas within the region and, in particular, the pattern of population fluctuations.
- The likely changes in koala populations with predicted climate change.
- The likely success of proposed direct management actions aimed at providing koalas with water including:
 - Providing watering points for koalas,
 - Rehabilitating the creek lines within the Pilliga forests,
 - Koala habitat restoration.

4 CAMPBELLTOWN LGA – A LOW DENSITY KOALA POPULATION

Campbelltown LGA is situated in the south-west of Sydney and is part of the greater Sydney metropolitan region. The first report of a European sighting of a koala was made on 26 January 1798, 10 years after British settlement, near Bargo, within Campbelltown LGA (Lunney et al., 2010a). This makes the Campbelltown koala population the longest-known population to Europeans in Australia (Lunney et al., 2010a), and one that survives today: a record all the more surprising given the rapidly expanding urbanisation of Sydney.

4.1 THE CURRENT KOALA POPULATION

The current population of koalas within Campbelltown LGA is estimated at between 100 and 150 individuals (Biolink Ecological Consultants, 2016): Distributed over an area of 31,166 ha, this represents a low density population. While undoubtedly the current populations levels are in part due to past disturbance and habitat clearing (Biolink Ecological Consultants, 2016; Lunney et al., 2010a, 2010b), recent work has suggested that koala population densities can be low, as in the case of Campbelltown, without being in danger (Close, Ward, and Phelan, 2015).

4.2 RECENT POPULATION TRENDS

The current population within Campbelltown LGA can best be described as stable or increasing, with the clear acknowledgement that the population is low and always has been (Close et al., 2015). Close et al. (2015) provide evidence of a low but stable (or increasing) population including findings from a 20-year radio-tracking study that showed that female koalas lived long lives and produced many offspring.

4.3 HISTORICAL POPULATION TRENDS

It is likely that the population of koalas within what is now Campbelltown LGA has always been a low density population, at least since European settlement. The first report of a European sighting of a koala came 10 years after British settlement (Lunney et al., 2010a): this is surprising given the extent of vegetation clearing surrounding the newly formed Sydney and the uniqueness of the koala. This suggests that koalas were never abundant near Sydney (Close et al., 2015). The draft CKPoM for Campbelltown LGA suggests that historical clearing of fertile plateau land for agriculture and urban development resulted in an initial decrease in the Campbelltown population. A series of major fires in the latter part of the 20th century further reduced the population (Biolink Ecological Consultants, 2016). Whether the population seen in Campbelltown today represents a population that has always been low density or a population recovering from past perturbations remains to be seen.

4.4 LIKELY THREATS

The draft CKPoM for the Campbelltown LGA indicates that the most significant long-term threats to the koala population viability are wildfire, mortality due to vehicle collision and domestic dog attack and habitat loss. While these threats are the same threats that occur throughout the koalas range, two stand out as particularly important for the Campbelltown population. Firstly, mortality due to collision with vehicles highlights the problems faced by road managers making busy peri-urban roads safe for road users, while at the same time reducing wildlife mortality. For example, the provision of solid barriers along secondary roads dividing oncoming traffic in areas with high traffic volumes often represent solid barriers for fauna. Secondly the loss of habitat, or more importantly the protection of habitat, is important

in maintaining connectivity of the population with surrounding populations (Biolink Ecological Consultants, 2016; Lunney et al., 2010b).

4.5 CURRENT MANAGEMENT ACTIVITIES

Campbelltown City Council has recently prepared a draft CKPoM (Biolink Ecological Consultants, 2016), which maps koala habitat within the LGA and provides detailed management actions related to the population.

4.6 DATA REQUIREMENTS/GAPS

If approved, the CKPoM for Campbelltown will provide support for data gathering relating to the Campbelltown koala population. The draft plan provides for monitoring of the population and the support on ongoing research into the population.

5 SOUTH COAST KOALAS – A DECLINING POPULATION AFFECTED BY HABITAT LOSS AND CLIMATE CHANGE

The south coast region is situated in the south-east corner of NSW. It covers an area of approximately 7000 km² and falls within the Bega Valley Shire LGA.

5.1 THE CURRENT KOALA POPULATION

Although once relatively abundant across the forested areas of the south-eastern corner of NSW, koalas are now restricted to the north-east of the region between Bermagui and Tathra. A survey of the forested regions between 2012 and 2014 recorded evidence of koalas at 105 of the 918 sites surveyed, giving a total level of activity of 11.4% (Office of Environment and Heritage, 2016). Based on the level of occupancy, the extent of available habitat and estimated koala home ranges, the population in the north east corner is between 30 and 60 koalas (Office of Environment and Heritage, 2016).

5.2 RECENT POPULATION TRENDS

Comparison of a series of community (citizen science) surveys in the region between 1985 and 2011 allowed the pattern of population change to be determined (Lunney, Stalenberg, Santika, and Rhodes, 2014). As recently as the early 1990s, koalas were observed throughout the south-east forests (Figure 5.1). However, by 2005, the probability of koala occurrence had contracted to the coast and in particular to the north-east corner. Lunney et al. (2014) demonstrated through modelling that a succession of multiple threats to koalas from land use (human population growth and habitat loss, including logging) and environmental change (temperature increase and drought) were significant contributors to this decline. They suggested that climate change was a hitherto hidden factor that was a major driving force for the koalas in the Eden region (Lunney et al., 2014).

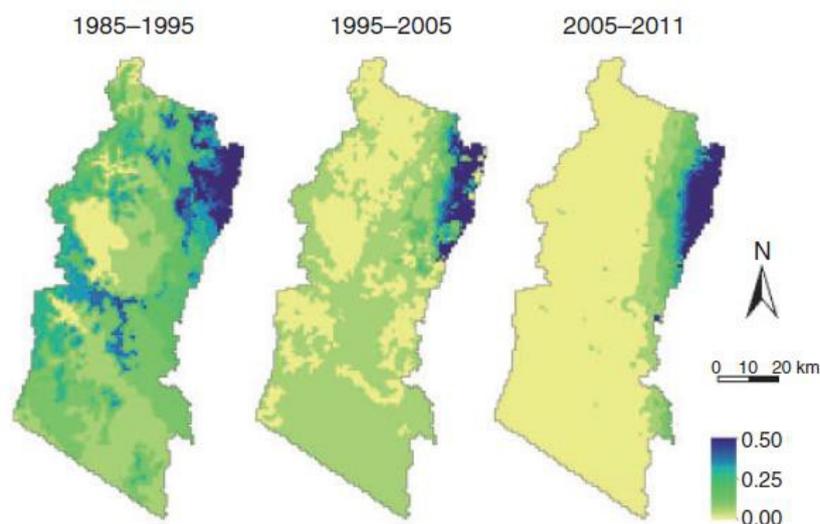


Figure 5.1: The change in the probability of koala occurrence in the Eden region from 1985 to 2011.

Dark areas represent a higher probability of occurrence, i.e. a probability of 0.5 means that there was a 50% chance of a koala sighting being reported by the community. Figure from Lunney et al. (2014).

A 2012-2014 field survey of the coastal forests in the north-east corner (Office of Environment and Heritage, 2016) allowed comparison with the results of surveys undertaken in 2007-2009 (Allen, Saxon, and McDougal, 2010). Using a paired site comparison, the study found a significant increase in the level of activity in 2012-14 (17%) compared to 2007-09 (10%). The koala population estimate increased from 23-47 koalas in 2007-09 to an estimate of 30-60 koalas in 2012-14 (Allen et al., 2010). The study authors report the results indicate the population may be increasing, possibly in response to improved environmental conditions following earlier drought or the increased time since the major impacts of fire and logging have occurred in the habitat (Office of Environment and Heritage, 2016). They do, however, indicate that the results must be treated with caution because of the small sample size and the lack of clear links with causal factors (Office of Environment and Heritage, 2016).

5.3 HISTORICAL POPULATION TRENDS

The long-term trend for the koala population of the south coast region is one of drastic decline. At the end of the 19th century koalas were sufficiently common in the region to support a commercial pelt industry (Lunney et al., 2014), but by 2014 they were rare and localised (Office of Environment and Heritage, 2016).

An ecological history of the Bega Valley region (Lunney and Leary, 1988) reported that koalas were at high numbers and increasing in the region in the 1860s and remained high for three decades until the turn of the century. The koala population then apparently declined between 1905 and 2009, possibly as the result of disease or malnutrition with koalas:

"very sick and dejected in the trees before they were found in hundreds dead at the foot of trees" (H.A. Tarlington, quoted in Lunney and Leary, 1988).

The decline of koalas also coincided with the end of the land clearing phase in the region (primarily for agriculture) and the sudden decline may be the result of the perception of koala decline rather than a dramatic decline. Regardless, following the decline, koalas remained rare and in isolated patches within the Bega Valley until the 1980s (Lunney et al., 2014).

5.4 LIKELY THREATS

The historical pattern of decline can be attributed to land clearing, particularly for agriculture (Lunney and Leary, 1988). Disease has been suggested as playing a role in the decline (Lunney and Leary, 1988), although whether or not this is a primary cause of decline or a threat exacerbated by other factors is open to debate (Strahan, 1985). Modelling of the recent contraction of the koala population to the north-east indicated that land use and vegetation (including logging) were significant contributors to the decline and that climate change further contributed to, and exacerbated, the contraction (Lunney et al., 2014).

The Far South Coast Koala Management Framework (EcoLogical Australia, 2008) identified a range of threats operating in the region as identified through consultation and a literature review.

Table 5.1: Recognised threats for the far south coast koala population

Information from EcoLogical Australia (2008).

Threat
Very low population numbers and density
Habitat destruction
<ul style="list-style-type: none"> • Asset protection zones for residential and rural assets • Lack of high quality valley floor habitat • Land clearing for residential and industrial purposes

Threat

- Land clearing – rural and agricultural and rural residential
- Logging

Habitat degradation

- Fragmentation
- Degradation of habitat on rural land and rural residential
- Changed flora species composition resulting from logging and fire regimes
- Logging – low and very low intensity tree removal and understorey damage
- Drought
- Soil degradation
- Dieback
- Roads (including fire trails, snigging trails)

Ineffective legislation and planning instruments

- SEPP 44 – inappropriate tree species list and use in LEP
- LEP and Development Control Plans – failure to include koala specific provisions or information in zoning
- Rural Fires Act – Failure to consider koalas in APZ guidelines and fire frequency planning
- Threatened Species Conservation Act – failure to ensure koalas are considered in 7 Part test
- Native Vegetation Act – failure to include koala (regionally specific info) in PVP test
- Catchment Management Act – potential failure to get optimal outcomes from incentive schemes and funded projects

Bushfire

- High intensity crown fires
- Fire frequency

Predation

- Wild dogs
- Domestic dogs
- Natural predators e.g. owls & dingoes
- Vehicle accidents
- Shooting in habitat areas

Disease

Lack of knowledge regarding koala ecology

- Effectiveness of survey and research methods
- Impacts of survey and research methods
- No knowledge of disease
- No knowledge of genetics

Lack of knowledge – community involvement and action

Climate change

5.5 CURRENT MANAGEMENT ACTIVITIES

A management framework for the far south coast koala populations was finalised in 2008 (EcoLogical Australia, 2008). The framework considered the knowledge and views of the community and the major land managers of the Far South Coast region of NSW, regarding the koala and aimed to identify threats to the koala, and potential actions and processes to reduce these threats, across all tenures.

In 2016, 12,000 ha of State Forest in the region were converted to four new Flora Reserves in order to protect the remaining koalas of the south coast (Brown, 2016). The reserves will

be managed by NSW National Parks and Wildlife Service on behalf of State Forests. As part of the arrangement, the NSW Government also provided a \$2.5 million grant to facilitate the sourcing of timber from alternative South East NSW State Forests, highlighting the land use conflicts that occur in the region.

5.6 DATA REQUIREMENTS

The management framework for the far south coast koala population (EcoLogical Australia, 2008) identifies four knowledge gaps relating to koalas in the far south coast:

- effectiveness of survey and research methods
- impacts of survey and research methods
- no knowledge of disease
- no knowledge of genetics.

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Acronyms

CKPoM	Comprehensive Koala Plan of Management
LEP	Local Environment Plan
LGA	Local Government Area
NSW	New South Wales
SEPP44	State Environmental Planning Policy 44: Koala Habitat Protection