A Review of the Evidence for the Management of South Australia's Free-ranging Koala Populations

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Purpose

This report provides a summary of the available evidence to inform the management of SA's free-ranging koala populations, with a particular focus on the management of overabundant populations and the impact that they have on native vegetation. The report synthesises research undertaken by universities and field surveys undertaken by DEW staff, to summarise the state of current knowledge and to identify priority knowledge gaps. The focus of this review is on the status and trend, ecological impact, and management of free-ranging koala populations in South Australia.

Background

South Australia has developed a strategy to help conserve and manage the koalas across our state (Department of Environment Water and Natural Resources, 2011). This Strategy brings together government, community representatives, natural resource managers, experts and scientists to look at ways of collectively managing koala populations in South Australia into the future. The South Australian Koala Conservation and Management Strategy addresses the key conservation and management issues which affect the health and welfare of koalas and their habitat, as well as outlining the actions that will help manage these impacts.

Nationally, Koalas face significant challenges from the impacts of development and subsequent destruction of their habitat. Other threats include mortality due to disease, vehicle collisions and attack by dogs, as well as issues arising from climate change and wildfire. Dynamic koala populations across the state (increasing in some areas and decreasing in others) also means that koala numbers can have an ecological impact on native vegetation communities. This report outlines what we currently know about free-ranging koala population dynamics in SA, and the measured and potential ecological impact. It does not address the threats to koala populations.

Status and Trend of Free-ranging Koalas in South Australia – density and total population

Kangaroo Island

Koala Density

On Kangaroo Island, koala density is determined annually at an average of 35 sites (range 20-73 between 1996 and 2017), with a more comprehensive survey undertaken at an average of 105 sites (range 97-115 between 2000 and 2015) every 5 years. The sites are stratified across six management units, and across three 'habitat quality' classes (high, medium and low), that are based on the dominant Eucalypt species at each site. Survey sites weren't evenly distributed across management units or habitat classes, being weighted toward high and medium quality habitats.

Changes in the average density of koalas, in high, medium and low quality habitats, between 1996 and 2015. In high quality habitats, koala density in 2015 was 1.2 ± 0.17 (SE) koalas/ha (n=106 sites). This average density in high quality habitats is higher than the desired maximum density articulated by the KIKMP (0.75 koalas/ha – see below), and higher than was observed in high quality habitats in 2010 (0.73). While densities in high quality habitat have increased in the past five years, they are far lower than was observed when surveys began (and prior to the implementation of the KIKMP; 1997-1998: 3.7 ± 1.0 (SE) koalas/ha; (Masters et al., 2004)), This density was also lower than that recorded in the first census in 2000, where the average density was 2.28 ± 0.87 (SE) koalas/ha (Molsher, 2016).

Over the survey period, a significant decline in koala density occurred between 1996 and 2007, particularly across high and medium quality habitats, after which density essentially stabilised, with the exception of the increases in high and medium quality habitat density over the past 3-4 years that have exceeded the desired maximum density (Figure 1).

These estimates of koala density are restricted to native vegetation, as these surveys are directly linked to the objectives of the Kangaroo Island Kangaroo Management Program. Density estimates in non-native koala habitat (i.e. Tasmanian Blue Gum forestry plantations) are presented below.

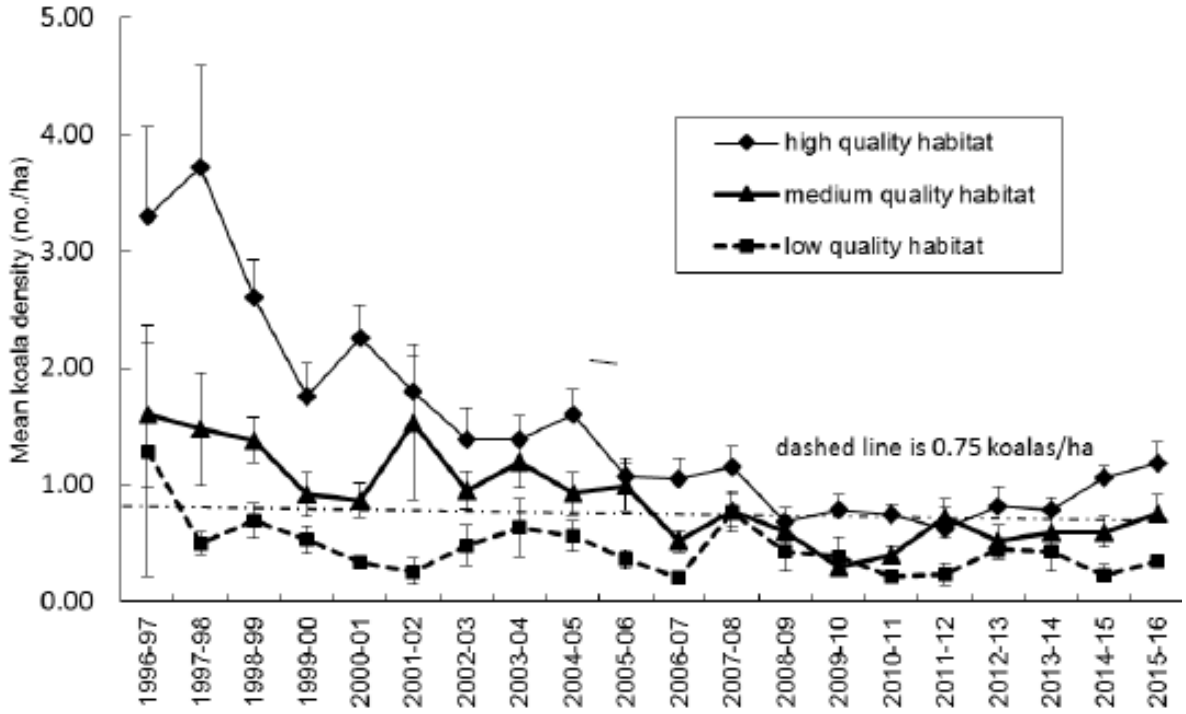


Figure 1 Mean (±SE) density of koalas between 1996-97 and 2015-16, stratified by habitat quality class. After Molsher (2016).

Koala density in Tasmanian Blue Gum Plantations

In order to obtain a more comprehensive understanding of koala distribution and abundance on Kangaroo Island, a number of surveys have been undertaken to estimate the density of koalas in Tasmanian Blue Gum Eucalyptus globulus plantations in Kangaroo Island.

Ground counts: Koala density has been estimated from ground surveys four times (2010-11, 2011-12, 2014-15 and 2015-16). In 2015-16, 19 sites were surveyed, with each site being approximately 5ha in size. Most (73%) of these sites were undertaken using standard double count techniques. The average density across these 19 sites was 1.77 ± 0.25 (SE) koalas/ha, and ranged from 0 to 4.12 koalas/ha. Koala density in blue gum plantations appears to be increasing based on these surveys (Figure 2), although sample sizes were small (n=4) in the first two surveys of blue gum plantations (Molsher, 2016).

Drones: In 2017, URAF investigated the efficacy of unmanned aerial vehicles ("drones"), in comparison to the use of ground counts. This found that there was no significant difference in the number of koalas counted in blue gum plantations by URVs vs ground counters at 2 of 3 sites, while significantly more koalas were counted by URVs at the third site (Hennekam and Koh, 2017b). Following this initial trial, four sites (totalling 19.1ha, average site area 4.8ha), all within the Kelly Hill region, were surveyed for koalas using URVs. The average density of koalas in these four sites was 1.87 ±0.28 (SE) koalas/ha, and ranged from 1.2 to 2.5 koala/ha (Hennekam and Koh, 2017a).

Summary: Both the ground counts and the URV-based counts estimate an average koala density of between 1.77 and 1.87 koalas/ha. This is higher than the current management target density of 0.75 koalas/ha, although the relevance of this target density for E. globulus plantation trees in unknown. The implications of koala populations in blue gum plantations on the broader koala populations, and impacts on native vegetation, are also unknown, and the interaction between koalas in blue gum and the surrounding landscape is a key knowledge gap.

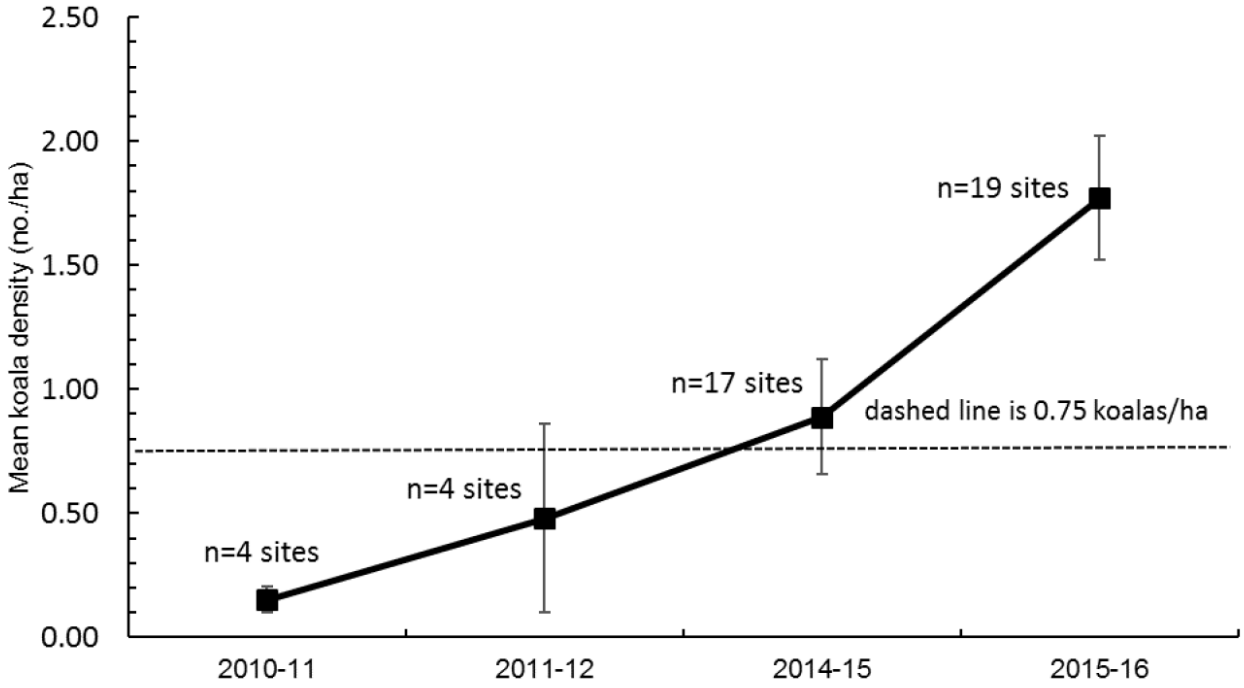


Figure 2 Mean (±SE) koala density in Eucalyptus globulus commercial plantations on Kangaroo Island. After Molsher (2016).

Estimated population size

Based on the 5-yearly censuses, a modelled estimate of the total population size of koalas on Kangaroo Island has been made since 2000. The total population estimates for Kangaroo Island were calculated by multiplying the mean density within each habitat class across the island, by the total mapped area of each habitat class (using the existing South Australian floristic vegetation mapping, SAVeg). The Dudley Management Unit was excluded from these calculations, as no koalas have ever been recorded on the Dudley Peninsula (Molsher, 2016).

In 2015, the total estimated population size of koalas in native vegetation was 25,146 ± 4,764 (SE). This estimate was higher than the estimated population size in the previous two censuses (2010 and 2006), but not different from the population size estimated in 2000. While a revised estimate of the population size in native vegetation on Kangaroo Island is currently being developed, preliminary results suggest that the revised estimate will not differ significantly from the estimate developed in 2015.

Mt Lofty Ranges

Koala Density

Koala density in the Mt Lofty Ranges has not been measured as systematically, or over the same length of time, as on Kangaroo Island. Recent evidence, however, suggests that, in habitats that contain preferred food tree species, the current density in the Mt Lofty Ranges approaches that found on Kangaroo Island before the initiation of the Koala Management Plan. A 'citizen-science' project, the Great Koala Count (Sequeira et al., 2014, Hollow et al., 2015), used directed observations of koalas from the public to predict the distribution of koalas across the Mt Lofty Ranges (and subsequently estimate the population size – see below). More recently, a second Great Koala Count has been undertaken with improvements to survey design. This second count was undertaken in conjunction with some targeted survey by professionals with long experience of surveying koalas (staff from Natural Resources KI and Natural Resources A&MLR). Neither of the Great Koala Count programs were able to measure variation in koala density. Given the increasing focus on managing density and impact with respect to free-ranging koala management, this limitation needs to be considered in the future.

In addition to the citizen science data, DEWNR field staff surveyed koala densities in the Mt Lofty Ranges, using the standard double-count method, at 14 sites in winter 2016 (eight of these sites were also re-surveyed in spring 2016). The area of the sites ranged from 1.6 ha to 5.4 ha. Koalas were detected 10 of these 14 sites in winter, with the median density of koalas being 0.67 koalas/ha . However, excluding those sites in which koalas were not detected, the median density was 3.0 koalas/ha. Across all 14 sites, koala density ranged from 0 to 13.4 koalas/ha. The sites with the highest density were all in Horsnell Gully South, where the total area surveyed was 1.6ha.

Regional staff have already identified a number of areas where koala densities are much higher than would be considered desirable (>13 /ha), and where the impact of overbrowsing by koalas on tree condition is well recognised. These could provide the basis for initial intervention in the region. However, an improved region-wide understanding of koala density (and impacts on trees) is required to support strategic planning and management in this region.

Estimated Population Size

The only estimate available for total population size of koalas in the Mt Lofty Ranges was developed by Sequeira et al. (2014), based on the surveyed conducted by volunteers as part of the first Great Koala Count. This analysis estimated that 113,704 koalas lived in the Mt Lofty Ranges. However, the uncertainty around this estimate was very high (95% confidence limits: 27,685-199,723). Furthermore, the total population size assumed that koala densities were similar to those estimates recorded in the national literature (mean density of 1.57 koalas/ha ± 1.19 SD). Currently available data for the Mt Lofty Ranges do not allow us to assess the revelance of this mean density estimate for the Mt Lofty Ranges. Other key limitations of this estimate include the fact that koala surveys were not conducted in a stratified way across the range of environments and habitats in the Mt Lofty Ranges (largely limited to areas with high visitation by people) and only recorded locations where people saw koalas (i.e. prescence only data). The second Great Koala Count, whose results are due in November 2017, has been designed to overcome at least some of these design issues.

Other South Australian Regions (Eyre Peninsula, South-east South Australia)

The abundance, distribution and density of koalas on Eyre Peninsula is only known from a small number of records collected opportunistically, suggesting that koalas are distributed from Lincoln NP in the south, to properties just north of

Coulta in the north. In 2017, a citizen-science project aimed to obtain a better understanding of the distribution of koalas on lower Eyre Peninsula. Koala densities were obtained from five sites of Eyre Peninsula Blue Gum (1 site, 6.05 ha), Red Gum (3 sites, totalling 21.39 ha) and Manna Gum (1 site, 7.22 ha) woodlands, including the site at which koalas were originally released on EP in 1969 (Mikkira Station). Koalas were detected at three of these sites; however, the vast majority (46/54) were recorded at Mikkira. Tree condition was also measured at these five sites, with the proportion of trees considered to be affected by koala browsing ranging from 20 to 30%. The total population size for lower EP has been estimated to be 236, with most of these across the Manna Gum woodlands of Mikirra Station (Freeman, 2018). However, there is still significant uncertainty around these estimates, or the impact that koalas are having on these communities on Eyre Peninsula.

The abundance, distribution and density of koalas in the south-east of South Australia is currently less well known. The implications of this knowledge gap may be significant, given the nature of the landscape (combination of suitable native vegetation and E. globulus plantations) and in the context of koala population dynamics in adjacent south-west Victoria, where overabundant koalas have had significant economic, environmental and animal welfare impacts (Ramsey et al., 2015).

Evidence of Impact

The impact of koalas on natural resources has largely been focused on the impact of defoliation of food trees (Eucalyptus sp.). High koala density leads to excessive defoliation of forage trees, which ultimately leads to the death of these trees, and the loss of values that these trees and woodlands provide (e.g. habitat for threatened species, streambank stabilisation, and aesthetic). Among the environmental risk associated with tree defoliation and death is the loss of habitat for the koalas themselves (Whisson et al., 2016), where high koala density can lead to loss of food habitat, and the koala population crashing. For example, in Cape Otway, Victoria, koala densities in manna gum forests reached densities of 18.1 koalas/ha (Whisson et al., 2016), resulting in significant tree defoliation and death. This, along with the high site fidelity exhibited by koalas (in spite of the availability of habitat nearby), led to a high number of koalas dying from starvation or being euthanized (Whisson et al., 2016, Ramsey et al., 2016), along with, presumably the broader environmental impacts of tree loss.

Koalas feed on a variety of Eucalypt species, but prefer to feed on a small number of species where available. On Kangaroo Island, the preferred food tree species are Rough-barked Manna Gum Eucalyptus viminalis ssp. cygnetensis, South Australian Blue Gum E. leucoxylon and Swamp Gum E. ovata.

While the overall picture relating preferred food tree condition and koala density requires further analysis, preliminary evidence, particularly from the Cygnet River Management Unit on Kangaroo Island, suggests that a reduction in koala density can lead to improvements in canopy cover, even in the context of declining tree condition as a result of other (non-koala) factors (Watters, 2015). The Cygnet River Management Unit provides a good example of these relationships, as there is a both pre-management tree condition data for E. viminalis, and there has been constant management intervention (sterilisation and translocation) through the life of the KIKMP. Prior to the commencement of the KIKMP, tree condition surveys demonstrated significant impacts of koala browsing on manna gum in the Cygnet River area, with 78% of trees showing greater than 50% canopy loss (St. John 1997, cited in Watters 2015). More recently, an analysis relating koala density to species-specific tree condition on Kangaroo Island was undertaken by Watters (2015). The proportion of E. viminalis with greater than 50% canopy loss in the Cygnet River declined from ~60% in 2000, to ~40% in 2014. This is against a background of worsening E. viminalis condition in the absence of koalas (Dudley Peninsula), where the proportion of trees with greater than 50% canopy loss increased from ~20% in 2000 to ~30% in 2014 (Figure 3). At this stage it is unclear what may be driving declines in tree condition in the absence of koalas, although the broader drivers of tree condition in agricultural landscapes are likely. There was also a positive relationship between the proportion of trees in poor condition and koala density, suggesting that increasing koala density leads to a decline in the condition of food

trees at a site/patch scale (Figure 4). However, this relationship was by no means consistent across other management units, or for other food tree species.

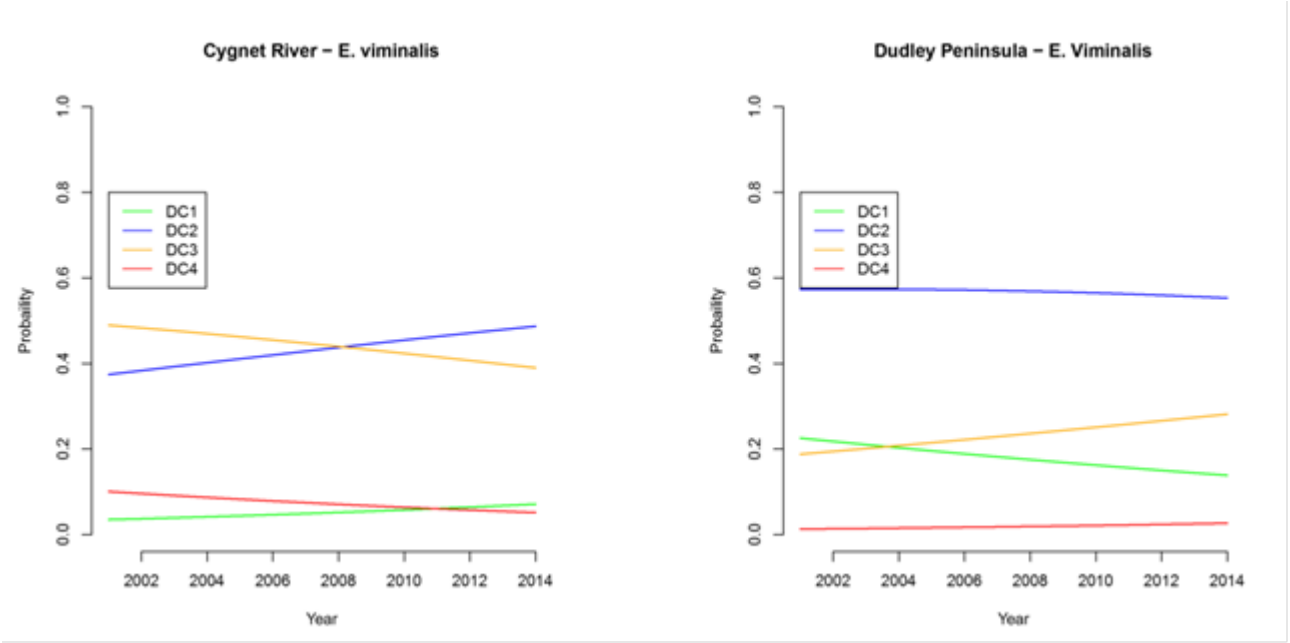
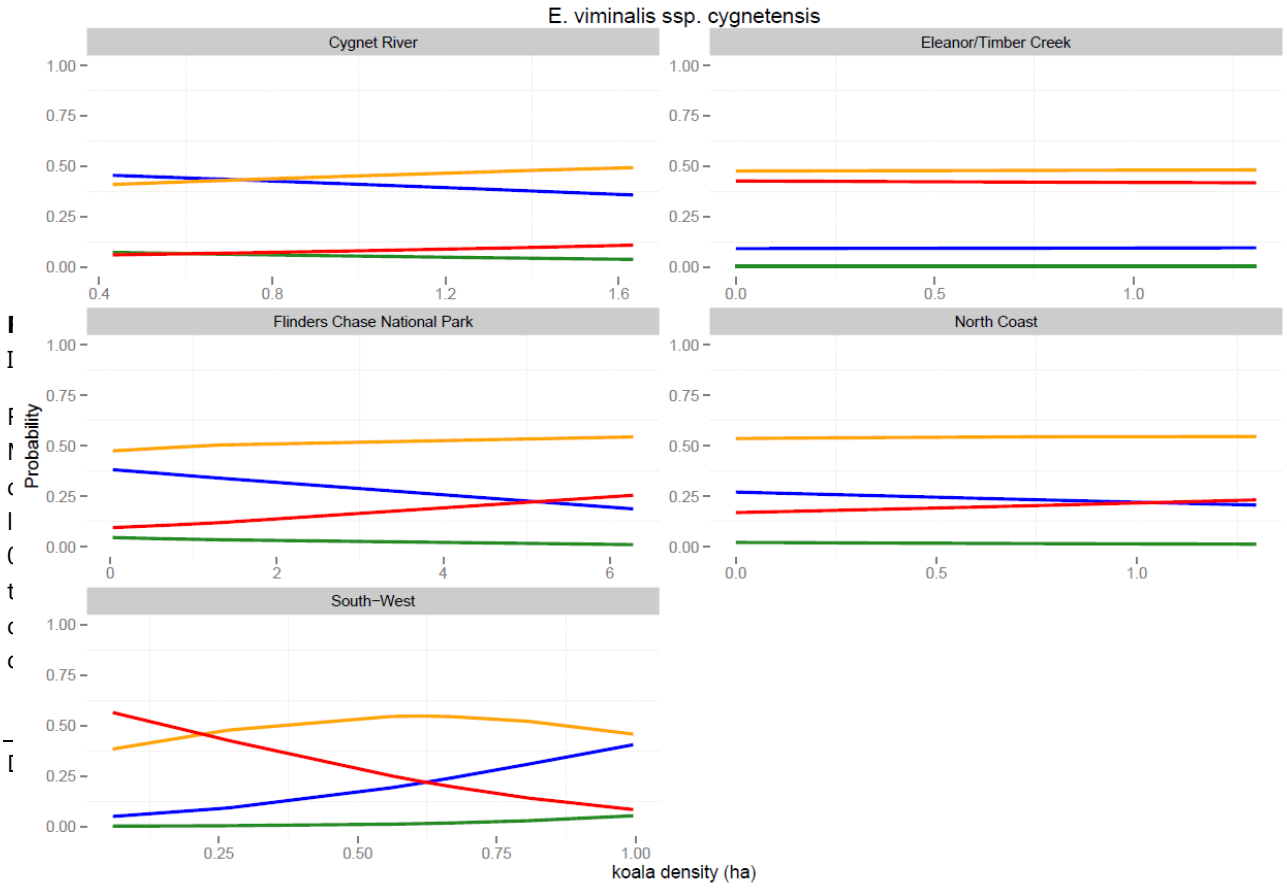


Figure 3 Change in *E. viminalis* tree defoliation classes through time, for two koala management units on Kangaroo Island. Cygnet River Management Unit has historically had high quality density, and has been the subject of regular koala sterilisation and translocation through time. Dudley Peninsula Management Unit has never had koalas, and is therefore not the subject of koala management. Tree condition classes are as follows: DC1 (green) - Crown 'normal'; DC2 (blue) – Crown thinning (up to 50% defoliation); DC3 (orange) – Crown very sparse (50%-80% defoliation); DC4 (red) - >80% defoliation; epicormics growth dominates. After Watters (2015).



at the same rate for these other species (e.g. Eucalyptus obliqua; defoliation rate = 0.4 at 5 koalas/ha), and koalas were never recorded at as high densities in these sites.

Managing Koala Populations and Impacts

Strategic Intervention

In order to reduce the impact of high koala densities on native vegetation, a number of interventions have been implemented to reduce local koala density (sterilisation and translocation). Given limited resources, managers need to target intervention in such a way that ultimately minimises the risk to native vegetation (in line with the objectives of the KIKMP), while maintaining sustainable populations of koalas. This strategic planning can be framed by asking a number of key questions:

- At what scale do we need to manage koala populations?
- What resources are required to manage koalas? What range of viable interventions are available to manage koala populations (e.g. sterilisation, contraception, translocation)?
- Where do we need to prioritise management?

In South Australia, there are a number of geographically discrete koala populations (e.g. Kangaroo Island, Mt Lofty Ranges, south-east, Eyre Peninsula). Within these populations, the evidence suggests that our management effort need not treat the entire population; rather that management should prioritise effort toward those areas where koala densities are at or above target densities, and/or there is evidence of emerging impacts by koalas on preferred food tree species. A number of koala movement studies (summarised by Louter, 2017) have been undertaken on Kangaroo Island (and, for comparison, elsewhere in Australia). These suggest that koalas on Kangaroo Island typically have smaller home ranges, and travel shorter distances, than koalas elsewhere in Australia. Furthermore, movement between Management Units on Kangaroo Island was low, with 95% of movement records of koalas being within the Management Unit within which the koala was originally recorded. This suggests that a time lag between density reduction (e.g. through management) and immigration is likely, and that effective management at a local scale will have reasonable long-term benefits to tree recovery. However, the impact of lowering densities at local scale on the rate of immigration is still unknown. Nonetheless, this evidence suggests that management at some scale (e.g. Management Unit) below the total regional population provides an opportunity to focus on addressing local impacts.

This focus on managing for local tree impacts, and local koala density, has also been proposed by Ramsey et al. (2016) for the high density koala populations of south-western Victoria. The authors first defined a foliage cover threshold of 25%, below which individual trees were considered 'defoliated', and unlikely to recover from browsing. This threshold was then used to define the proportion of defoliated trees at a site ("canopy defoliation level"), which was used to trigger different scales of intervention at that site (Figure 3). These thresholds will need to be modified to suit South Australian regions. For example, the current desirable koala density threshold for the KIKMP is 0.75 koalas/ha (although this threshold needs to be refined), while the koala density thresholds proposed by Ramsey e al. (2016) range from 0.9 koalas/ha (in areas of high defoliation to 8 koalas/ha). While the decision-making framework outlined by Ramsey et al. (2016) should be considered with respect to the management of South Australia's free-ranging koala populations, the details around the threshold impacts and densities will need to be developed and tested in each regional context. Furthermore, the nature of how we currently manage koalas (sterilisation of adult females) means that there will be time lags between treatment (sterilisation) and outcome (reduced koala densities). These lags will need to be accounted for if we are to use thresholds of tree defoliation as our triggers for intervention (as recommended by Ramsey et al. 2016).

CANOPY DEFOLIATION LEVEL*	SUGGESTED ACTION
Green – low defoliation (0.0 - 0.2)	Forest condition monitoring at no more than 2 yearly intervals
Yellow – moderate defoliation (0.2 - 0.4)	Forest condition monitoring plus Koala monitoring at no more than 2 yearly intervals
Orange – high defoliation (0.4 - 0.6)	Intervention recommended if Koala densities are >8 Koalas/ha (Cape Otway Manna Gum) or >1.6 Koalas/ha (elsewhere)
Red - very high defoliation (0.6 -1.0)	Intervention required to minimise the risk of severe canopy defoliation. Koala densities should be reduced to <5 Koalas/ha (Cape Otway Manna Gum) or <0.90 Koalas/ha (elsewhere). To enhance the recovery of trees exposed to repeated defoliation, Koala densities should be kept below 0.90 Koalas/ha until recovery of the canopy has occurred.

Figure 5 Action Triggers, as defined by Canopy Defoliation Levels, to guide overabundant koala management, as recommended by Ramsey et al. (2016). Note that different thresholds will need to be developed in a South Australian regional context.

These lags, however, are well understood. The population models developed by Delean et al. (2013) and Delean et al. (2016) provide a mechanism that relates the level of intervention (female sterilisation) and changes in koala density (at the Management Unit scale) for Kangaroo Island, and could be applied (with adequate data) in other South Australian landscapes. In combination with these density and population estimates, Delean (2013, 2016) used estimates of the proportion of sterilised females within each Management Unit, to estimate the number of additional sterilised female koalas required within each MU to achieve a high likelihood of a declining population. This model is currently being updated to account for an improved understanding of spatial variation in koala density, and for immigration and emigration, and will better allow us to spatially target intervention to priority areas, in a spatially and temporally dynamic way. Linking the distribution of management action to the predicted distribution of koala density (in space and time) and to change in tree condition, will allow for a comprehensive model for koala management that will help us understand the influence of management on both koala density and tree condition, and inform where and how much management is required to achieved desirable outcomes with respect to koala populations and tree condition.

The long-term objective of the Kangaroo Island Koala Management Program is to "To conserve native vegetation by reducing koala densities to sustainable levels". In order to achieve this, the Program has been designed to reduce or maintain the density of koalas at any site at, or below, 0.75 koalas/ha (National Parks and Wildlife South Australia, 2002). This density target was established by investigating the relationship between koala density and the proportion of trees that were in poor condition (canopy cover <50%). In order to reduce the proportion of trees in poor condition to 0% (i.e. 100% of trees in greater than poor condition), it was estimated that koala density needed to be reduced to 1.0 koalas/ha. However, the authors of this investigation determined that:

"due to the small amount of data used in this calculation, and the emphasis on habitat maintenance, a safety margin was included in the analysis and the target density was reduced to 0.75 koalas/ha" (p36).

Furthermore, this analysis was undertaken for only one species of Eucalypt – E. viminalis ssp. cygnetensis, and was based on. If we are to apply the type of management approach recommended by Ramsey et al. (2016), a more thorough

analysis of the relationship between koala density and species-specific tree condition is required, that also accounts for the time lags between treatment (sterilisation), density reduction, and tree recovery.

Currently, the KIKMP focuses management on areas where the koala density is greater than this single threshold of 0.75 koalas/ha, with limited understanding of how relevant this threshold is in achieving the maintenance or recovery of trees affected by koala overbrowsing. If we are to develop an intervention strategy for free-ranging koalas that focuses on tree condition, and sets koala density objectives for management that are dependent on tree condition, we will need to develop both appropriate tree condition thresholds (that are likely to be region-specific) and target koala densities within these tree condition categories.

Knowledge Gaps

Fundamentally, an integrated management model that links management through koala density to tree condition is required for all regions where koalas are present, with the priorities being KI and the Mt Lofty Ranges. This model would build on the existing koala population models that have been (and continue to be) developed for KI (Delean et al., 2013, Delean et al., 2016), and could ultimately be applied to other regions. This model would be use to both predict the koala density and tree condition responses to management of koalas, and inform the extent and distribution of management programs within these regions. In order for this model to be useful, a number of key knowledge gaps need to be filled:

- Better understand the density and distribution of koalas and tree defoliation in the Mt Lofty Ranges, Eyre Peninsula and South-east South Australia;
- Better understand the relationship between tree condition and koala density, accounting for other key determinants of tree condition (such as climate);
- Better predict the impact of future conditions (e.g. land use change, climate change, scale of management) on koala density and distribution;
- Determine appropriate tree condition, stand condition, and koala density thresholds for the application of the management model proposed by Ramsey et al. (2016) that also account for the lag impacts of sterilisation (as an update to the single universal koala density threshold of 0.75 koalas/ha);
- Continue to improve our understanding of the efficacy of hormonal implants as an approach to sterilising female koalas in the field;
- Understand the relationship between landscape connectivity (including Tasmanian blue gum plantations), koala density, and movement of local immigration and emigration of koalas. This will help us understand the likely lags between management, local reduction in koala density, and subsequent immigration into managed areas.

References Cited

DELEAN, S., PROWSE, T. & CASSEY, P. 2013. Kangaroo Island Koala Management Model. Adelaide, South Australia: University of Adelaide.

DELEAN, S., PROWSE, T. & CASSEY, P. 2016. Update of the Kangaroo Island Koala Management Model. Adelaide, South Australia: University of Adelaide.

DEPARTMENT OF ENVIRONMENT WATER AND NATURAL RESOURCES 2011. The South Australian Koala Conservation and Management Strategy. Adelaide, South Australia: Government of South Australia, through the Department of Environment Water and Natural Resources.

FREEMAN, A. 2018. Eyre Peninsula Koala Management Plan - DRAFT. Adelaide, South Australia: Department for Environment and Water.

HENNEKAM, M. & KOH, L. P. 2017a. Using drone technology to monitor koala populations on Kangaroo Island. University of Adelaide.

HENNEKAM, M. & KOH, L. P. 2017b. Using drone technology to monitor koala populations on Kangaroo Island: Preliminary Report. Adelaide: University of Adelaide.

HOLLOW, B., ROETMAN, P. E. J., WALTER, M. & DANIELS, C. B. 2015. Citizen science for policy development: The case of koala management in South Australia. Environmental Science & Policy, 47, 126-136.

LOUTER, M. 2017. Habitat Use and Movements of Koalas in Native Vegetation on Kangaroo Island. Adelaide, Soutgh Australia: Department of Environment, Water and Natural Resources.

MASTERS, P., DUKA, T., BERRIS, S. & MOSS, G. 2004. Koalas on Kangaroo Island: from introduction to pest in less than a century. Wildlife Research, 31, 267-272.

MOLSHER, R. 2016. Kangaroo Island 2015 Koala Census Report. South Australia: Natural Resources Kangaroo Island.

NATIONAL PARKS AND WILDLIFE SOUTH AUSTRALIA 2002. A review of the Kangaroo Island Koala Management Program. 1996-2001. Adelaide, South Australia: National Parks and Wildlife South Australia.

RAMSEY, D. S. L., TOLSMA, A. D. & BROWN, G. W. 2016. Towards a habitat condition assessment method for guiding the management of overabundant Koala populations. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning.

RAMSEY, D. S. L., WOODFORD, L., TODD, C. R., FORSYTH, D. M. & WOOD, M. 2015. Population dynamics of Koalas and changes in forest condition at Mt Eccles National Park, 2004–2014. Heidelberg, Victoria: Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning.

SEQUEIRA, A. M. M., ROETMAN, P. E. J., DANIELS, C. B., BAKER, A. K. & BRADSHAW, C. J. A. 2014. Distribution models for koalas in South Australia using citizen science-collected data. Ecology and Evolution, 4, 2103-2114.

WATTERS, F. 2015. Population level effects of fertility control on an over-abundant Koala population on Kangaroo Island, South Australia. BSc (Hons) Honours, University of Adelaide.

WHISSON, D. A., DIXON, V., TAYLOR, M. L. & MELZER, A. 2016. Failure to Respond to Food Resource Decline Has Catastrophic Consequences for Koalas in a High-Density Population in Southern Australia. PLOS ONE, 11, e0144348.