NSW GOVERNMENT | Office of Environment & Heritage

CORRIDORS AND CORE HABITAT FOR KOALAS

Report on surveys conducted in 2012-2014 for Koalas in coastal forests in the Bermagui/Mumbulla area of South eastern NSW

Sponsored by the Australian Government's Biodiversity Fund
Managed by the NSW Office of Environment and Heritage
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Introduction

The *Corridors and Core Habitat Project* is a 6 year cross-tenure landscape management initiative that commenced in 2012 aiming to protect, enhance and connect habitat sustaining the last known koala population in NSW Far South Coast forests. It is sponsored by the Australian Government's Biodiversity Fund and managed by the NSW Office of Environment and Heritage.

The project's objectives for the coastal forests study area were to:

- undertake a survey program across the study area,
- protect 2800 ha of core koala habitat in State Forests and locate alternative timber resources,
- consolidate partnerships with other agencies, local landholders and indigenous communities
- support integrated monitoring and management actions to increase the recovery potential of these koalas.
- review landscape environmental issues such as fire, degraded and fragmented habitat and feral predators and develop effective measures to maintain and enhance koala habitat.

This report provides information on the koala survey component of the project. This was primarily undertaken in the period 2012-14 and built on a previous survey that was undertaken in 2007-9.

The objectives of the study were to gather and analyse data to:

1. assess the distribution and abundance of the population
2. compare its results with the koala survey undertaken in 2007-9
3. provide baseline data for an ongoing monitoring program, and
4. provide data for specific areas to assist with operational decision-making in regards to applied fire and logging in order to minimise impact on koalas.

The survey in 2007-9 assessed approximately 21,000 ha hectares of forest, including National Park, Nature Reserve, State Forest and private land (Figure 1). Less than 12% of the sites surveyed had evidence of koalas and the highest concentrations of activity were identified in Mumbulla State Forest. The study provided a population estimate of less than 50 koalas within the study area (Allen et al. 2010).

The area surveyed in the 2012-2014 period was 26,000 ha, a little larger than in 2007-2009 (Figure 2).

The main difference between the areas assessed in the two periods was that extensive surveys were undertaken in Bermagui State Forest to the north of the Bermagui River in 2007-9, but not repeated there in 2012-14 whilst the latter survey extended further south to include the southern part of Mimosa Rocks National Park and Tanja State Forest.

Another difference in the surveys between the two periods is that whereas grid-sites were only assessed at 1km intervals in some parts of the study area in the 2007-9 survey (primarily Murrah State Forest), grid-sites at 500m intervals were assessed throughout the study area in 2012-14. This is the main reason why the number of grid-sites assessed increased in the latter survey.

Figure 1. Location of the survey sites with the recorded activity level (percentage of trees at a site with koala pellets) for the 2007-209 surveys.

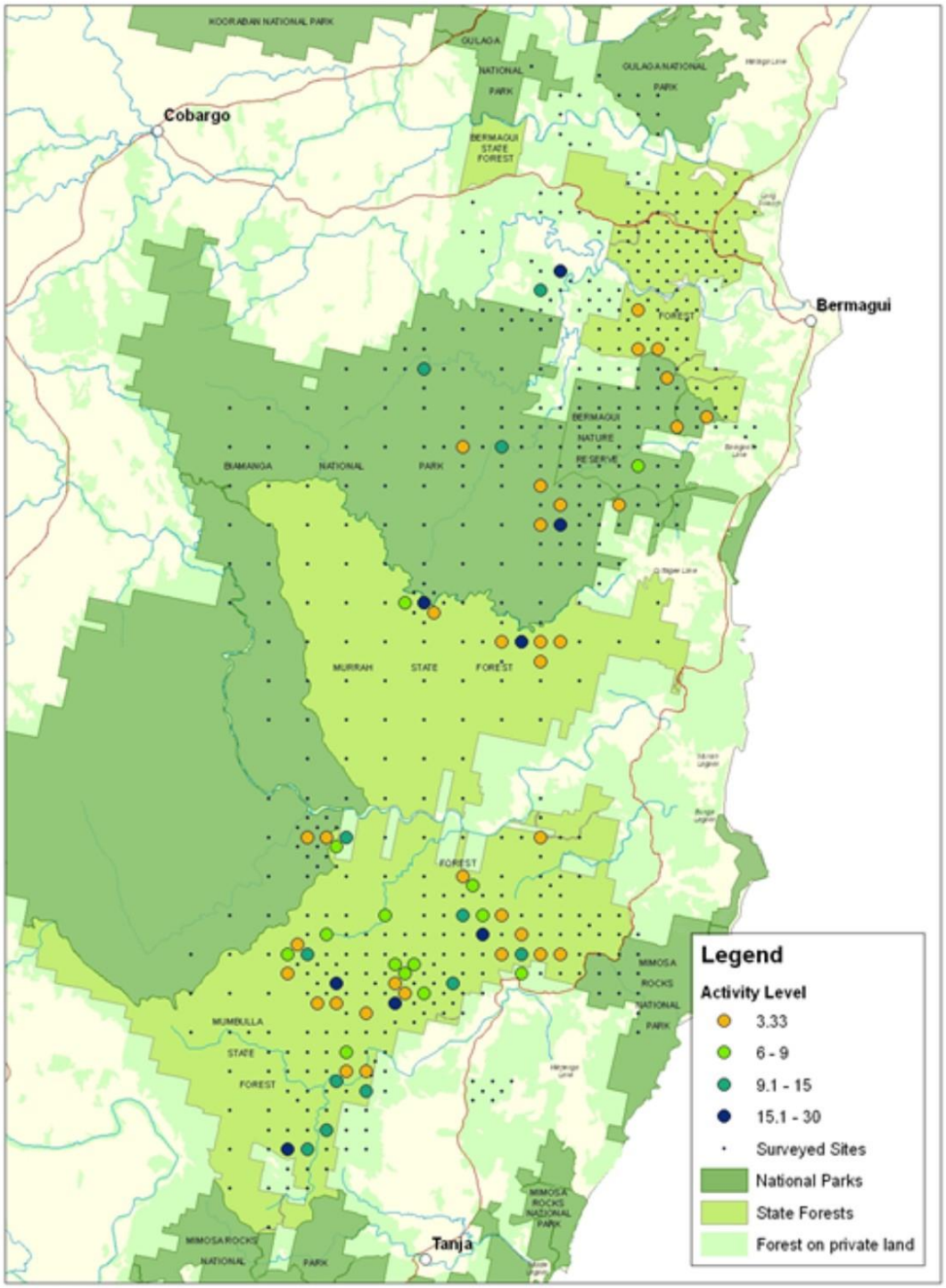
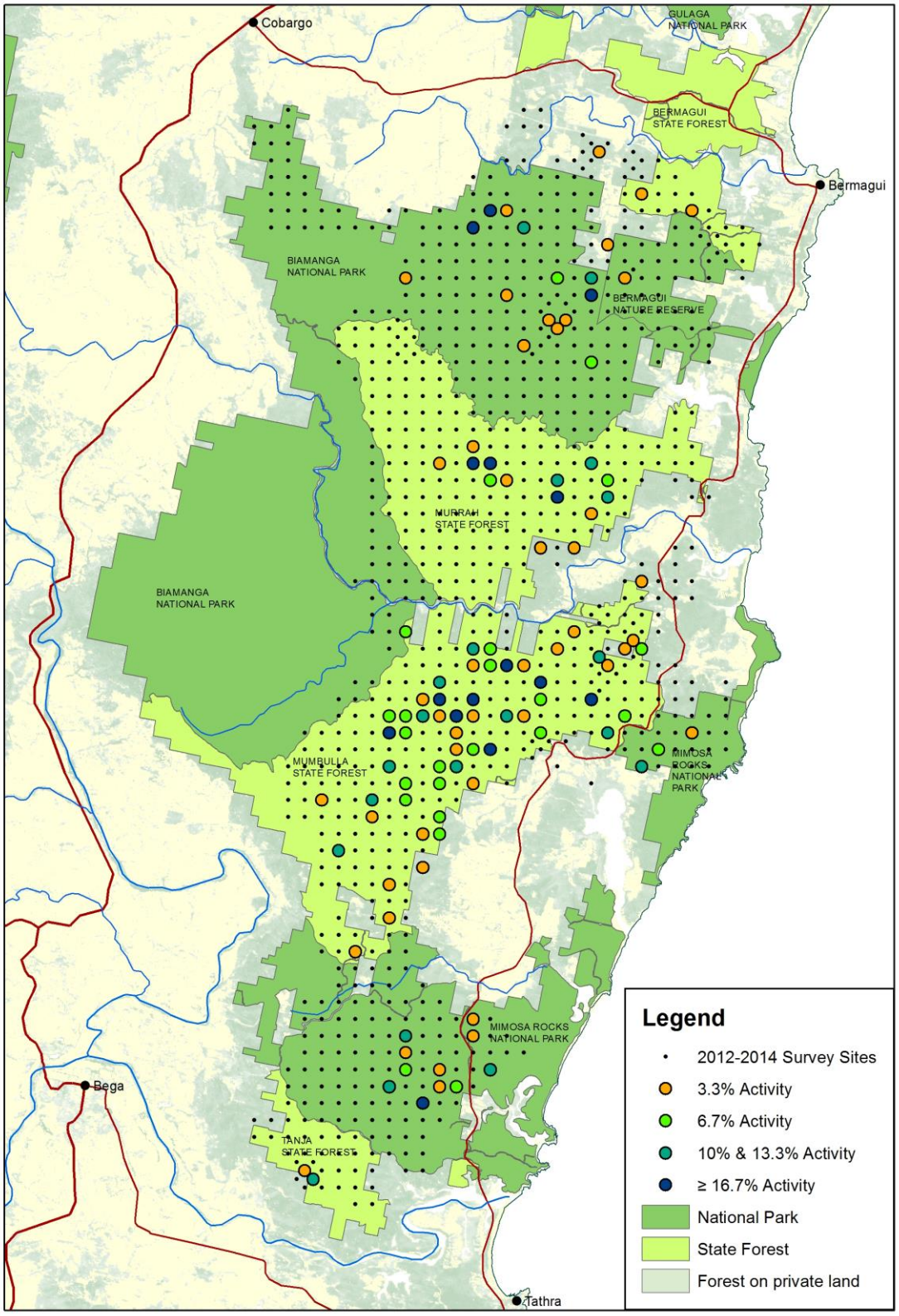


Figure 2. Location of the survey sites with the recorded activity level (percentage of trees at a site with koala pellets) for the 2012-2014 surveys.



Survey and Analysis Methods

The survey and analysis methods for 2012-2014 were the same as those for 2007-2009 and for clarity are repeated below. The only major change in the method was the survey grid for 2012-2014 was aligned with the Geocentric Datum of Australia (GDA94) one kilometre grid coordinate intersections.

Survey Method

The study used a survey method known as the *Regularised Grid-Based Spot Assessment Technique* (RGBSAT) (Phillips et al. 2000, Phillips and Callaghan 2000, Biolink 2007). The survey teams conducted searches for evidence of Koalas on a 500 metre square grid aligned with the MGA94 coordinate intersections across the study area. In some locations where Koala activity was detected and where it was considered important to gather further information, the four neighbouring sites located 350 metres on the diagonal from the detection site were also surveyed.

The location of the 589 sites assessed in 2007-9 and the 918 sites assessed in 2012-14 is shown in Figures 1 and 2 respectively. At each of these sites the forest litter of the closest 30 live trees over 150mm diameter at breast height (dbh) was searched for koala faecal pellets out to a metre from the trunks. The species and dbh of each of the 30 trees were recorded. The distance from the centre tree to the farthest tree in each site was recorded as the radius of the site.

The proportion of trees with koala pellets compared with the total number of trees assessed at each site (30 per site) is termed the site's *activity level* (Phillips et al. 2000, Phillips and Callaghan 2000, Phillips 2000) (i.e. 1 tree with pellets = 3.33% activity; 2 trees with pellets = 6.67%; 3 trees with pellets = 10%, and so on). The activity level at each site was calculated and also shown in Figures 1 and 2.

Mapping of Activity Cells

A Geographic Information System mapping tool described as *regularised splining* (Biolink 2007) was used to interpolate the grid-site activity levels across all of the sites to derive koala activity contours and cells (Figure 3).

Activity cells are approximately analogous to home-ranges. However, the area within an activity cell may be being used by more than one animal. The technique does not distinguish between resident animals and those that might be dispersing, though clusters of active sites, particularly those with relatively higher activity levels, are more likely to be occupied by resident koalas. The boundaries of activity cells were calculated at three activity levels: 2, 3 and 9%. The 9% activity contour (which indicates the area where the average usage of trees is approximately 9% of the 30 trees at each site) indicates the areas of highest use.

As was the case in 2007-9 study the resulting activity cells were generally clusters of sites where koala evidence was located, but in some cases were derived from a single detection site.

Results

Overview

The survey program was managed by OEH and most of the surveys were undertaken teams of local contractors who gained their experience through the 2007-2009 survey program. Ten contractors, 160 volunteers and 19 local Aboriginal people contributed more than 1,200 person days of fieldwork searching for koala pellets under 27,540 trees.

Koala evidence was located at 105 of the 918 survey sites, giving an overall occupancy rate[1] of 11.44 percent (see Table 1). The occupancy rates by tenure and overall were similar to those reported from 2007-2009 despite the larger survey area and sample size.

Table 1. Number of sites assessed, active sites, occupancy rates by land tenure (2012-2014 results in black text; 2007-2009 results in blue text).

Tenure	No. sites assessed		No. trees searched		No. sites with Koala faecal pellets		% of sites occupied	
Biamanga NP	233	128	6990	3840	14	9	6.01	7.03
Gulaga NP	1	8	30	240	0	0	0	0.00
Bermagui NR	30	38	900	1140	1	4	3.33	10.53
Mimosa Rocks NP	120	9	3600	270	13	0	10.83	0.00
Mumbulla SF	229	176	6870	5280	54	38	23.58	21.59
Murrah SF	170	55	5100	1650	12	8	7.06	14.55
Bermagui SF	23	89	690	2670	1	3	4.34	3.37
Tanja SF	28		840		2		7.14	
Private Land	78	72	2340	2160	7	2	8.97	2.78
Other Aboriginal Land	6	14	180	420	1	2	16.67	14.29
All National Parks and Nature Reserves	384	183	11520	5490	28	13	7.29	7.10
All State Forest	450	320	13500	9600	69	49	15.33	15.31
Total All Sites	**918**	**589**	**27540**	**17670**	**105**	**66**	**11.44**	**11.21**

Koala activity occurred over a distance north to south of approximately 30 km. Sites with koala activity were not random or uniformly spread across the study area but were clustered and tended to occur with adjacent sites that were also used by koalas. Figure 2 shows the distribution of the sites where activity was recorded in 2012-14. At some sites large and small koala pellets were found at the same location indicating the presence of adult females with young, providing evidence of breeding.

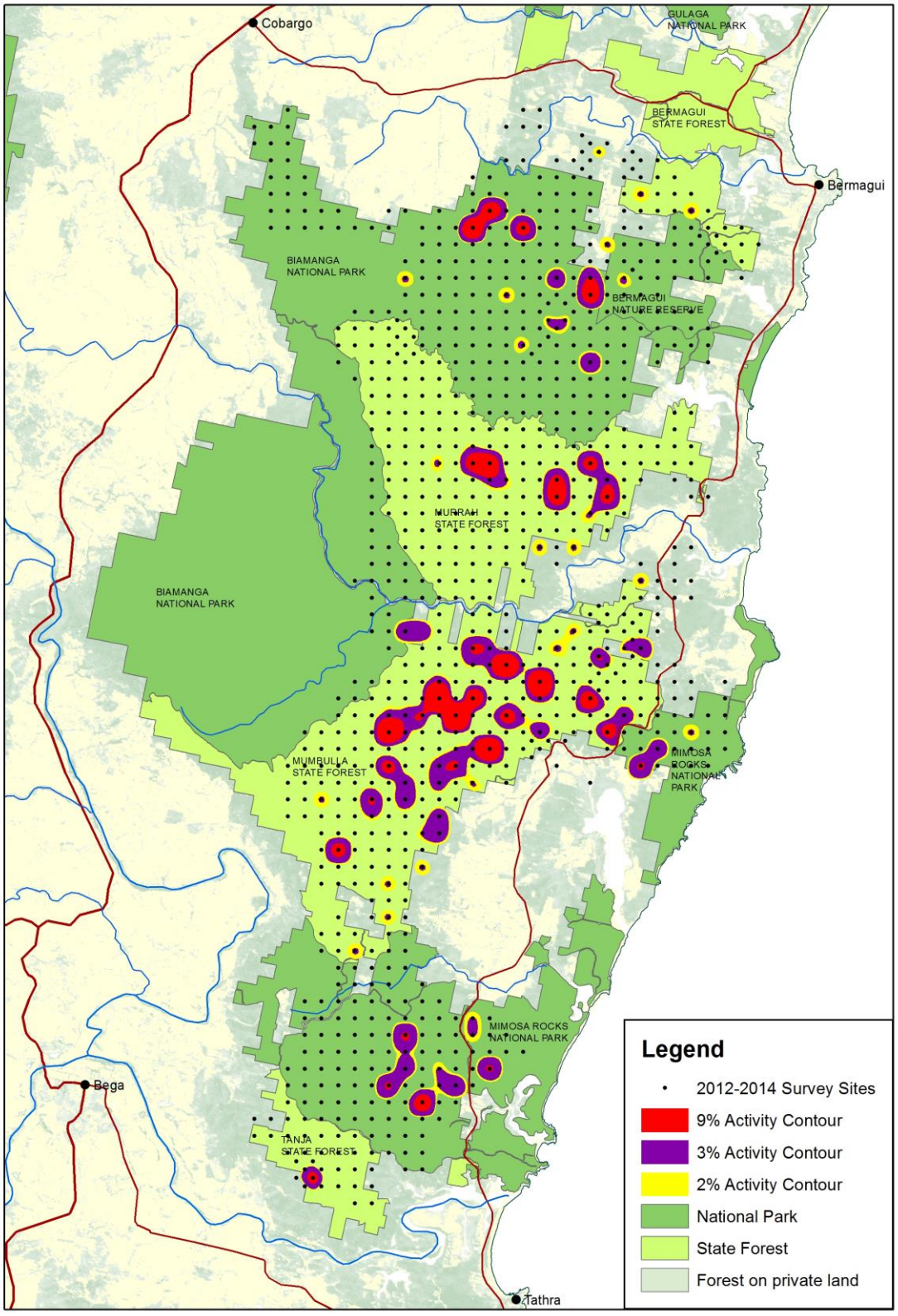
Figure 3 shows the distribution of the activity cells and associated activity contours across the study area derived from the 2012-14 survey results. Similar to 2007-2009, the highest concentration of activity was in the Mumbulla State Forest. However in 2012-14 this activity extended further eastwards and into Mimosa Rocks National Park (northern section). A smaller cluster of activity was identified further south in Mimosa Rocks National Park (southern section) as well as a small isolated cell of activity in Tanja State Forest. The pattern of activity to the north of the Murrah River was similar to 2007-2009 with a cluster of activity in the northern section of Murrah State Forest and then scattered koala activity, with generally smaller activity cells, in the northern section of Biamanga National Park, other Aboriginal-owned land, small areas of Bermagui Nature Reserve and parts of the south western section of Bermagui State Forest.

As was the case with the 2007-2009 report, the outer boundary of mapped activity (i.e. the 2% boundary) was used to estimate the size of the areas used by koalas in 2007-9. Using

[1] Biolink 2007 defines occupancy rate as the proportion of the sites assessed which had Koala faecal pellets (expressed as a percentage).

this method a total of 3,348 ha of forest was identified as being actively used across the study area, considerably larger than the 2007-2009 figure of 1,089 ha.

Figure 3. Location of koala activity cells with activity contours for the 2012-2014 surveys.



Eucalypt species use and preferences

The species under which Koala pellets were most commonly found in the 2012-14 survey were *Eucalyptus longifolia* (woollybutt), *E. globoidea* (white stringybark) and *E. sieberi* (silvertop ash). These species, together with *E. cypellocarpa* (monkey gum), also had the highest proportion of use (strike rate) relative to tree species occurrence within the active sites. The tree species use results for 2012-2014 and 2007-2009 are presented in Table 2.

Table 2. Tree species use: number of each tree species under which pellets were located; number of each species at all active sites; and, percentage of trees of each species under which pellets were located (2012-2014 results in black text; 2007-2009 results in blue text).

Tree Species	**# of each species with pellets**		**# of each species at active sites**		**% of trees of each species with Koala pellets**	
E. longifolia woollybutt	82	49	394	313	20.81	15.65
E. globoidea white stringybark	46	26	341	319	13.49	8.15
E. cypellocarpa monkey gum	26	10	193	91	13.47	10.99
E. sieberi silvertop ash	39	16	353	265	11.05	6.04
E. tricarpa red ironbark	7	11	105	104	6.67	10.58
Ang. Floribunda rough-barked apple	8	4	136	96	5.88	4.17
E. bosistoana coast grey box	4	7	72	65	5.56	10.77
E. muelleriana yellow stringybark	25	20	533	307	4.69	6.51
E. agglomerata blue-leaved stringybark	2	2	76	71	2.63	2.82
Al. littoralis black she-oak	11	4	425	188	2.59	2.13

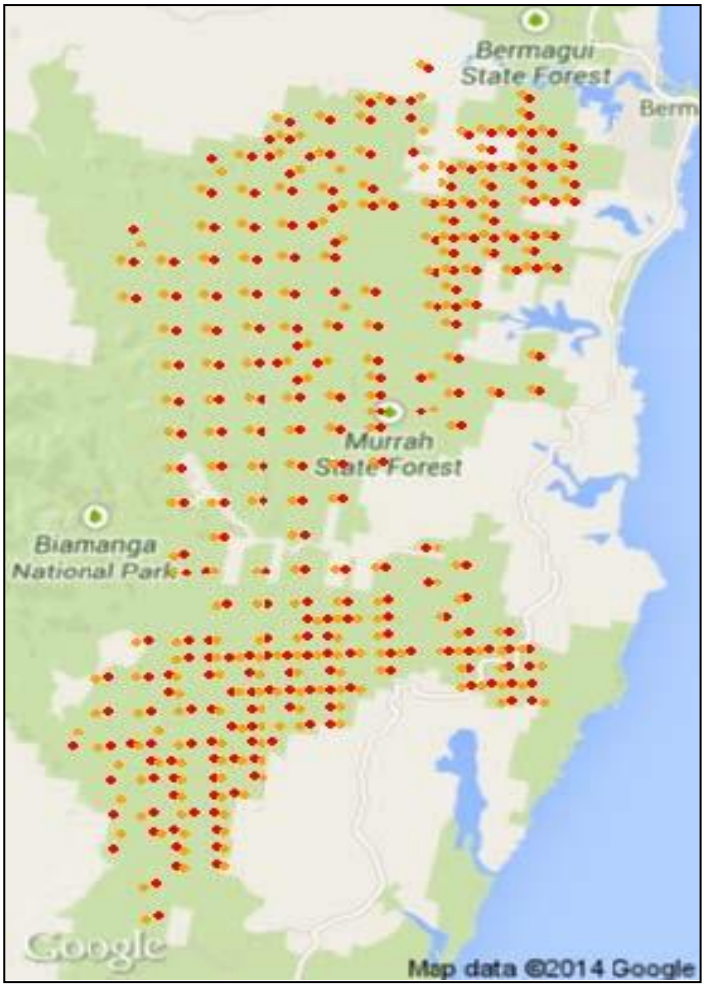
Discussion

The results show that koalas are present in parts of Mumbulla State Forest, Biamanga National Park, Murrah State Forest, Mimosa Rocks National Park, Bermagui Nature Reserve, Bermagui State Forest, Tanja State Forest and some private land (the order of these represents the largest area of activity to the smallest).

The 2012-2014 results confirm the outcomes of the 2007-2009 survey that the southern part of the current study area appears to support the greatest concentration of koalas in the Bermagui/Mumbulla area.

The University of Canberra (UoC) undertook a comparative analysis of the results from the two survey periods. Due to the change in the alignment of the survey grid between the two survey periods, the UoC identified 262 pairs of sites across the study area from the 2007-2009 and 2012-2014 koala surveys that were suitable for direct comparison (Figure 4).

Figure 4. Location of the paired survey sites from the 2007-2009 and 2012-2014 surveys used for comparative analysis by the University of Canberra.



Using just the paired sites, UoC found that there was a significant (Chi-square test, p = 0.015) increase in the percentage of active sites from 10% of sites during the 2007-2009 survey to 17% of sites during the 2012-2014 survey. Similarly, the number of active trees also increased significantly (Chi-square test, p <<0.0001) from the 2007-2009 survey to the 2012-2014 survey. During the 2007-2009 survey, koala activity was scattered and generally

at low levels across the study area. During the 2012-2014 survey, koala activity was more clustered, with a large cluster of koala activity in the southern half of the study area, and an increase in the size of the clusters of koala activity in the northern half of the study area. The intensity of koala activity (ie grid-site koala activity levels) appeared to be higher in the 2012-2014 survey as 60% of active sites during the 2007-2009 survey had only a single active tree while for the 2012-2014 survey, nearly 70% of active sites had 2 or more active trees. Additionally, the range for the number of active trees increased from 1-6 for the 2007-2009 survey to 1-15 for the 2012-2014 survey.

The 2007-2009 report provided a population estimate of 23-47 koalas. This was based on an occupancy rate 11.21% in a study area of 21,000 ha giving approximately 2,354 ha of occupied habitat and estimated home range sizes of 50-100ha. Using the same estimation process, the 2012-2014 survey had an occupancy rate of 11.44% in a study area of 26,000 ha giving approximately 2,974 ha of occupied habitat and a population estimate of 30-60 koalas.

These preliminary results indicate the population may be increasing, possibly in response to improved environmental conditions following the drought years and/or the increased time since the major impacts of fire and/or logging have occurred in the habitat. However, this observation should be treated with caution as it is based on a subset of data (262 sites) and links to the causal factors are only speculative. That the number and extent of active sites has not declined between the two survey periods gives some confidence that the population is at least stable and capable of recovery through appropriate management.

The population estimates provided above are tentative, with some factors suggesting a higher estimate for each period is warranted (e.g. koalas will have overlapping home ranges and there may be unidentified activity cells) and others suggesting it should be smaller (e.g. the area derived using the occupancy rate data overall may be larger than home range areas). Additionally the significantly higher activity levels at the active grid-sites revealed in the 2012-14 period, compared with the 2007-9 period, suggest that average home-range sizes may have contracted, possibly because better seasonal conditions probably means that suitable browse is more available. If that is so then the possible increase in koala numbers may be higher than is suggested by the estimates above.

Regardless of these uncertainties, the total population in the study area is undoubtedly small. Thus it will be essential to ensure that the population does not experience any further loss and that provision is made for its expansion into apparently unoccupied but suitable habitat.

This conclusion is consistent with the following joint statement arising from a workshop of scientists, held on 14 June 2006, to advise on Koala management (from EcoLogical Australia 2006):

The Far South Coast Koala population has declined to very low levels and requires immediate, assertive actions to maintain and improve Koala numbers in the area and avoid localised extinctions.

OEH also undertook surveys in Kooraban National Park (immediately to the north of the Eden MA approximately 20 km to the north west of Bermagui) in 2012-2014. One hundred and twenty-six (126) sites were surveyed and koala pellets were detected at nine of these giving an occupancy rate of 7.14 percent. This indicates this sub-population is very small and probably isolated from koalas in the Bermagui/Mumbulla area with the nearest activity cells being about 10 kilometres to the south in Biamanga National Park and adjoining Aboriginal land.

Since 2007-2009, surveys have also been conducted in the Tantawangalo/Yurrammie area which historically supported koalas. One hundred and sixty-three (163) sites were surveyed

and no koala pellets were detected, supporting the conclusion that koalas are now locally extinct in this area. This adds weight to the importance of managing the Bermagui/Mumbulla area to conserve the only koala population known to be surviving in the coastal and hinterland forest of south-east NSW.

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