

# EUROBODALLA KOALA RECOVERY STRATEGY – 2014 to 2026

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*Photo: Australian Koala Foundation*

## ***Objective, introduction and background***

This document consolidates an initial draft prepared by Eurobodalla Koalas project volunteers with amendments and advice kindly provided by Forestry Corporation NSW, the NSW Office of Environment & Heritage and the NSW Department of Primary Industries.

The document's purpose is to stimulate, guide and support a long-term recovery strategy for koalas in the Eurobodalla Local Government Area.

The simple objective is to have koalas return to the Eurobodalla as a viable low density population. (*For expansion on the objective see **Overall design of the Eurobodalla Koala Recovery Strategy**, p.7 below.*)

Partial implementation of aspects of this recovery strategy had already begun at the time of publication (see **Forestry Corporation NSW, Office of Environment & Heritage, Environment Protection Authority** and **NSW Roads & Maritime Services** sections), but full commitment by the whole community and all land managers was seen by the authors as the prerequisite for success (see **Priority actions and responsible stakeholders**, below).

The Eurobodalla Koalas project Pilot Study Report (January 2013) [1] touched briefly upon local history of koala presence (Pp. 18-19). Although records are sparse, koalas appear to have been abundant in and near the Eurobodalla Shire until the mid-19<sup>th</sup> Century (Townsend, 1849) [2]; then numbers seemingly declined Shire-wide but still persisted strongly in certain Eurobodalla locations until the end of that Century (Warry, 2004) [3]. The 19<sup>th</sup> Century context included the contraction of the traditional Aboriginal population, a shift from colonial pastoral activity to smaller cleared farm holdings, hunting for skins, a possible koala chlamydia epidemic, the “Federation drought”, timber-getting and gold mining (*nggh heritage/DECCW*, 2010) [4]. Nevertheless koalas appear to have persisted as resident groups in isolated pockets into the second half of the 20<sup>th</sup> Century including close to towns (Lawler et al, *pers comms*) [5], a period of increasing urban/peri-urban development, road transport and more mechanical forestry techniques. Koala numbers appear to have continued to decline towards possible functional extinction (ie only scattered records of apparently dispersing animals) by about the Year 2000 (NSW Wildlife Atlas) [6]. Loss of habitat is considered the greatest contributor to the 20<sup>th</sup> Century decline (National Koala Conservation and Management Strategy, 2009) [7]. In 2012 after apparent further diminution of sightings, the volunteer Eurobodalla Koalas project began emphasizing predictive habitat modeling for contemporary circumstances, focusing as its best case scenario on the capacity of the Local Government Area to accommodate low-density koala populations adapting to less than optimum conditions.

The pilot study report recommended a recovery strategy be designed, for the general Eurobodalla community and relevant agencies to decide whether to give it sufficient priority for implementation. As well as historical, cultural and “biodiversity health” reasons for implementing a recovery strategy, it was considered a worthwhile goal to establish the temperate and still widely forested Eurobodalla as a refuge for koalas retreating from diminishing core habitat elsewhere because of the effects of continued urban development, industry and climate change (Adams-Hosking et al, 2011) [8]. It was also reasoned that identifying, protecting and rehabilitating koala home ranges and connecting corridors would add value to existing local government protections for multi-species biodiversity and to planning practice, since many plants and animals threatened by continued human population growth, industry and climate change share the same habitat as the koala.



*Bandicoot dig at Bendethera*

Implementing a Eurobodalla koala recovery strategy would mesh well with national and state level plans (National Strategy, [7 op cit] and NSW Approved Recovery Plan, 2008 [9]) and especially with parallel local initiatives in the Bega Valley and Cooma-Monaro Shires (see **NSW Office of Environment & Heritage priorities**, at Pp.15-16 below).

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***Survey volunteers on private land at Mogendoura, October 2013. Photo: Naomi Cassilles Southgate***

## Science

The Eurobodalla Koalas project Pilot Study Report [1, op cit] should be read in conjunction with this strategy. The report contains a substantial reference list and reviews relevant research, especially on theory, habitat, field surveys and GIS mapping. The pilot study established a model for ongoing monitoring and provided part of the basis for designing a recovery strategy. More specifically the pilot study:

- conducted a literature review;
- modeled and mapped habitat on the basis of vegetation types within the Eurobodalla Shire (Fig 1);
- surveyed 21 sites using the RGBSAT technique to assess the model and search for koala evidence; and,
- began analysing data using *ESRI ArcGIS10* (Geographic Information Systems) software.

As an extension of this work, the project's 2013 priorities included:

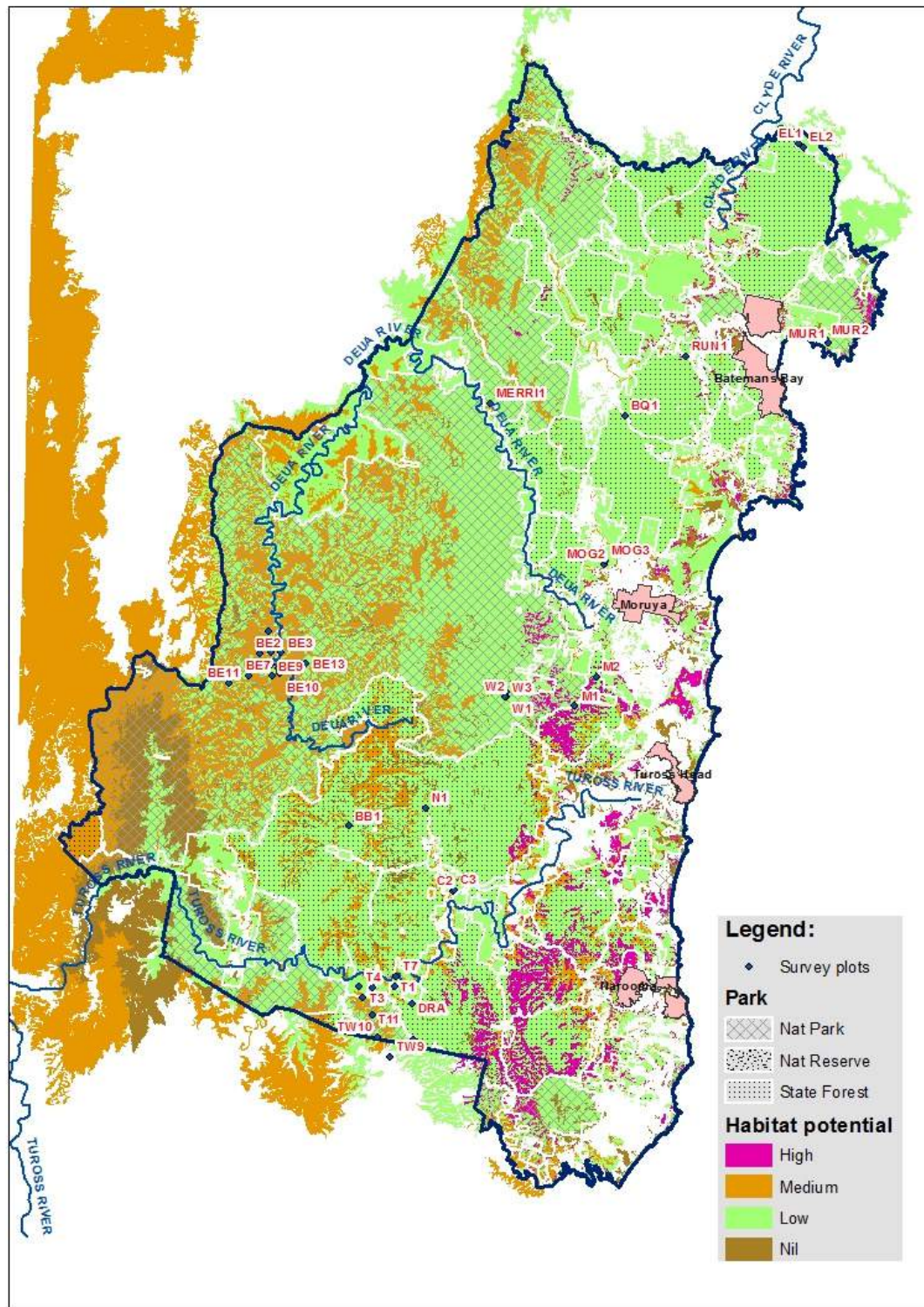
- conducting 13 additional plot surveys at Bendethera, then attempting to measure a wider range of variables including: (a) size and crown class of trees, foliage cover scales and chemical composition of browse; (b) geology and soil nutrients; (c) altitude, steepness of slope and aspect; (d) distance to viable water source; (e) various disturbance types, eg fire, flood, mining, farming, logging, roadworks, proximity to urban and peri-urban development; (f) size of the patch in relation to known low density home range areas and connectivity corridors for breeding; and, (g) weather history and microclimate;
- analysing the localised patch data in GIS with an improved control for interpreting layers and the content of attribute tables (the Bendethera May 2013 Surveys and Analysis Report [10] should also be read in conjunction with this strategy);
- undertaking further field plot surveys to follow up community reports and continue building the data set (Wamban Creek; Maloneys Beach; Mogendoura); and,
- beginning work on this research-based Eurobodalla Koala Recovery Strategy.



*Bendethera survey, May 2013*

Full detail on the background information and research is available in the Recovery Strategy's supporting documents (see **References**).

Fig 1 – Potential koala habitat within the Eurobodalla LGA stratified on the basis of modeled habitat quality



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## ***Overall design of the Eurobodalla Koala Recovery Strategy***

This strategy provides a framework for private and public stakeholders to take responsibility for specified priorities within their scope. Stakeholders are grouped in no priority order as follows:

- Forestry Corporation NSW
- NSW Office of Environment and Heritage (National Parks and Wildlife Service)
- NSW Environment Protection Authority
- Eurobodalla Shire Council
- NSW Roads and Maritime Services
- Owners and managers of private forests
- Farmers
- Urban and peri-urban dwellers

The strategy aims to provide for:

- a landscape-scale koala recovery program within the Eurobodalla LGA
- consideration of koala habitat as an integrated mosaic across urban, peri-urban, semi-rural, rural, private, State Forests and National Parks tenures
- continued sustainable forest management consistent with the maintenance of koala habitat
- potential koala translocation in the future
- nomination and conservation of potential home range and connectivity zones
- linkages amongst adjacent habitat within and beyond Shire borders
- consideration of animal movement during future infrastructure development
- retention and reestablishment of specified eucalypt species
- domestic and hunting dog control
- availability of coordination and advice

Land management agencies and community landholders will need to develop local detail consistent with the available science and best practice guidelines. Although the necessary detailed advice is directly accessible for those with time to follow through this document's references, for practical purposes a designated coordination and advice service is required.

### General recommendation

***It is recommended that a designated coordination and advice service be located with Eurobodalla Shire Council, emphasizing a Local Government Area perspective, but jointly resourced with State agency stakeholders.***

## ***Priority actions and responsible stakeholders***

***Note: Stakeholders are not listed in any priority order.***

### **Forestry Corporation NSW priorities:**

1. Continue to implement conditions relevant to the management of koala within the Southern Integrated Forest Operations Approval (2001) South Coast Threatened Species Licence, with particular relevance to Bodalla State Forest and Dampier State Forest for the purposes of this strategy
2. Review existing Forest Management Zones in reference to future management of koala under the strategy where necessary
3. Adopt agreed future management actions within the LGA within other State Forests where appropriate, and connectivity to sub-populations in adjacent LGAs
4. Consider participation in a partnership with OEH, ESC and community groups to initiate a southern Eurobodalla Comprehensive Koala Plan of Management (CKPoM)

### **Note**

***There is a complex framework of federal and state agreements that govern and regulate public land management. The licenses and prescriptions that allow for and guide forestry operations already exist, are regularly audited and reviewed within an existing framework that already considers state and federal recovery programs that have legal weight. Whilst respective land managers are willing to support the Eurobodalla Koalas project, and this Eurobodalla Koala Recovery Strategy may inform future management decisions, however it has no statutory authority to determine any agreed management actions.***

### **Elaboration**

The large overall size and location of State Forests in the Eurobodalla means they, along with adjoining tenures, provide for large areas of potential habitat, as well as for connectivity to adjacent sub-populations.

A review of habitat management on State Forest may be explored as new data regarding the persistence of low density koala populations becomes available; and also considers historic data regarding low-density habitation of low or marginal quality habitat.

It is important to respect the comprehensiveness of individual FCNSW harvest plans (according to the rules governing them), value the rich history and local knowledge within the local forestry industry and acknowledge the contention that the industry is already sustainable in terms of wildlife protection. As existing prescriptions already provide for the retention of preferred browse species additional to other conditions for the protection of koala, future review of the relevant species and the adequacy of current conditions may be warranted as additional data from this and other similar projects becomes available. This may also consider the distribution and silviculture prescribed, in conjunction with the adequacy of current Forest Management Zones.

Another question is the extent to which both historic and recent forestry operations might have altered any vegetation types given koala occupancy of disturbed habitats in coastal forests in the Bega Valley, NSW North Coast and dryer inland forest types as indicated by Kavanagh et al (2007) [11], who demonstrate the viability of logged landscapes as koala habitat. This Recovery Strategy offers an opportunity to assess these conclusions within the Eurobodalla LGA.

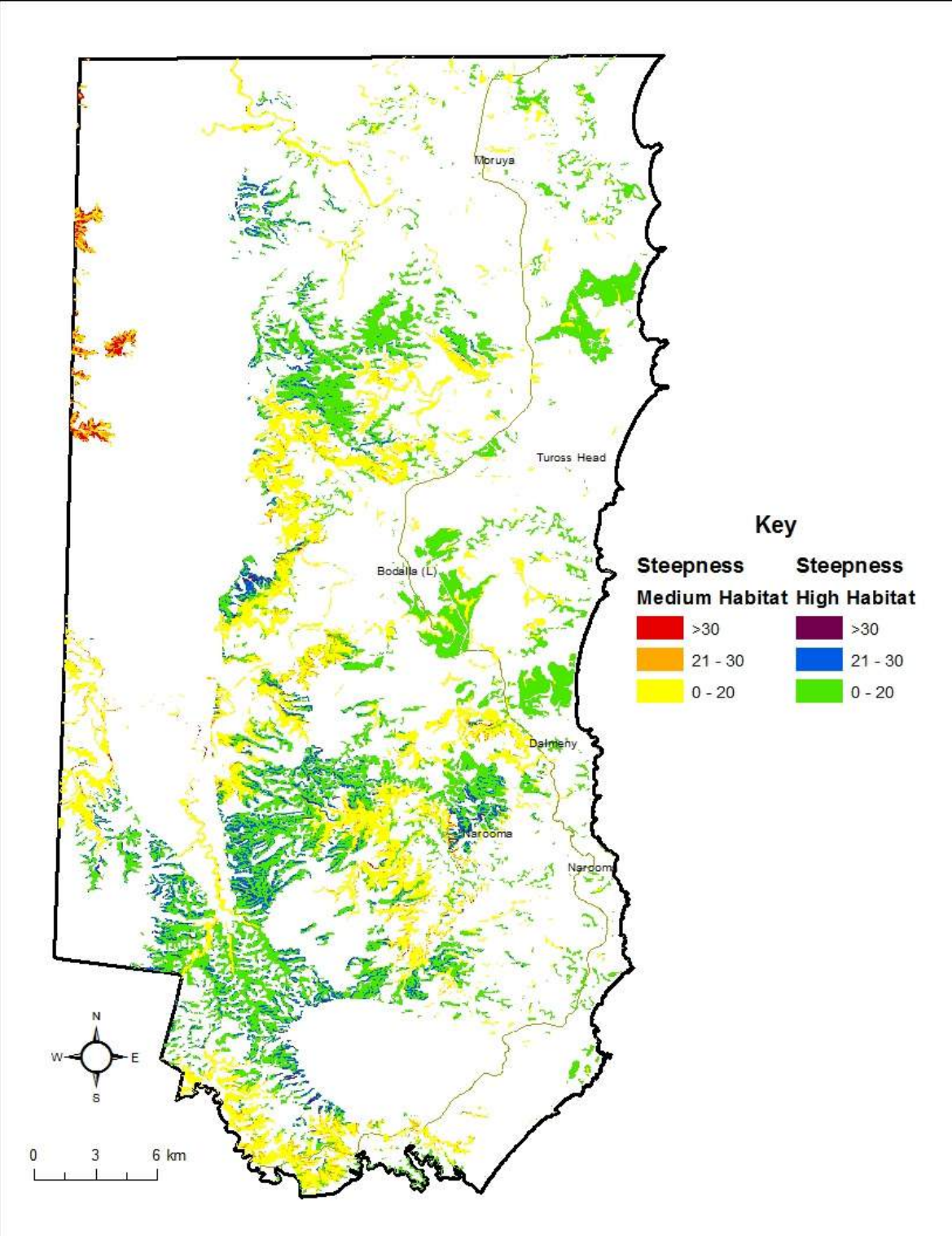
Bodalla and Dampier State Forests are proposed as the initial locations for FCNSW's involvement as:

- habitat modeling suggests a large area of potential high quality habitat area to the south-east of the LGA, including Bodalla State Forest;
- Sightings from 2009 near Nerrigundah and Cadgee, and the 2013 Wamban Creek evidence suggest potential movement from Bermagui or Sam's Ridge to potential moderate quality habitat west of Bodalla and Turlinjah (see Fig 2, and *Addendum* re November 2013 Nerrigundah sighting, p. 17 below); and,
- The Wamban Creek records were within Deua National Park adjacent to Moruya State Forest. If this is a resident group of animals home range which may be as large an area as several hundred hectares and its connectivity to adjacent habitat may warrant consideration, requiring collaboration between relevant agencies and private landholders.



*Wamban Creek survey, November 2013*

**Fig 2 – Map by Chris Malam overlaying steepness of slope on modelled “medium” and “high” potential low density habitat, to help test breeding connectivity between known Bermagui/Sam’s Ridge koala populations and the 2012/13 Wamban evidence**



If a 2013 record near Maloney's Beach can be confirmed, habitat linkages between Murrumbidgee National Park and adjacent State Forests west of the Princes Highway should be reviewed across all tenures, and linked to older records in the area of Shallow Crossing, Big Bit, Benandarah, Old Store Creek, and Skid Ridge Road. History indicates that ample koalas occurred at Dithol (Pigeon House Mountain) [Townsend, 1849, 2 op cit]. Connectivity of populations at Bungonia and Morton National Parks north of Eurobodalla may also require consideration.

Southern Rivers Catchment Management Authority (SRCMA) has supported replanting of 3000 koala browse trees on 40 hectares of private land at the Clyde River, adjacent to State Forest. It has been suggested this might be a good site for a reintroduction study, however it is as yet unclear what is the total area of available continuous quality habitat to make it attractive. Additionally, there is no translocation suggested for the area under the state or national recovery plans, so this will not be considered a priority by relevant governments or consequently supported by agencies.

The viability of connectivity between the Monaro tablelands, Bendethera and the Deua catchment is also being assessed (Figs 3, 4 & 5). This will bring into play tenures like Tallaganda and Badja State Forests.



**Fig 3 – Elevation Map: Bendethera surveyed patch to Tablelands West and South West**

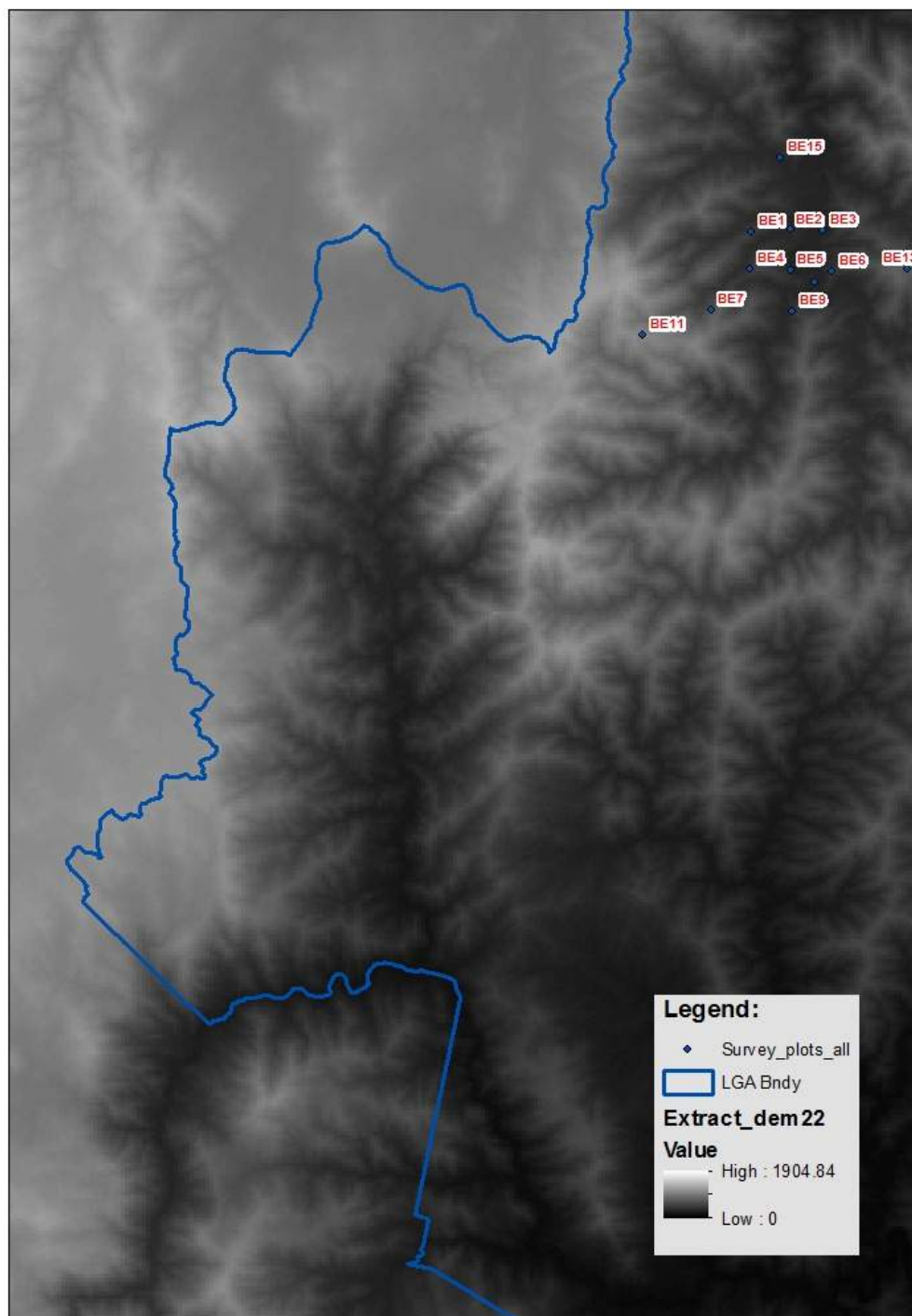
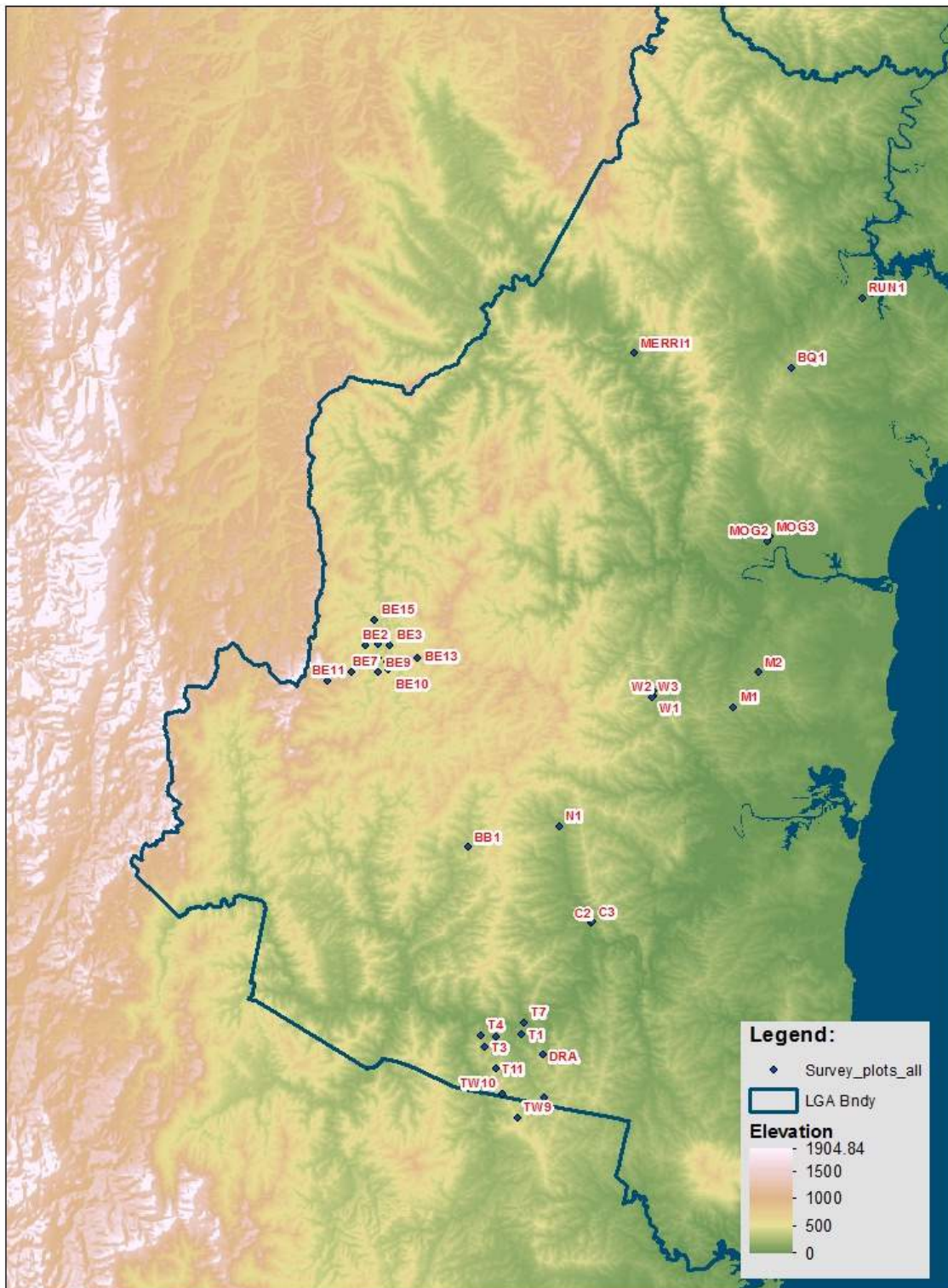
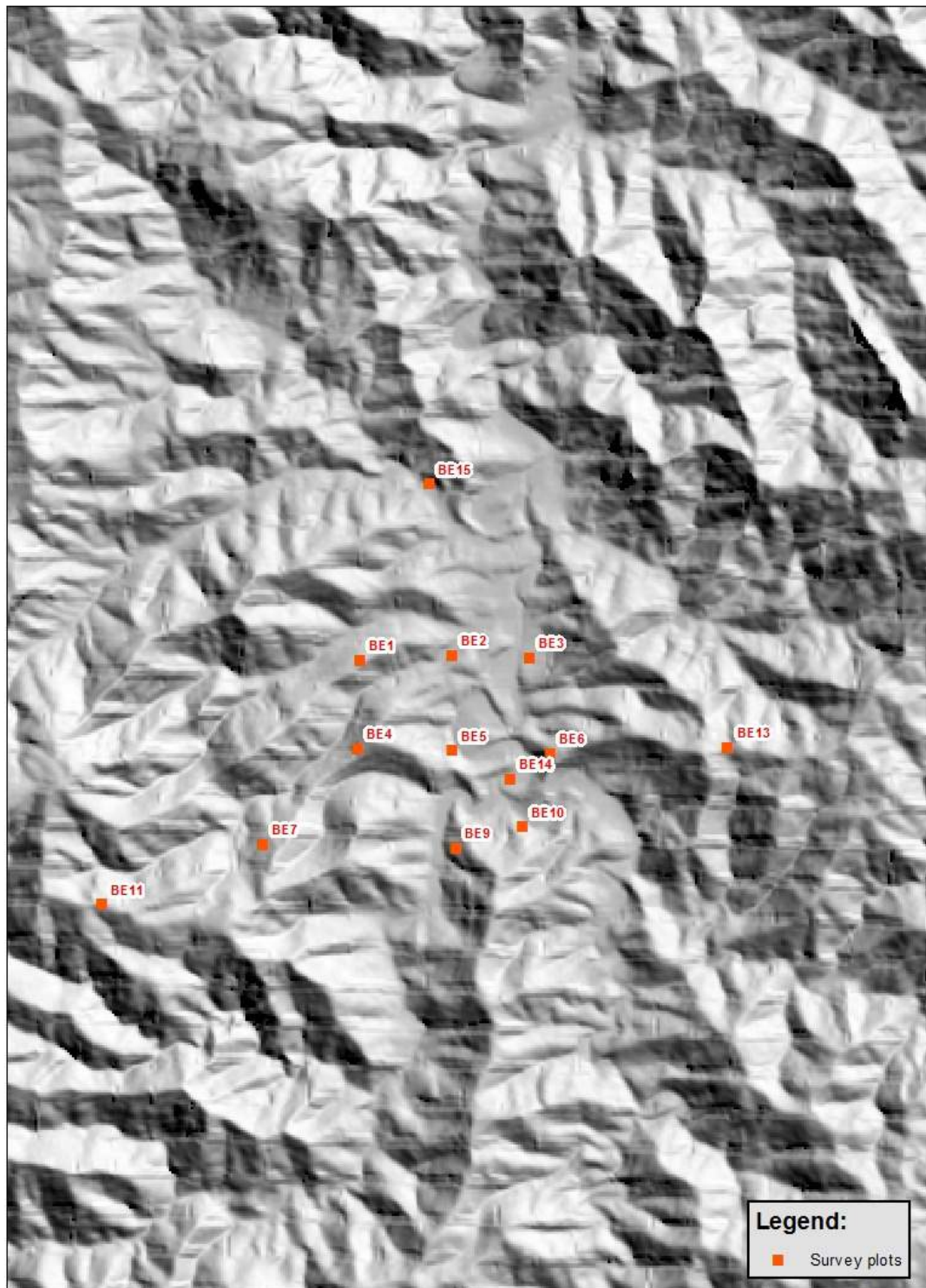


Fig 4 – Elevation Map: Eurobodalla LGA & Tablelands



*Fig 5 – Aspect Map: Bendethera*



### OEH (NPWS) priorities:

1. Establish a partnership with other agencies and community groups to initiate a southern Eurobodalla Comprehensive Koala Plan of Management (CKPoM)
2. Reinvestigate Woila Creek Basin as a translocation habitat
3. Develop a focus for Deua National Park as a large-scale host landscape for viable low density koala home ranges and safe breeding connectivity corridors
4. Strengthen landscape-scale koala breeding connectivity corridors with the known Bega Valley, Monaro and Shoalhaven populations



*Fresh koala scats at Wamban Creek, February 2013. Photo: Candace Wirth*

### Elaboration

*OEH makes the following points:*

- In respect of speculation about functional extinction, OEH has cautioned that the recent records in Wamban Creek and the upper reaches of Dignams Creek suggest that small numbers of koalas are persisting in these areas, and this may also be true of other locations.
- Possibly the best avenue for progressing the Eurobodalla Koala Recovery Strategy is as part of a comprehensive Koala Plan of Management (KPoM). For OEH, this would be focused on the southern area of the Eurobodalla Shire and would also include north-eastern Bega Valley Shire. Further survey work needs to be undertaken on both private and public land to establish the size and extent of the koala population before a KPoM is commenced. Such work would be focused on the Wamban Creek, Bodalla and Moruya State Forests where koalas are known to persist.
- At the time of publishing this Eurobodalla Koala Recovery Strategy the current priority for OEH was expected to continue, ie emphasis on managing the extant populations of the Bega/Bermagui area and the Southern Tablelands over areas where koalas are not known to be present, however OEH would support increasing attention to the population known to occur in the southern areas of Eurobodalla Shire. OEH anticipates its current full commitment to the

Cooma-Monaro KPoM and the Australian Government funded Key Habitats and Corridors for Koalas project (KH&C project) will either be met or reduced by the end of 2014, when OEH should be in a position to initiate a KPoM for the southern Eurobodalla (see discussion about a partnership in ***Eurobodalla Shire Council priorities***, p.19 below).

- OEH agrees on the need to augment and rehabilitate the north-south forested corridor particularly between the Gulaga and Biamanga National Parks. There may also be merit in supporting corridor rehabilitation to the north and west of Eurobodalla Shire. OEH has completed a project to refine and validate the habitat corridors mapped in the South Coast Regional Conservation Plan (the detail behind the South Coast Conservation Strategy). These corridors have been included in the new Southern Rivers CMA Catchment Action Plan and have been mapped over areas of known native vegetation with a focus on private land.
- OEH is willing to share its relevant data.



*Young volunteers survey a “medium” potential habitat patch at Bendethera, May 2013. Photo: Chris Malam*

*Volunteers in the Eurobodalla Koalas project had previously suggested the following:*

- There would be value in replicating and extending the 2012 Phillips & Allen [13] translocation feasibility study for Deua National Park, but with emphasis on parts of Deua NP accepting refugee koalas from other places in Eastern Australia where continued urban development and climate change are rendering their ongoing occupancy untenable. (Note: *At the time of preparation of this Recovery Strategy, OEH observed that it was investigating the translocation matter as part of the Corridors and Core Habitat for Koalas Project. OEH said this would be an expensive and complex initiative with some major hurdles to overcome before we {sic} could commence the first translocation trial in SE NSW. It is likely that would be followed by several years of monitoring and review of outcomes before we could consider another, similar initiative.*)

- In addition, the work of the CSIRO “*South Coast Project*” of the 1970s and 1980s [12] and past National Parks Advisory Committee consideration about Woila Creek Basin, could be revisited in the light of contemporary local research.
- Connectivities between the Bermagui and Sam’s Ridge koala populations, Bodalla State Forest, Dampier State Forest and the Woila Creek area should be nurtured, in light of the volunteer Eurobodalla Koalas project’s findings so far (see ***Forestry NSW priorities***, p.8 above), as should any continuities between the Monaro and the eastern escarpment National Parks, eg Bredbo-Tallaganda-Deua Catchment link (where topography as a potential inhibitor is one aspect being pursued by the volunteer Bendethera analysis, but would benefit from specialist NPWS attention) and any potential Numeralla-Badja-Wadbilliga-Tuross Catchment link. The volunteer Bendethera analysis has paid some attention to connectivity possibilities between the extended Deua catchment (Bendethera/Merricumbene/Wamban) and Nerrigundah/Cadgee and Belowra/Woila. [***Addendum: Val and David Byard sighted a koala at Nerrigundah on 10th November 2013 at 8pm, on the ground just past the monument on the Ag Bureau road (straight ahead at the monument).***] Local *Landcare* replanting activity in 2013 included input by and collaboration with the Upper Deua landholder communities.
- Eurobodalla National Park and Murramarang National Park should be audited for low-density koala habitat patches, connectivity and movement barriers, including their relationship to adjacent other tenures as well as Shoalhaven Shire habitat (see ***Forestry NSW Priorities***, p.8 above).
- Continued effective dog and fire management programs in National Parks are clearly critical.



***The upper Deua***

## NSW Environment Protection Authority (EPA) priorities:

1. Take account of potential cross-tenure Eurobodalla koala habitat (including both the issues of rehabilitating cleared fertile land and potential koala adaptation to less than optimum habitat) when considering options for how current and future koala habitat mapping could be better integrated with the regulation of private native forestry
2. Engage with the Eurobodalla Koala Recovery Strategy and any resulting CKPoM to assist monitoring and ensure consistency of Priority Actions with developments arising from the EPA stakeholder consultation and policy development initiatives in this area
3. Consider joining the Southern Eurobodalla CKPoM partnership with ESC (proposed by OEH) in order to play a lead role in enhancing the extent of suitable habitat across the more fertile Eurobodalla regions that have been previously cleared

### Elaboration

*The Department of Primary Industries (DPI) makes the following points:*

- [The Eurobodalla Koala Recovery Strategy's] Stakeholder list should include the EPA.
- DPI supports the Strategy initiatives to gather further data to examine the extent and status of koala populations in the area and to work collaboratively with various stakeholder groups and land managers.
- In promoting changes relating to koala management care should be taken to ensure the Strategy is consistent with existing guidelines and legislative requirements, and also flexible in relation to planning reviews currently in progress.

In particular:

- The Strategy needs to align with the review of the Integrated Forest Operation Approvals (currently in progress), and the approved *Recovery Plan for the Koala* (NSW DECC 2008), which includes the following actions:
  - a) Action 1.8 DECC (now OEH) will identify important koala populations in NSW for active management, monitoring and conservation
  - b) Action 1.24 DECC will approach Forests NSW ([then] DPI) to collaborate in developing policy and practice consistent with the NSW Koala Recovery Plan; exchange information, given that koalas move across tenure boundaries; and work within the context of agreed regional forest agreements

DPI considers that prescriptions relating to koala management on state forests should be developed by the agencies involved in these processes.

- The NSW Government is currently considering options for how current and future koala habitat mapping could be better integrated with the regulation of private native forestry to ensure consistency and improved protection for important koala habitat. Details are available at <http://www.epa.nsw.gov.au/pnf/compprior1314.htm>

The EPA has identified a program of stakeholder consultation and policy development to address this issue. Any implementation of proposed Priority Actions should be monitored against developments in this area to ensure they align with current strategies.

- As the majority of koala sightings occur within National Parks and State Forests, there may be bias towards managing koalas in these areas. The report acknowledges koala preferences for tree species growing on the largely cleared fertile floodplains and valleys. It is suggested that rather than assisting low-density koalas to adapt to 'less than optimal habitat', the main priority should be to enhance the extent of suitable habitat across the more fertile regions which have been previously cleared.

### Eurobodalla Shire Council priorities:

1. Establish a partnership with OEH, other agencies and community groups to initiate a southern Eurobodalla Comprehensive Koala Plan of Management (CKPoM)
2. Nominate potential tenure-wide low density koala home range areas and connectivity corridors, urban, peri-urban, semi-rural and rural, for both rehabilitation and protection purposes
3. Implement planning policy to ensure development is compatible with the rehabilitation and preservation of these zones
4. With help from other agencies, support a Council staff or resourced external advisory position responsible for coordinating the Koala Recovery Strategy and advising stakeholders on implementation detail
5. Lead or sponsor a community education initiative

### Elaboration

As mentioned in **OEH priorities** (p.15, above) the opportunity exists for a partnership between Eurobodalla Shire Council, OEH, community groups and other stakeholder agencies such as Forests NSW, EPA and SRCMA, initially to seek funds and then to prepare a Comprehensive Koala Plan of Management (CKPoM) for the southern Eurobodalla and northern Bega Valley Shire areas. Establishment of the partnership and preparation of the funding submission can start immediately with a view to initiating the CKPoM at the end of 2014.

Eurobodalla Shire Council can adopt an underpinning philosophy of designing for a future that includes koalas, as well as other native animals and plants that occupy the same habitat. Many of the proposed actions in this Recovery Strategy could be incorporated into the planning process resulting from a CKPoM partnership.

OEH agrees with the logic of rehabilitating habitat and creating connectivity corridors of vegetation and supports initiatives in these directions. OEH acknowledges that these will also have broader biodiversity benefits. The remarks in **OEH priorities** (p.15, above) about the mapped corridors included in the Southern Rivers CMA Catchment Action Plan are relevant to ESC and consistent with ESC's intention to draft a Eurobodalla Biodiversity Strategy in 2014/15.

In its 2013 response OEH noted that many of the initiatives recommended in the then draft Eurobodalla Koala Recovery Strategy had already been initiated in collaboration with both the NSW department of Planning and Eurobodalla Shire Council under the South Coast Conservation Strategy (SCCS). The SCCS

has included modeling of threatened fauna species habitat, as well as endangered ecological communities and other areas of high conservation value. Additionally OEH provides ongoing non-binding advice to Council regarding the protection of high conservation value private lands.



*Photo: Birdland Animal Park, Batemans Bay*

<http://birdlandanimalpark.com.au/>

As in the Coomera-Pimpama LGA (see **Supplement: KPoMs in other LGAs**, p.30 below) locations of developments, street alignments, overpasses and underpasses, direction of street lighting etc should all be inbuilt at the initial design stage on the assumption home range patches and safe connectivity all need to be preserved according to their status in terms of the mix of researched koala habitat factors.

Because large and small instances of paving, tree damage, disturbance and blocking of free movement incrementally (but ultimately broadly) diminish habitat, designs and requirements for residential, industrial and infrastructure approvals need to minimize these effects in keeping with a landscape-scale vision. Despite the local political resistance, a form of publicly accessible and accountable biodiversity overlays will be necessary.

### NSW Roads and Maritime Services priorities:

1. Ensure all new roads are underpinned by a “design for a future that includes koalas” assumption
2. Ensure protections and safe passage features are inbuilt at the initial design stage
3. Align all new roads consistent with the retention and rehabilitation of habitat suited to low-density koala populations
4. Retrofit the existing Princes Highway with protections and safe passages

#### Elaboration

At the time this document was prepared, the NSW Office of Environment and Heritage was working closely with RMS to minimize impact of the upgrade of the Princes Highway at Dignams Creek, with outcomes including offsets, re-vegetation and road underpasses.

Volunteers believed alignment options for new roads and upgrading should be considered first.

The next consideration, protection and safe passage features, would appear to be mainly fencing and strategically positioned underpasses or overpasses.

Volunteers recognized that major retrofitting is expensive, so strategically located fencing and small over-bridges designed for arboreal marsupials might be the best way forward for existing roads.

In the case of major upgrades or new roads, incorporating protection and safe passage features from the beginning saves future costs and inconvenience. In a context of strong competition for limited road upgrade funds it also provides the best chance that something will be done.

### Private forestry priorities:

1. Maintain a viable mix of koala browse species on forested private land
2. Maintain trees of sufficient size
3. Maintain habitat connectivity between forested private land and adjacent forested areas
4. Rehabilitate degraded areas (see ***Farmer priorities***, p.24 below)

#### Elaboration

At the time this document was being prepared, the Crown Forestry Branch of the EPA was committed to reviewing the code of practice for Private Native Forestry with regard to the protection of koala habitat.

Interested private forest owners/managers need not wait for (although they can already work in concert with EPA consultations and developments towards) the new Private Native Forestry (PNF) classifications and revised regulations or new Koala Plans of Management (KPoMs) vegetation maps, to decide which species to preserve or plant, and in what proportions.

Where conditions permit (altitude; slope; aspect; soil type; drainage) the best trees to preserve are the “primary” local browse species for low-density koalas. At least two “primary” species is a desirable number amongst an optimum total of five browse species across a whole home range (300+ hectares).

Below are tables prepared through a preliminary modeling exercise by the volunteer Eurobodalla Koalas project in 2012-13. The volunteers used available research reports from elsewhere, digital vegetation type mapping (“SCIVL”) data and the results of their own plot surveys to classify eucalypts by potential “primary”, “secondary”, “supplementary” and “suspected” importance in the browse mix for local low-density koalas adapting to less than optimum habitat. These tables are included to give Eurobodalla landholders some idea of the mix of trees they could begin preserving or planting, but the classifications should not be treated as completely correct or final. They are a work in progress and would benefit from a properly resourced enquiry as part of the Recovery Strategy. Responding to the first draft of this document in September 2013, NSW Office of Environment and Heritage made the following observations concerning these classifications, showing how landholders should stay informed about emerging new knowledge and cautioning that the NSW Recovery Plan’s [9, op cit] criteria were still the guide for deciding on primary species:

***“The koala browse species list and habitat definitions in the draft Strategy need further consideration. The use of the phrase ‘primary species’ is not useful in this regard as there is as yet no evidence that any of the species listed meet the criteria for primary species as defined in the NSW Recovery Plan. Additionally some of the browse species listed are in our view probably not important for koalas. It may be appropriate to review the list to limit it to those species which have been demonstrated to be important. Analysis of the substantial datasets gathered in fieldwork in recent OEH koala surveys in the coastal or tablelands areas of SENSW is currently under way and the resulting data will be provided to you to assist with that review, should you require them. It is also worth noting that any koala habitat modeling using SCIVI vegetation mapping is limited as such maps should be considered indicative only. OEH is currently exploring other options for habitat mapping in South East NSW. We would be happy to share these methods with you should they bear any meaningful results.”***

The Department of Primary Industries also made the following point:

***“The Strategy promotes preservation of certain tree species, nominated by local Eurobodalla Koala volunteers as primary and secondary browse species. This differs from the list included in the Koala Recovery Plan, and may require peer review.”***

The local species nominated as “primary” by the volunteer Eurobodalla Koalas project were:

E longifolia		Woollybutt
E cypellocarpa		Monkey Gum/Mountain Grey Gum
E tricarpa		Red Ironbark
E bosistoana		Coast Grey Box
E globoidea		White Stringybark
E viminalis		Manna Gum/ Ribbon Gum/White Gum
E robusta		Swamp Mahogany/Swamp Messmate
E tereticornis		Forest Red Gum
E smithii		Gully Gum/Gully Peppermint/Blackbutt Peppermint
E obliqua		Messmate/Messmate Stringybark
E pilularis		Blackbutt

**By comparison, the NSW Recovery Plan lists only: Cabbage gum *E. amplifolia*, Forest red gum *E. tereticornis* and Ribbon gum *E. viminalis* as “Primary food tree species for the South Coast”.**

The disparity between the volunteers’ modeled lists and the NSW Recovery Plan classifications is discussed at p.40 of the Eurobodalla Koalas Project Pilot Study Report [1, op cit] where the issue of emerging new knowledge about browse preferences amongst low density koalas is explored.

Different natural forest types are often dominated by two co-occurring species with smaller numbers of other species intermingled. Certain species co-occur with certain others. For practical purposes it will not be possible to maintain a forest populated purely by five primary species, so a mix of (or including) secondary or supplementary species is necessary.

The local species nominated by the volunteers as likely to be of “secondary” preference by low-density koalas were:

E radiata		Narrow-leaved Peppermint
E fastigata		Brown Barrel/Cut-tail
E pauciflora		Snow Gum
E botryoides		Bangalay/Southern Mahogany
E elata		River Peppermint/River White Gum
E maidenii		Maiden's Gum
E muelleriana		Yellow Stringybark
E consideniana		Yertchuk
E scias		Large-fruited Red Mahogany
E baueriana		Blue Box/Round-leaved Box
E saligna		Sydney Blue Gum

**By comparison, the NSW Recovery Plan lists as “Secondary food tree species” for the South Coast:** Yellow box *E. melliodora*, Woollybutt *E. longifolia*, Brittle gum *E. mannifera*, Maiden’s gum *E. maidenii*, Yertchuk *E. consideniana*, Snow gum *E. pauciflora*, Swamp gum *E. ovata*, Red box *E. polyanthemos*, Large-fruited red mahogany *E. scias*, Coast grey box *E. bosistoana*, Apple-topped box *E. bridgesiana*, Blue box *E. baueriana*, Monkey gum *E. cypellocarpa*, and Bastard eucalypt *E. pseudoglobulus*.

The volunteers’ local “supplementary” species list was:

E sieberi		Silvertop Ash/Coast Ash
Angophora floribunda		Rough-barked Apple
E agglomerata		Blue-leaved Stringybark
C maculata		Spotted Gum
E angophoroides		Apple-topped Box
E ovata		Swamp Gum
<i>Allocasuarina littoralis</i>		<i>Black She-Oak; Roosting only?</i>

**By comparison, the NSW Recovery Plan’s supplementary list is the Stringybarks:** White stringybark *E. globoidea*, Brown stringybark *E. capitellata*, Yellow stringybark *E. muelleriana*, Southern white stringybark *E. yangoura*, Blue-leaved stringybark *E. agglomerata*, and *E. baxteri*.

Other species suspected by the volunteers to be useful locally were:

E saligna hybrid		Sydney Blue Gum with <i>E botryoides</i> intergrade
E botryoides hybrid		Bangalay/Southern Mahogany with <i>E saligna</i> intergrade
Angophora costata		Smooth-barked Apple/Sydney Red Gum

In terms of size, the larger the better. A minimum diameter at breast height (dbh) of 150 millimetres is desirable, and upwards of 300 to 800 millimetres is ideal.

### Farmer priorities:

1. Select koala feed trees for wind-break and other farming purposes
2. Rehabilitate degraded river flat and low hill country by planting koala feed species
3. Maintain native species connectivity across the farm, and between the farm and neighbouring areas
4. Minimise obstacles to safe koala ground movement
5. Keep fresh water sources (eg creeks and springs) clean and viable
6. Minimise disturbance (eg control dogs and avoid unnecessary clearing or burning)
7. Minimise the use of toxic substances

#### Elaboration

Evidence from elsewhere (eg Lismore) indicates that viable koala populations are not incompatible with farming. Koalas will move between forested patches across cleared land for browsing and breeding purposes, and have been known to use isolated trees in paddocks.

One viewpoint strongly held amongst certain specialists is that the most cost effective way of encouraging koala revival is to rehabilitate the more nutrient-rich alluvial country that has long been cleared for farming.

Suggestions and information in ***Private forestry priorities***, p.21 above are relevant.

### Urban and peri-urban dweller priorities:

1. Become familiar with the basic behaviours and habitat needs of low-density koala populations (eg residency in and across urban, peri-urban, semi-rural, rural and wilderness conditions; size of home ranges; makeup of breeding associations; breeding ages and movement; eucalypt browse species; the need for safe ground-level passage from one feed tree to the next; dog danger; traffic strike danger; fire danger)
2. Preserve and where possible plant browse species
3. Control dogs
4. Collaborate with neighbours and local government to enhance the mosaic of interconnected habitat

#### Elaboration

Although it is difficult to position eucalypts in urban domestic yards, wherever possible koala browse species should be retained and/or planted in linked patches in urban and peri-urban situations.

This is especially feasible for owners of “bush blocks”, who can typically divide their properties strategically into three working zones, one for human use (eg houses; sheds; vegetable gardens; fruit

trees; domestic animal space), one for forested hobby farm-type use with modified understory (eg horse grazing; recreation; bushfire protection) and one where native vegetation is allowed to thrive and recover largely untouched.

The Australian Koala Foundation has produced a list of browse species by Local Government Area, indicating altitudes, climatic, drainage and soil conditions for each tree. For planting selection purposes as well as the lists shown previously, urban and peri-urban dwellers can use the AKF list as follows:

*E. agglomerata* Blue-leaved Stringybark shale-derived soils, gentle to moderate slopes, good levels of subsoil moisture  
***E. amplifolia* ssp. *amplifolia* Cabbage gum by streams or in lower moister sites, in deeper loamy soils**  
*E. baueriana* Blue box, Round-leaved box low rolling hills on well-drained granitic soils, elevations below 500m, 700–1100 mm rainfall  
*E. bosistoana* Coast grey box, Gippsland grey box, Bosisto's Box lowland areas on better quality soils, particularly over limestone, 700 to 1200 mm  
*E. botryoides* Bangalay, Southern mahogany sandstone or shale-based soils generally close to the coast  
*E. considaniana* Yertchuk, Prickly Stringybark shale or sandstone-derived soils  
***E. cypellocarpa* Mountain grey gum, Mountain gum, Monkey gum, Spotted mountain grey gum, Pyrenees Gum wet forest on deep fertile soils in sheltered valleys**  
*E. globoidea* White Stringybark moist well drained soils in foothills  
*E. globulus* ssp. *maidenii* Maiden's gum heavy clay loam or sand, wet forest on fertile soils in valleys in subcoastal ranges  
*E. longifolia* Woollybutt near coastal, soils of medium fertility, often on alluvial flats  
*E. mannifera* ssp. *mannifera* Brittle gum, Red spotted gum always on dryish, often stony sites, skeletal soils of plateaus and hill slopes, cold, frost-prone sites  
*E. melliodora* Yellow box, Honey box, Yellow ironbox gentle slopes, foothills or on flats near watercourses. Soils include alluvials, loams and clays, frost and drought tolerant, 500-1400 mm  
*E. muelleriana* Yellow Stringybark coastal plains and foothills, often on nutritionally poor soils but grows well on well-drained deep clay loams  
*E. obliqua* Messmate Stringybark fertile acidic well-drained loams, > 600 mm rainfall, drought tolerant  
*E. ovata* var. *ovata* Swamp Gum poor drainage or swamps  
*E. piperita* ssp. *urceolaris* Sydney Peppermint sandstone-derived soils on plateaus, slopes and gullies, drought tolerant  
***E. robusta* Swamp Mahogany swampy, seasonally waterlogged soils, very moist fertile soils, heavy clay, sandy clay, alluvial sand soils**  
***E. tereticornis* ssp. *tereticornis* Forest red gum, Blue gum, Red iron gum alluvial soils, 600-2500 mm, tolerates salt-laden coastal winds, tolerates saline soils, medium-heavy clays, does not tolerate waterlogged soils**  
*E. tricarpa* Red ironbark 550-1000 mm, tolerates slight frosts, drought tolerant, well-drained, wide variety of soils  
***E. viminalis* ssp. *viminalis* Manna gum lower slopes adjacent to major streamlines, well-drained alluvial or sandy loam soils with clay subsoils, tolerates frosts**

The numbers are Elevation: height above sea level

mm: annual rainfall in millimetres

Bolded entries indicate the AKF's nominated primary tree species, coinciding with those in the NSW Recovery Plan

Dogs are a particularly destructive predator for koalas, especially when the marsupials are moving from tree to tree across open ground. It is essential that dogs are never allowed to be in situations where they can attack or seriously disturb koalas.

Urban dwellers are obviously also amongst those who need to be especially aware of the traffic strike danger.

## ***Monitoring, evaluation and reporting to the public***

The history of very sparse koala evidence in the Eurobodalla in modern times indicates that expectations should not be inflated, especially in the short term. Recovery of a healthy koala population in the Shire, even in low density, will take a determined community-wide and inter-agency effort over a period of years. It requires a values shift. Initially the success of the Recovery Strategy should not be measured in koala numbers but in terms of how well the various priorities are being implemented.

The following time frame is recommended.

### **2014 to 2020**

Implementation of each priority with measurement and reporting according *Performance Indicators*, specified below.

### **2020 to 2025**

Surveys (both RGBSAT and community postal techniques) to determine koala numbers.



### **2026**

Review, and decision about continuation.

## ***Performance Indicators***

### **Forestry Corporation NSW:**

1. Forestry Corporation NSW has considered participating with OEH, ESC and community groups in a partnership developing a Comprehensive Koala Plan of Management (CKPoM) for the southern Eurobodalla
2. Monitoring indicates that koalas and their habitat are adequately catered for under the Southern Integrated Forest Operations Approval (2001) South Coast Threatened Species Licence, with particular relevance to Bodalla State Forest and Dampier State Forest for the purposes of this plan
3. Forest Management Zones are reviewed in reference to future management of koala under the plan and revised where appropriate
4. FCNSW adopts agreed future management actions within the LGA relevant to other State Forests, and connectivity to sub-populations in adjacent LGAs, where appropriate

### **OEH (NPWS):**

1. OEH is participating with ESC, other interested agencies and community groups in a partnership developing a Comprehensive Koala Plan of Management (CKPoM) for the southern Eurobodalla
2. A scientific investigation into Woila Creek Basin as a translocation habitat has been undertaken and publicly reported upon
5. Pre-existing conditions for Deua National Park to function as a large-scale host landscape for viable low density koala home ranges and safe breeding connectivity corridors have been described, and any necessary interventions for the development of this focus specified, begun and publicly reported upon
3. Landscape-scale koala breeding connectivity corridors with the known Bega Valley, Monaro and Shoalhaven populations have been identified, and any necessary interventions specified, begun and publicly reported upon



*Photo: Potoroo Palace, Merimbula*

<http://www.potoroopalace.com/>

### EPA:

1. EPA has taken account of potential cross-tenure Eurobodalla koala habitat (including both the issues of rehabilitating cleared fertile land and potential koala adaptation to less than optimum habitat) when considering options for how current and future koala habitat mapping could be better integrated with the regulation of private native forestry, and has included these aspects in the resulting policy and procedural outcomes
2. EPA has engaged with the Eurobodalla Koala Recovery Strategy and any resulting CKPoM to assist monitoring and ensure consistency of Priority Actions with developments arising from the EPA stakeholder consultation and policy development initiatives in this area
3. EPA has considered joining the Comprehensive Koala Plan of Management (Southern Eurobodalla CKPoM) partnership with ESC (proposed by OEH) and where possible has begun to play a lead role in enhancing the extent of suitable habitat across the more fertile Eurobodalla regions that have been previously cleared

### Eurobodalla Shire Council:

1. ESC is participating with OEH, other interested agencies and community groups in a partnership developing a Comprehensive Koala Plan of Management (CKPoM) for the southern Eurobodalla
2. Potential cross-tenure low density koala home range areas and safe connectivity corridors, urban, peri-urban, semi-rural and rural, have been mapped for both rehabilitation and protection purposes, and the maps made publicly available
3. Planning policy has been described to ensure development requiring Council approval is compatible with the rehabilitation and preservation of these zones, implementation has begun and a time frame for full delivery specified
4. With help from other agencies, Council is hosting a position responsible for coordinating the Koala Recovery Strategy and advising stakeholders on implementation detail
5. A community education initiative has been constructed and implementation begun according to specified components and a time frame

### NSW Roads and Maritime Services:

1. Roads & Maritime Services can demonstrate that all new roads under its responsibility in the Eurobodalla are underpinned by a “design for a future that includes koalas” assumption
2. Protections and safe passage features are inbuilt at the initial design stage for all new and proposed new roads
3. All new roads and proposed new roads have alignments consistent with the retention and rehabilitation of habitat suited to low-density koala populations
4. Retrofitting the existing Princes Highway with protections and safe passages has begun, with specific projects and time frames publicly reported upon

### Private forestry:

A study sponsored by the local and state agency stakeholders has been designed and begun to measure the extent to which owners/managers of private native forests are:

1. Maintaining a viable mix of koala browse species on forested private land
2. Maintaining trees of sufficient size
3. Maintaining habitat connectivity between forested private land and adjacent forested areas
4. Rehabilitating degraded areas

### Farmers:

A study sponsored by Eurobodalla Shire Council has been designed and begun to measure the extent to which farmers are:

1. Selecting koala feed trees for wind-break and other farming purposes
2. Rehabilitating degraded river flat and low hill country by planting koala feed species
3. Maintaining native species connectivity across the farm, and between the farm and neighbouring areas
4. Minimising obstacles to safe koala ground movement
5. Keeping fresh water sources (eg creeks and springs) clean and viable
6. Minimising disturbance (eg controlling dogs and avoiding unnecessary clearing or burning)
7. Minimising the use of toxic substances

### Urban and peri-urban dwellers:

1. Evaluation of the community education initiative so far, measures how well urban and peri-urban dwellers have become familiar with the basic behaviours and habitat needs of low-density koala populations (eg residency in and across urban, peri-urban, semi-rural, rural and wilderness conditions; size of home ranges; makeup of breeding associations; breeding ages and movement; eucalypt browse species; the need for safe ground-level passage from one feed tree to the next; dog danger; traffic strike danger; fire danger)
2. Council has collected and made public data on residents' preservation and planting of browse species
3. Council has collected and made public data on domestic, bush block, hobby-farm, farm and hunting dog control
4. A community survey has been implemented to test the level of collaboration amongst neighbours and local government to enhance the mosaic of interconnected habitat, and the results publicly reported

## ***Supplement: Koala Plans of Management in other Local Government Areas***

As well as the national and state-level strategies [7 & 9, op cit] and the wider body of research, Koala Plans of Management (KPoMs) in other Local Government Areas (LGAs) have been used to assist this Eurobodalla Koala Recovery Strategy design, particularly:

- Ballarat [14; 15; 16]
- Coffs Harbour [17]
- Coomera-Pimpama (Gold Coast) [18]
- Lismore [19]
- Cobbadah, Manilla and Tamworth [20]
- Redland [21]
- Port Stephens [22]

### **Note**

***The Department of Primary Industries cautions that the detailed information below pertains to strategies specific to individual LGAs. DPI suggested that these be presented in summary form, in order to avoid the risk of management actions inappropriate for the Eurobodalla area being promoted without proper consideration.***

### **Ballarat**

The purpose of the Ballarat City Council Comprehensive Koala Plan of Management is to provide for the long-term survival of koala populations within the City through the implementation of actions aimed at safeguarding the koala within its natural range within the City.

The Plan features promotion of koala conservation to residents, vegetation mapping, monitoring programs, identification of and attention to threats, and a set of performance indicators and performance measures.

There is considerable attention to planning controls. A guide to best planning practice for koala conservation and recovery is appended. The guide addresses the questions of: how much habitat is enough; patch size; patch shape; habitat integrity; connectivity corridors; threat management; rezoning; and, development applications.

Examples of practical topics covered by the Plan's intensive community education campaign are the preparation of land management plans by property owners, and dog, traffic and fire management strategies.

The Ballarat arrangement involves an Australian Koala Foundation Officer, who manages and runs the project, working from a Council-provided office. Council provides the office space and the use of a computer and photocopying/printing resources as its contribution to the initiative, whilst the AKF pays all other costs.

The Plan has resulted in a City Council Vegetation Protection Overlay with controls applying to land that falls within the overlay.

#### Coffs Harbour

Under the heading Management of Koala Habitat, the Coffs Harbour Koala Plan of Management features: identification of primary, secondary and tertiary habitat; lands adjoining koala habitat; habitat links (including the mapped habitat interface between urban, rural, state forest and national parks tenures); relationship to other plans of management; notification of development in koala habitat; and, guidelines for planting trees in Coffs Harbour.

Under the heading Koala Road Risk, the Plan looks at black spots, management strategies and actions, and future roads in koala habitat.

There are also sections on: koalas and dogs; koala health and welfare problems; areas of compromised viability for koalas; koalas and fire; ongoing management actions and review; and, public education.

#### Coomera-Pimpama

The Coomera-Pimpama Koala Habitat Area (C-PKHA) Final Report deals with a KHA that covers approximately 3640ha with a koala population of about 500.

Pre-approved developments would result in the loss of 416ha of habitat and the displacement of up to 140 koalas. Longer-term development expectations would result in a further significant reduction in the extent of koala habitat and the ongoing displacement of many more koalas. Remaining areas of koala habitat within the C-PKHA are currently not large enough to accommodate the numbers of animals likely to be displaced by the development process, nor are they presently capable of supporting a viable koala population in the long-term.

Population Viability Analysis (PVA) indicates the population's theoretical ability to endure the extent of habitat loss and commensurate reduction in carrying capacity associated with currently approved development commitments, subject to the qualification that any incidental harvest (annual mortalities due to motor vehicles and dogs) remains below 3% of population size. However, this value will be exceeded as a consequence of increasing urbanization within the UKA. Indeed, PVA modelling using the EPA's incidental harvest rate data from elsewhere in developed areas of south-eastern Queensland confirms that the C-PKHA's koala population will invariably decline towards extinction independently of population size once the incidental harvest approximates 6%. In order to retain at least the Minimum Viable Population (MVP) of 170 koalas within the C-PKHA long term, a large and virtually unroaded habitat patch approximating 1500ha in size will need to be established within a relatively short period of time (10 – 15 years).

The document makes recommendations for staged actions, encompassing: securing identified habitat areas; translocating koalas (comprehensively discussed, with scientific backgrounding); developing restoration management plans; undertaking habitat restoration works; transferring certain development

rights; reviewing the efficacy of koala management guidelines; and, holding discussions with landholders.

There are additional sections on determining suitable offsets and recommended koala protection measures for future Development Applications, including: retention of preferred koala food trees; lot sizes; prohibitions on the keeping of domestic dogs; traffic speeds and buffer zones; fencing and underpasses; direction of street lighting; and, options for seeking developer contributions for compensatory habitat protection.

Best practice guidelines similar to those for Ballarat are appended, addressing in detail: habitat thresholds; patch size; patch shape; connectivity; restoration programs; and, maintaining ecological integrity of habitat (whether it already contains koalas or not).

### Lismore

The Lismore example suggests that given the right protections koalas can thrive (and recover their numbers) in and across a mosaic of existing mixed urban and rural land uses, without compromising the latter.

In its Historical Overview, the 2011 Report to Lismore City Council describes the results of an analysis of historical koala records for the Lismore LGA and the proposed planning area with a view to examining:

- any indications of broad changes/trends in the geographic distribution of koalas over time; and,
- determining the extent to which the historical record may be capable of assisting/informing decisions relating to koala conservation by way of identifying important source populations.

The key outcomes of this comprehensive analysis were:

- The historical record indicates that koalas have a long history of occupation in the Lismore LGA. The population was significantly reduced at some time in its past, but appears to have been on a recovery trajectory over the last three koala generations.
- There have been progressive increases in the Extent of Occurrence (*EoO*) over the time period 1949-2010, with that for the last 3 koala generations exceeding that of all generations before it. The current *EoO* for koalas in the Lismore LGA approximates an area of 146,000ha, or the entire LGA. There has also been a significant increase in the area being occupied by koalas, from approximately 25% of the LGA in the period 1949-1992, to 30% in the time period 1993-2010. Optimal occupancy rates for free ranging koala populations are estimated to be approximately 50% of available habitat.
- Generational Persistence Analysis (GPA) further evidences a much reduced population over the period up until 1992 with only three small source areas in the Lismore-Goonellabah, Wyrallah and Tucki-Tuckurimba areas. In contrast, the 1993-2010 GPA data alludes to both an expansion of these areas and the establishment of additional source populations in the area of the former Big Scrub to the northeast of Lismore.
- Disease, road-strike and dog attack feature prominently in the mortality data but do not appear to have significantly impeded the overall trends of positive population growth and gradual range expansion over the last 6 koala generations. This is not to say however that these issues can

simply be discounted, because they have potential to significantly influence longer-term population viability.

- The authors consider that the recovery and associated range expansion of koalas in the Lismore LGA is arguably attributable to fire – or the lack thereof – throughout the two areas where the majority of the population(s) now reside, the first in a highly fragmented floodplain landscape with scattered food trees and little risk of wildfire, the second in a largely horticultural setting where koala food trees such as Tallowwood *Eucalyptus microcorys* have been planted as windbreaks.
- The authors argue recovery and range expansion detailed in their report accommodates neither complacency nor apathy in its outcomes. There are also interesting genetic issues to consider (two significantly differentiated gene pools are present), along with the potential for rapid human population growth and urban expansion to turn this trend around within a single koala generation.

The Lismore genetic issues are of relevance to any potential natural Eurobodalla recovery or recovery by translocation. One group in the Lismore LGA's south is small and genetically weak, suggesting a small founding population in the past. The other group in the LGA's north is larger, genetically more diverse and appears to be radiating southward and now interbreeding with the smaller group.

The Lismore Report contains a section on food tree preferences and habitat mapping, one of the source references for the predictive habitat approach taken by the Eurobodalla Koalas project.

The importance of patch size, patch shape and level of connectivity are discussed.

The Report concludes with the following recommendations:

#### *Population size*

- Current knowledge does not include key information such as an estimate of population size and the juxtaposition between occupied and unoccupied habitat areas; tools are available to provide such data. This baseline information is required in order to be able to inform on the efficacy of management actions that may be initiated by the Council's Plan of Management (CKPoM), and to enable effective monitoring of the population over time; it is also necessary to gauge the potential impacts arising from incidental mortalities in terms of whether they are currently sustainable or not.

#### *Mitigation of threatening processes*

- There is a need to develop effective habitat protection measures that can be enacted under the auspices of the CKPoM, in order to address any potential for further fragmentation and/or loss of koala habitat within the planning area. Measures that facilitate the protection of high-quality koala habitat and/or individual preferred koala food trees should be considered as a matter of priority.
- Available knowledge points to a need for development of effective measures such as vehicle calming devices and/or exclusion fencing and underpasses (such as those installed along Skyline Road) in key areas to effectively minimise the potential for road-strike at blackspots identified herein, with particular emphasis on the Wyrallah Road.

### *Planning considerations*

- In the development of the CKPoM's planning provisions, there is a need to not only recognise and protect currently occupied areas to the maximum extent possible, but also areas of adjoining high quality (Primary/Secondary A) koala habitat.
- There will be a need for adoption of standard measures to ensure that all future developments in areas of koala habitat consistently result in implementation of 'best-practice' koala-friendly planning measures.
- There is a need to support strategic bushland regeneration for areas of koala habitat with a view to infilling existing gaps in canopy cover so as to reduce the extent of habitat fragmentation and invasion by weeds that inhibit natural regeneration.
- There is a need to develop "minimum data set" assessment standards to ensure that a high standard of habitat assessment by ecological consultants is maintained and that it is this level of assessment that informs development and future planning within the study area.
- There is a need to develop long-term monitoring programs to form part of the CKPoM in order to enable the tracking of the success or otherwise of working provisions that may be promulgated for the planning area; again, data on population size and the extent and distribution of currently occupied areas will be fundamental to future planning and monitoring of the population.
- The planning area is already extensively fragmented and future koala management will benefit from development of an informed network of linkages and corridors, none of which necessarily need to compromise existing land uses. Given knowledge that koala population viability within the planning area does not appear compromised at this point in time, some time can be afforded this process as a task to be completed within the first few years of the plan.

### Cobbadah/Manilla/Tamworth

A draft map of eucalypts and koala records was prepared in 2012 for the Cobbadah/Manilla/Tamworth region. This was part of a habitat trial in the context of Koala Recovery Plan Species for the NSW Western Slopes and Plains. Its usefulness for a low density, less than optimum habitat Eurobodalla scenario is in terms of its comparative mix of browse species (certain species clearly substitute for each other in different geographic regions), relative sizes and locations of land that is predominantly vegetated by trees compared with that which is not, and the intriguing Eurobodalla-like pattern of koala sighting locations (some in non-forested zones).

### Redland

Redland sits close to the city of Brisbane, linked by busy trunk routes to mature eastern suburbs (eg Wynnum-Manly area) and is in a rapidly developing urban zone (previously peri-urban), so its strategy concentrates on reducing koala hits from vehicles.

The Main Report prepared for Redland Shire Council canvasses koala behavior and interactions with roads, supported by an analysis of Queensland Parks and Wildlife Service koala-vehicle collision data and stakeholder consultations.

The Report then details and discusses road treatments and management strategies, including:

- overall design considerations;

- fauna exclusion or guide fencing;
- underpasses;
- overpasses;
- signage and ‘cats eye’ reflectors;
- lighting;
- verge treatment;
- median strip treatment;
- reflectors;
- road speed limits;
- traffic calming;
- cuttings and walled areas;
- road works;
- public awareness and community participation; and,
- monitoring.

The Report also includes road treatment case studies (eg for a wide range of highest casualty roads) and a section on cost-benefit issues.

A fully detailed Action Plan is provided, with a comprehensive list of recommendations organized by precise location within the LGA. The recommended actions can be summarized for comparison with Eurobodalla circumstances as follows:

*The Precautionary Principle*

- In order to address all causes of premature Koala death, in addition to the implementation of this Action Plan to Reduce Koala Hits from Vehicles in Redland Shire, habitat protection, contribution to Koala disease research, and the implementation of dog controls in and adjacent to Koala habitat are vital.
- Within Council’s immediate jurisdiction, habitat protection, safer opportunities for Koalas to cross roads and a reduction in deaths from dog attack would significantly reduce pressure on a Koala population under threat primarily from habitat loss and disease.
- As Koala behaviour cannot be modified and Koalas will continue to populate high-risk areas throughout the Shire, the management of vehicle strike as a threatening process is vital to reduce the existing and future impacts of roads on the Shire’s Koala population. To achieve an effective level of management will require the commitment not only of Redland Shire Council, but of the relevant State Government Authorities, particularly the Department of Main Roads in its role as the provider and manager of State-controlled arterial roads which represent the majority of high Koala-vehicle strike roads in the Shire.

*Problem Roads and Recommended Actions*

- The highest casualty roads are Redland Bay Road and Mount Cotton Road, with almost 200 Koala casualties recorded on each between 1994 and 2003. Finucane Road, Boundary Road and Cleveland–Redland Bay Road are also high casualty roads (between 100 and 150 reported casualties each since 1994). They are all high speed (80km/hr) roads, with Finucane Road

traversing key habitat areas associated with Hilliards Creek, Boundary Road with poor visibility conditions traversing key fragmented habitat areas; and Cleveland-Redland Bay Road separating core habitat associated with Hilliards Creek to the west and the high quality food tree corridors along the foreshore to the east. None of these roads incorporate safe crossing opportunities for Koalas.

- While it is possible to narrow problems areas to sections of roads within suburbs for the sake of comparison, it is difficult to narrow down “hot spot” areas. Spatial representation of the data shows that the term “hot roads” more aptly describes the problem locations.
- So that road treatments are not planned and managed in isolation, without due consideration of the influences of surrounding land uses and land use practices on Koala presence and movement, Koala habitat types have been mapped and broad recommendations for land use planners and environmental managers have been made in Section 7.0 of the Action Plan for Koala habitat management in relation to roads.

#### *Recommendations for Progressing and Improving Outcomes*

The Action Plan includes recommendations for Redland Shire Council to continue consultation with Main Roads regarding:

- the establishment, maintenance and monitoring of existing bridge structures at certain locations;
- design, installation and monitoring of a Koala overpass structure trial;
- potential for Redland Shire Council to contribute to infrastructure monitoring programs; and,
- requirements for Koala movement infrastructure for future road upgrades in Redland Shire.

It has also been recommended that Redland Shire Council consider commissioning the following work:

- formulation of a standardised monitoring program for Koala movement infrastructure in Redland Shire; and,
- determination of the existing and future economic value of the Koala to the economy of Redland Shire.

The following information should be reviewed and where relevant incorporated into any future revisions of the Action Plan:

- the finalised Redland Shire Strategic Plan (currently in draft form); and,
- fauna habitat mapping being prepared as part of the new State Government planning legislation.

*The pending Conservation Plan for Koalas in Queensland is currently being prepared by the Queensland Parks and Wildlife Service (QPWS).*

- the inclusion of QPWS Koala data collection, analysis and reporting as results become available; and,
- results of the current Consolidated Rutile Limited research program of North Stradbroke Island Koalas, their distribution and resource partitioning. Upon completion of this study the findings should be used to map Koala habitat for the North Stradbroke Island precinct as has been undertaken for the mainland precincts.

It should also be noted that the mapping of Koala habitat ‘types’ for the Action Plan was conducted primarily via desktop methodologies, although with good local knowledge. The mapping should be refined and progressively updated to correct any erroneous allocations and to reflect conditions as they change over time.

### Port Stephens

Port Stephens is a known NSW koala habitat area, characterized by urban coastal development and natural bushland features, worth comparing with the Eurobodalla. The 2002 Port Stephens Council Comprehensive Koala Plan of Management (CKPoM), produced in conjunction with the Australian Koala Foundation, includes:

- Koala Habitat Identification
- Ecological History
- Habitat Conservation Measures
- Development Assessment
- SWOT Analyses
- Habitat Restoration
- Traffic Management
- Dog Management
- Feral Animal Management
- Bushfires
- Koala Welfare
- Education
- Tourism
- Funding
- Research
- Monitoring
- Implementation
- Action Plan

The Plan's objectives are to:

- *Evaluate and rank koala habitat throughout the Port Stephens LGA;*
- *Identify priority conservation areas and strategies to protect significant koala habitat and populations;*
- *Identify threats that impact on koalas and koala habitat;*
- *Provide for the long-term survival of koala populations by devising conservation strategies to effectively address each of the threats impacting on koalas and koala habitat;*
- *Provide for the restoration of degraded koala habitat areas;*
- *Ensure that adequate detail is provided with Development Applications in order to assess, minimize and ameliorate likely impacts on koala habitat;*
- *Provide guidelines and development standards to protect koalas and koala habitat;*
- *Provide for effective public awareness and education programs concerning koala conservation issues;*
- *Encourage appropriate eco-tourism programs;*
- *Provide a formal approach for the assessment, retrieval, rehabilitation and release of sick, injured, orphaned or distressed koalas;*
- *Identify potential funding sources for implementation of the CKPoM;*
- *Facilitate targeted koala conservation and management-oriented research projects within the Port Stephens LGA; and*
- *Provide for the effective implementation and monitoring of the CKPoM.*

The document states "These objectives will be achieved through co-operation with the community as a whole".

The Port Stephens Council Plan's attention to performance Indicators is instructive:

*"It is necessary to establish performance indicators against which the success of each of the recommended actions in the CKPoM can be assessed and, if necessary, refined.*

*The performance indicators consist of a number of specific conservation goals. These conservation goals are:*

- *Loss of koala habitat within areas identified as Preferred and Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas is:*

- i) minimised and restricted to that permissible in accordance with the performance criteria for development applications (see the Development Assessment chapter of the CKPoM Resource Document and the performance criteria for development applications in Appendices 4 and 5 of this CKPoM); and*
- ii) reduced in each successive year over the next five years (initially).*

- *Annual koala population assessments undertaken at designated monitoring sites indicate that the majority of the surveyed koala populations, including urban populations, are stable or increasing (determined on the basis of activity levels, evidence of successful breeding, signs of disease, mortality and survivorship, and population estimates) within 5 years from the adoption of the Port Stephens Council CKPoM.*

- *Annual statistics indicate a decrease in koala mortality due to collisions with motor vehicles, in conjunction with stable or increasing koala population estimates in the vicinity of identified black spot areas.*

- *Annual statistics indicate a decrease in koala mortality due to dog attacks, in conjunction with stable or increasing koala population estimates in the vicinity of identified high risk dog-attack areas.*

- *A minimum of 20 hectares of koala habitat per year is replanted (and successfully maintained in subsequent years) throughout the LGA in areas identified as a high priority for restoration according to the criteria outlined in the Habitat Restoration chapter.*

*In addition to the conservation outcomes listed above, the Port Stephens Council CKPoM should be assessed in terms of implementation of each of the proposed actions. For instance, the success of the habitat conservation strategy should be assessed initially by determining whether each of the proposed habitat conservation measures have been implemented on schedule."*



*Photo courtesy Billie McLeod*

## References

- [1] Joliffe, E.K., Bourne, J.A., Beissner, Kahli, & Bulman, D.E., *HABITAT ASSESSMENT AND KOALA REVIVAL PROSPECTS IN THE EUROBODALLA, NSW - A PILOT STUDY*, January 2013, Eurobodalla Koalas project, The Coastwatchers Association Inc., P.O. Box 521, Batemans Bay NSW 2536; Link: <http://www.coastwatchers.org.au/eurobodalla-koalas-project/pilot-study-report/>
- [2] J.P. Townsend's *Rambles and Observations*, 1849, [http://www.ozhistorymine.com/html/townsend\\_1849.html](http://www.ozhistorymine.com/html/townsend_1849.html)
- [3] Warry, Noel, *Sixteen Women of Early Eurobodalla*, Moruya & District Historical Society Incorporated, Campbell Street, Moruya, NSW 2537, 1990 (reprinted 2004).
- [4] ngh heritage/DECCW, *Bendethera - Deua National Park, Conservation Management Plan*, 2010, [www.ngh-hefitage.com.au](http://www.ngh-hefitage.com.au)
- [5] The volunteer Eurobodalla Koalas Project has collected and recorded local knowledge about koala history. Reports cited here pertain to: Dignams Creek, post-World War II (Cath Lawler); Nerrigundah, 1950s (Maureen Burdett); Pedros Swamp, 1950s (Bob Burdon); Mogendoura, 1968 (Robert Dubbelaar); and, Cadgee, 1980s (Margot Bruinsma).
- [6] NSW Government, Department of Environment, Climate Change and Water, *Wildlife Atlas*, <http://www.bionet.nsw.gov.au/>
- [7] Commonwealth Department of the Environment, Water, Heritage and the Arts, *National Koala Conservation and Management Strategy 2009 – 2014*, Canberra, December 2009; Link: <http://www.environment.gov.au/biodiversity/publications/koala-strategy/pubs/koalastrategy.pdf>
- [8] Adams-Hosking, Christine, Grantham, Hedley S., Rhodes, Jonathan R., McAlpine, Clive and Moss, Patrick T., *Modelling climate-change-induced shifts in the distribution of the koala*, Wildlife Research, Vol. 38, No. 2, Pages 122 - 130, April 2011.
- [9] DECCW NSW, *Approved Recovery plan for the koala (Phascolarctos cinereus)*, November 2008; Link: <http://www.environment.nsw.gov.au/resources/threatenedspecies/08450krp.pdf>
- [10] Joliffe, E.K., Bulman, D.E., Chockman, Lauren, and Malam, Chris, *Eurobodalla Koalas project - Bendethera May 2013 Surveys and Analysis Report*, The Coastwatchers Association Inc, PO Box 521 Batemans Bay NSW 2536, [www.coastwatchers.org.au](http://www.coastwatchers.org.au)

[11] Kavanagh, Rodney P., Stanton, Matthew A. and Brassil, Traeacey E., *Koalas continue to occupy their previous home-ranges after selective logging in Callitris–Eucalyptus forest*, Wildlife Research, Vol. 34, No. 2, Pages 94 - 107, April 2007.

[12] Baird, Ian, *A policy-based approach to defining data requirements for the planning and management of Deua National Park, New South Wales (and supporting references)*, Australian National University, Masters Thesis, 1985, University of Canberra Library, Dewey Number SB 484. A8. B34 1985.

[13] Phillips, S. and Allen, C., *Koala Conservation in the South East Forests: assessment of the need for and feasibility of a population augmentation program*, January 2012 (unpublished).

[14] Schlagloth, Rolf, Thomson, Hedley and Mitchell, Dave, *Ballarat City Council Comprehensive Koala Plan of Management – A Joint Initiative of the City of Ballarat and the Australian Koala Foundation - Part 1: The Plan*, August 2006.

[15] Schlagloth, Rolf, Thomson, Hedley and Mitchell, Dave, *Ballarat City Council Comprehensive Koala Plan of Management – A Joint Initiative of the City of Ballarat and the Australian Koala Foundation - Part 2: Resource Document*, August 2006.

[16] *Ballarat City Koala Protection Overlay 2009*; Link: <http://www.ballarat.vic.gov.au/pbs/city-strategy/planning-scheme-amendments/recently-completed-amendments/amendment-c95.aspx>

[17] Lunney, Daniel, Moon, Chris, Matthews, Alison and Turbill, John, *Coffs Harbour Koala Plan of Management – A Joint National Parks and Wildlife Service and Coffs Harbour City Council Initiative - Part A: The Plan*, November 1999; Link: [http://www.coffsharbour.nsw.gov.au/our-environment/Documents/KPOM\\_a.pdf](http://www.coffsharbour.nsw.gov.au/our-environment/Documents/KPOM_a.pdf)

[18] Biolink Ecological Consultants, *Conserving koalas in the Coomera-Pimpama Koala Habitat Area: a view to the future - Final report prepared for Gold Coast City Council*, March 2007; Link: [http://www.goldcoast.qld.gov.au/attachment/koala\\_conservation\\_strategy.pdf](http://www.goldcoast.qld.gov.au/attachment/koala_conservation_strategy.pdf)

[19] Biolink Ecological Consultants, *Aspects of the ecology, distribution and abundance of koalas in the Lismore LGA – Report to Lismore City Council*, October 2011.

[20] Bradley, J., *Koala Habitat Trial - Cobbadah, Manilla & Tamworth map sheets (VIS ID 3796 data) SQLTestVIS\_ID3796\_KoalaHabitatTrial\_Map9.mxd*, 19/03/2012, **DRAFT - NOT FOR PUBLICATION.**

[21] Caneris, A. H. and Jones, P.M. (checked by Dr. G. J. Ingram), *Main Report – Action Plan to Reduce Koala Hits from Vehicles in Redland Shire - Prepared for Redland Shire Council*, Biodiversity Assessment and Management Pty Ltd, Birkdale 4159, September 2004.

[22] Port Stephens Council (2002), *Port Stephens Council Comprehensive Koala Plan of*

*Management (CKPoM) – June 2002, Prepared by Port Stephens Council with the Australian Koala Foundation; Links:*

*Plan of Management*

[http://www.portstephens.nsw.gov.au/index.php?option=com\\_content&view=article&id=1132921:comprehensive-koala-plan-of-management-c&catid=2822:flora-fauna-portstephens&Itemid=4033](http://www.portstephens.nsw.gov.au/index.php?option=com_content&view=article&id=1132921:comprehensive-koala-plan-of-management-c&catid=2822:flora-fauna-portstephens&Itemid=4033)

*and*

<http://www.portstephens.nsw.gov.au/images/documents/portstephens/mig/1790-CKPoM.pdf>

*Accompanying Habitat Planning and Management Unit Maps:*

<http://www.portstephens.nsw.gov.au/images/documents/portstephens/mig/63367-KoalaHabitatPMlga.pdf>

*and*

<http://www.portstephens.nsw.gov.au/images/documents/portstephens/mig/63368-KoalaHabitatPMmedowietilligerry.pdf>

*and*

<http://www.portstephens.nsw.gov.au/images/documents/portstephens/mig/63369-KoalaHabitatPMmgtunits.pdf>



*Photo: Birdland Animal Park, Batemans Bay*

<http://birdlandanimalpark.com.au/>