Saving our national icon: An ecological analysis of the 2011 Australian Senate inquiry into status of the koala

Nicole Shumway [a,b,*], Daniel Lunney [c,d], Leonie Seabrook [a], Clive McAlpine [a,e]

[a] The University of Queensland, Landscape Ecology and Conservation Group, School of Geography, Planning, and Environmental Management, Queensland 4072, Australia
[b] Centre for Biodiversity and Conservation Science, School of Biological Sciences, The University of Queensland, Queensland 4072, Australia
[c] Office of Environment and Heritage, NSW 2220, Australia
[d] School of Biological Sciences, University of Sydney, NSW 2006, Australia
[e] National Environmental Science Programme (NESP) Threatened Species Recovery Hub, Queensland 4072, Australia

A R T I C L E   I N F O

1. Saving our national icon

If comprehensive policy and legislation are all that stands between a species and its extinction, then the foundations of that policy and legislation must be robust. National policies and legislation have a flow-on effect on regional and local conservation policy, which taken together, should have a positive impact on the conservation of the species at risk. This problem is particularly relevant to Australia, which has three levels of government: Commonwealth, state and local. All levels of government have environmental legislation focused on biodiversity conservation. The Commonwealth *Environmental Protection and Biodiversity Conservation 1999* (EPBC) Act is the overriding national policy, although its application is limited to 'matters of national significance', which reduces its effectiveness in protecting species that do not fall within the aegis of the Act. There are a number of reasons why conservation policy in Australia may be ineffective including conflicting interests between levels of government, changes in political ideologies, and inadequate funding (Waldron et al., 2013) or ineffective allocation of the available funding (Bottrill et al., 2011; Carwardine et al., 2012; Watson et al., 2009). The division and overlap of responsibility may cause conflict or confusion within all levels of government, leading to gaps in policy implementation (Treby et al., 2014). In addition, current policy changes, such as 'green-tape' reduction schemes continue at the state level and recent attempts to amend the EPBC Act to allow for a

'one-stop shop' for environmental approvals (Department of the Environment, 2014b) may result in regulatory savings for businesses at the cost of weakening the protections in place for endangered species conservation (McGrath, 2014; Ritchie, 2013; Ritchie et al., 2013). An amendment, before the Senate at the time of writing, would allow states the power to assess and approve matters that are nationally protected, undermining one of the key components of the EPBC Act, Commonwealth oversight of State government decisions (McGrath, 2014). Policy is only as effective as the funding and implementation it provides, and without the political will in place to make difficult decisions, the resulting ineffective planning and implementation will fail to conserve native species.

The EPBC Act has seen the listing of approximately 465 species of fauna, of which approximately a dozen have since been delisted (Department of the Environment, 2015a). From 2007 to 2011, five times more vertebrate species were listed than de-listed (McDonald et al., 2015). However, some species may not fall clearly within the EPBC guidelines for legislative protection (Shumway and Seabrook, 2015); for example if declines are only occurring in part of the range, or because of inadequate data availability on population trends (e.g. Endeavour Dogfish, *Centrophorus moluccensis*; Spotted Wobegong, *Orectolobus maculatus*; Hooded Plover, *Thinornis rubricollis tregellasi*) (Department of the Environment, 2015a). Another such example is the koala, *Phascolarctos cinereus*, which is a marsupial folivore endemic to eastern and southern Australia (Fig. 1). In the north and eastern part of the koala's range, a number of populations have declined significantly over recent decades or become locally extinct due to habitat loss, declining habitat quality, diseases and increased vulnerability to mortality

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* Corresponding author.
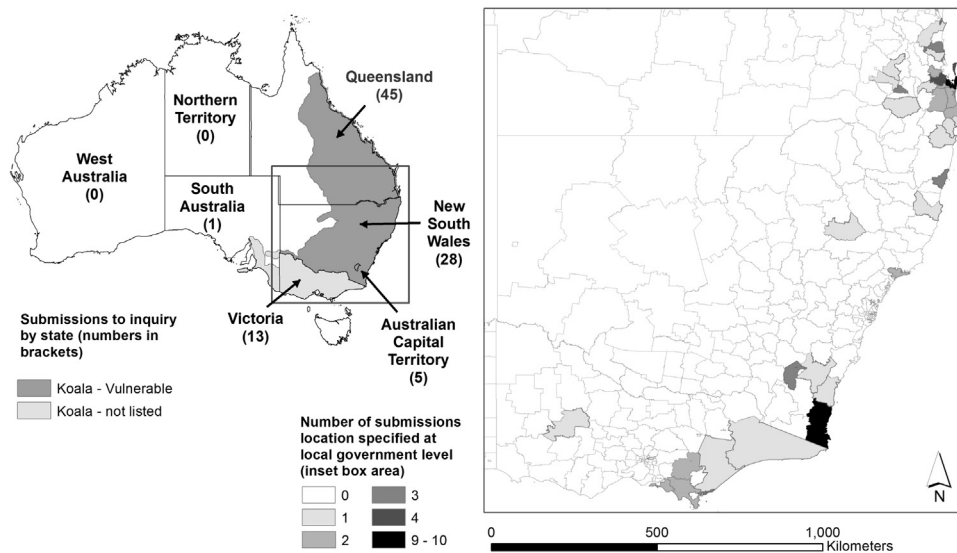E-mail address: shumwayn@gmail.com (N. Shumway).

Fig. 1. Map of koala distribution and area of submissions. Koala distribution (north and south populations) with current listing status, and the location of the submissions to the Senate 2011 inquiry into the koala by State (number of submission in brackets). Subset of number of submissions specified to Local Government Area (LGA).

from vehicle strikes and dog attacks (Department of the Environment, 2015b; Lunney et al., 2002; Seabrook et al., 2011). However, in the southern part of the range in Victoria and South Australia, overpopulation is the foremost management problem, with action being taken to reduce koala numbers by culling, sterilization, and relocation (Lunney et al., 2007; Masters et al., 2004; Menkhorst, 2008). An additional problem for widely distributed native fauna species, such as the koala, is that they are not limited to protected areas, which provide more specific conservation targets, but are found across urban, peri-urban and rural areas where threats are often diffuse and incremental, and hence difficult to manage. The variability of koala population trends meant that prior to 2012, the species was not listed as threatened under federal legislation, although in certain local areas, such as the South East Queensland bioregion, the population had been listed as vulnerable since 2004 (Department of the Environment, 2015b).

In 2011, a Senator lobbied for a Senate inquiry to assess the appropriate conservation status of the koala, and this ultimately led to the listing of the koala as vulnerable in the northern and eastern parts of its range. The outcome was a high point in the public awareness of koala conservation. The recommendations of the Senate Committee were based on evidence gathered during a consultation period and are likely to underpin the Australian government's forthcoming koala conservation and management strategy. While it may seem to be self-evident that the recommendations of a Senate inquiry on koalas should provide such a foundation, we contend that the Senate Committee's recommendations may not form a suitable basis due to the nature of the inquiry process, and hence a critical analysis is required to determine if gaps or flaws exist. The need to do so is particularly urgent now that a national koala recovery plan is being drafted to replace the expired *National Koala Conservation and Management Strategy 2009–14* (Commonwealth of Australia, 2009).

We examine how the Committee gathered its information, and assess its conclusions. The submissions and other inputs with respect to location and entity of origin, and content to the inquiry were analyzed. The Committee's recommendations were reviewed through the eyes of wildlife ecologists, and considered not just the management issues, but also the planning and policy context for action, including the legalities, practicalities and politics.

1.1. Background to the inquiry

On 17 November 2010 the Australian Senate referred 'the matter of the status, health and sustainability of Australia's koala population' to the Senate Environment and Communications References Committee (the Committee). The terms of reference (p1) mandated that the Committee have regard to such things as the status of the koala; estimates of population sizes; threats to koalas and their habitat; and a range of policy and management issues (Senate, 2011).

The Committee advertised the inquiry on its website and *The Australian* newspaper, wrote to relevant organizations inviting submissions, and held public hearings in Brisbane, Canberra and Melbourne. It received 101 submissions, two petitioning documents, and a large amount of evidence in the form of answers to questions on notice and additional information.

The Committee commented in their report entitled *The koala— saving our national icon* (Senate, 2011) that, 'it is likely that this is the last opportunity to properly conserve Australia's koala population before its threatened species listing becomes a *fait accompli*' (p137). This warning was heeded just one year later, when the koala was listed as vulnerable by the Commonwealth under the EPBC Act 1999 in the Australian Capital Territory (ACT), New South Wales (NSW) and Queensland (QLD). The koala was not listed in Victoria or South Australia where it also occurs (Department of the Environment, 2015b). The Senate inquiry thus captured a crisis point in koala conservation. A vulnerable listing means that a species is heading towards extinction, unless action is taken to avert that catastrophe; however, what comprises the most effective action is a primary concern that initiated this analysis.

2. The submissions to the inquiry

To assess the extent and focus of public concern over koala conservation, the public submissions ($n = 101$) to the Senate Committee were reviewed in their entirety, along with any accompanying information. Each submission was read and reviewed by one author (NS), and organized by various factors including the name, type and location of the author, location of concern, type of submission (group or individual), any concerns mentioned in the document and suggestions to address them

Table 1
Submission concerns. Entity making a submission to the Senate koala inquiry, by subject of submission, total for each category and total number within each entity.

	Habitat Clearing	Policy	Development	Logging	Road Kills	Predation	Disease	Fragmentation	Forest Management	Total submissions
Private citizens	27	23	20	14	13	11	13	11	6	
Researchers/scientists	7	8	7	3	5	5	6	2	2	
Conservation organizations	24	20	20	8	15	14	13	14	10	
Group/industry Representative	1	5	3	0	0	0	1	1	1	
Wildlife carer	5	3	4	2	6	6	3	2	2	
Government body	8	10	2	2	8	8	6	7	3	
Total:	**72**	**69**	**56**	**29**	**47**	**44**	**42**	**37**	**24**	**101**

(Table 1). The information was further broken down by key word, and categorized according to the broad themes of concern for each submission. Recommendations in each submission were organized by author type, or entity (researcher/research group, conservation organization, government body, private citizen), and then categorized by the recommendations most suggested by each author type.

2.1. Submission concerns

Of all the concerns mentioned by the submissions, three stood out: habitat clearing ($n = 72$), ineffective policy ($n = 69$) and urban development ($n = 54$). Habitat clearing was seen as the greatest cause of koala population declines, whereas habitat fragmentation (the subdivision of habitat) was of less concern ($n = 37$), particularly for private citizens. Ecologically, these factors are closely linked and if combined, then their value would become dominant ($n = 109$). In addition, if logging ($n = 29$) and forest management ($n = 24$) were combined, the issue of forests becomes more prominent ($n = 53$). Habitat clearing was mentioned in 72 submissions, while logging was mentioned in 29; however 23 of the 29 logging submissions discussed both clearing and logging. There is a case for merging these two categories, but since habitat clearing and logging are managed under different acts of State parliaments, and by the Parliament of Australia in relation to Regional Forest Agreements (RFAs), they are separated here. Logging was mostly mentioned by private citizens and focused on specific areas (e.g. Mumbulla/Bermagui State Forests ($n = 4$) in south-east NSW, Coffs Harbour ($n = 3$), mid north coast of NSW and Strezelecki forest ($n = 2$) in Victoria). The impacts of roads and vehicles, characterized as roadkill ($n = 47$), predation by wild and domestic dogs ($n = 44$) and diseases, such as chlamydia and koala retrovirus ($n = 42$), were also well represented in the submissions. If a submission focused on the *EPBC Act*, the *National Koala Conservation and Management Strategy 2009–14*, or any other government policy addressing koala conservation, 'policy' was listed as a theme in the submission breakdown. Most submissions to the inquiry were made by private citizens ($n = 42$) and conservation organizations ($n = 26$), while few government bodies were represented. Though scientists and/or researchers represented few submissions ($n = 8$), they did constitute the consensus of over 100 koala experts.

Of the 101 submissions, 45 were from Queensland, 28 from New South Wales, 13 from Victoria, 5 from the Australian Capital Territory, 1 from South Australia and 1 from the United States (Fig. 1). The location was withheld on 8 submissions. The hearings were conducted in Brisbane, Canberra and Melbourne, with none occurring in NSW, and the submissions to the inquiry were clustered near these three centres. These clusters are reflected in the concerns for decline, and are focused on local issues. Compounding the State biases was the concentration of the submissions along the coast, particularly in NSW and QLD. This spread represents neither the distribution of koala populations nor the distribution of threats.

An immediate State bias is evident, with the problem of vulnerability and land clearing gaining more prominence than the issue of koala overpopulation in Victoria and South Australia (Lunney et al., 2007; Masters et al., 2004; Menkhorst, 2008; Wilks, 2008). Shumway et al. (2014) noted local differences in interest in conserving local koala populations, and consequently clusters of local interests dominated the inquiry. Local interested parties do a great deal to conserve their koala populations, and generate local interest and action, however to gain a national picture of conservation concerns, it is essential to gather information from the full range of the koala. There were several submissions from local governments, however the NSW State Government department with the responsibility for koalas, did not make a submission beyond sending the 2008 NSW Koala Recovery Plan (DECC, 2008).

2.2. Comparison between submissions and Senate Committee recommendations

The actions most recommended by scientists (75%) and nongovernment conservation organizations (50%) to improve koala conservation outcomes were for more adequate governance and implementation of policy. Every scientific researcher discussed policy – whether local, regional or national. Better habitat protection also ranked highly and 37.5% of the scientists' submissions recommended better inter-agency and organizational cooperation (Fig. 2). Representatives of government bodies recommended habitat protection (42%), while most citizens did not recommend any specific action (26%), or suggested generally increased protection.

The Committee made 19 recommendations in their report (Senate, 2011). Four recommendations focused on habitat identification and protections (6–9), while a national monitoring, evaluation and population estimation program for koalas (2,4) and all threatened species (3) were the basis of three recommendations. Roads were the focus of three recommendations (13–15); research garnered two recommendations: one into genetic diversity, especially for the southern populations, and to determine priority conservation areas (1), and the other into disease and leaf chemistry (10). Dog control (12), and a liaison officer for a koala research network (11) each had one recommendation. Two recommendations focused on advice to the Environment Minister: that the Senate review be taken into consideration for the species listing (16), and to consider options to improve the koala's status where it is rapidly declining (17). The two final recommendations focused on policy, mainly that the national Strategy be reviewed and properly implemented (18–19).

The highest percentage of Committee recommendations (21%) were focused on habitat identification and protection, while only 11% were focused on a review of koala conservation policy. The Senate Committee's report reflects some strongly held local views, biased by location, and then influenced by what the Committee saw as the
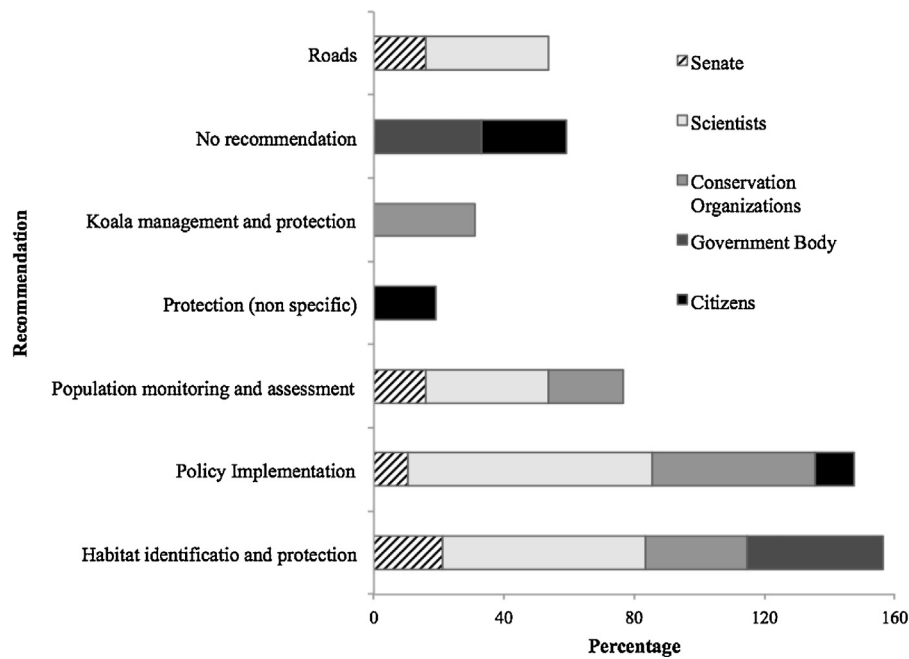
Fig. 2. Submission and Senate Committee recommendations. Recommendation subject by author type from submissions and Senate Committee report, percentages additive and based on the most recommended actions. Only the three highest percentages are represented.

Commonwealth's role in koala conservation. This is not a sound way to come to grips with the full extent of the plight of the koala.

3. Conserving koalas: ecological critique of the inquiry

The major issues driving declines in koala populations, according to the submissions from over 100 koala ecologists (represented in the 8 submissions from scientists and researchers), include habitat loss and fragmentation, accurate population assessments and monitoring, climate change and its effect on koalas directly and on habitat quality, disease, urban/industrial development, and increased mortality from vehicle strikes and dog attacks. The problem of overcrowding faced in the southern states, Victoria and South Australia, stems from the reintroduction of koalas into habitat areas that were previously vacant due to declines, isolated or outside of their historic range, and hence subject to overpopulation pressures such as severe over-browsing (Masters et al., 2004; Menkhorst, 2008).

In the following section, we critique from an ecological viewpoint the most significant recommendations or groups of recommendations put forward by the Senate Inquiry. These include knowledge about population numbers and trends, habitat identification and policy – all seemingly sound recommendations.

3.1. Population monitoring and assessment

The Committee report makes clear that the decline of Australia's koala population was widely recognized, but that an overall national picture was complex as some populations were in sharp decline while others are actively managed for overabundance (Senate, 2011). This highlights the problem of how to effectively manage a species threatened in part of its range and stable or increasing in the remaining areas. This problem is exacerbated by a lack of consistent national population monitoring and assessment methods of estimating koala population numbers and trends. It is apparent that the Committee's report had a direct bearing on the listing of the koala as vulnerable under the EPBC Act. Ecologically important is the statement from the Threatened

Species Scientific Committee (TSSC) in 2010 that the koala was ineligible for listing at the national level as it only met or approached one of the five criteria relevant for conservation listing (loss of 30% of total population size over 3 generations – 20 years for koalas), although noting the extreme patchiness and general lack of consistent, complete demographic data (TSSC, 2010). However, on review of the listing advice as recommended by the Senate inquiry (#16,17), the TSSC recognized the 'stark conservation challenges' facing the koala and stated that if the combined populations of QLD, NSW and ACT were considered a 'designatable unit' for the purpose of the EPBC Act then their rate of decline readily met the eligibility threshold for listing (TSSC, 2011). Although the koala is only recognized as one species, the TSSC adapted the EPBC Act to match the reality of the problem, despite the circumscription of a 'part-range' designation having few precedents, limited to populations that were notably more distinct and disjunct than that of the northern population of the koala.

Scientists and researchers found the lack of data on population numbers and trends to be one of the most important aspects of koala conservation. The Committee made two recommendations focused on population monitoring and assessment: a properly designed, funded and implemented national monitoring and evaluation program (#2), and a standardized method for koala population estimates (#4). However, recommendation 2 is ambiguous as governance, funding, policy implementation or health status also could be monitored. The most difficult task (but the one to aim for) would be to monitor long-term population changes and their causes, and to monitor and evaluate the efficacy of remedial action. This level of clarity is required to ensure that conservation actions do not bypass the intent of the recommendations in exchange for actions that are more easily implemented or more politically pragmatic. Effective ecological monitoring requires not only the application of sound science, but a government's willingness and capacity to examine programs and then re-adjust policy to take account of the findings from the monitoring.

The central point is that a long-term ecological view of population trends is necessary, and that the population issue is one of both rising and falling numbers, and that the rises and falls

are more localized for koalas than previously recognized. The Committee recommendations did not address the overabundance issues of populations in Victoria, although this can result in a major ecological and ethical problem of what to do with too many koalas (Lunney et al., 2007; Menkhorst, 2008). We are thus left with a report that is biased in favour of one element of population change – decline – but not the converse. This emphasises the need for local management plans that fit within a State and national framework. Given its ecological and ethical importance, more emphasis was needed on this subject in the Committee's report.

3.2. Habitat mapping and identification

The Senate Committee report dedicated four recommendations to habitat identification and protection ([#]6–9), more than any other subject. It also featured prominently in submission recommendations from scientists as the second most recommended action, non-government conservation organizations as the third most recommended action and for Government bodies as the only recommendation put forth (Fig. 2). The committee recommendations are seemingly ecological: that the Commonwealth 'undertake habitat mapping across the koala's national range, including the identification of priority areas of koala conservation, with a view to listing important habitat under the provisions of the *Environment Protection Biodiversity Conservation Act 1999*([#]6), and that the habitat mapping be used to 'identify and protect important habitat' ([#]7). However, the question then becomes what is important habitat, what are priority areas, and what can the EPBC Act really do to protect such areas, since currently there is no legally designated critical habitat and the Act only applies on Commonwealth land.

The EPBC Act has quite a high threshold before an area of habitat is recognized as 'important,' and is focused on impacts on 'habitat critical to the survival of the species' or impacts that 'substantially interfere with the recovery of the species' (EPBC Act). At the end of 2014 the Commonwealth minister for the Environment released a press statement, 'Creating certainty for koala populations' (Minister for the Environment, 2014), which was accompanied by guidelines (Department of the Environment, 2014a) to support the conservation of threatened koala populations by promising to identify habitat critical to their survival (Department of Environment, 2013). Crucially, the guidelines state that they will help to ensure that developments in the range of the koala avoid significant impacts on it and its habitat. The words 'critical habitat' and 'significant impact' are key: if the habitat is not critical, or the impact not deemed significant, then the Commonwealth cannot intervene. The guidelines also state that urban areas are unlikely to contain habitat critical for koala population recovery, as the 'existing effects of habitat loss, fragmentation, vehicle strike, dog attack and other threats are likely to continue to degrade these areas' and that these existing threats are best addressed by local action, rather than EPBC Act regulation (Department of Environment, 2013). Given this outlook, the Committee's recommendations are likely to be implemented in a narrow search for large, well-connected critical habitat likely to remain viable in the medium to long-term, and may boil down to only a few high profile locations in NSW and QLD where koala populations are currently the highest. In addition, the significance of habitat restoration was not reflected in the recommendations of the senate committee. It will require a sophisticated approach to recognize the 'ghost habitats' of koalas for restoration purposes (i.e. the rich, fertile valleys on the coast, or the riverine habitats in the western edge of the range, where koalas used to be before the habitats were taken over as farmland, towns and roads), and there needs to be more emphasis on ecological history than has been seen hitherto if we are to define critical habitat (e.g. Knott et al., 1998; Lunney et al., 2010). Neither the guidelines

nor the recovery plan will apply to Victoria or South Australia, making the new policy more limited in its scope than the *National Koala Conservation and Management Strategy 2009–14* (Commonwealth of Australia, 2009). Even with guidelines, the question of what is 'important habitat' is difficult to determine ecologically and has yet to be proven as an effective tool. While habitat mapping is valuable, a map is no guarantee that action will be undertaken to conserve koala habitat, and if the habitat is protected, that the koala population will not be fading away due to a range of other threats. Mapping koala habitat is a tool to assist planners and researchers and part of an overall measure needed to conserve and manage koalas and recover their populations, but it alone will not conserve koala populations.

3.3. Policy: The National Koala Conservation and Management Strategy 2009–14 and The EPBC Act's critical limitation

More adequate implementation of koala conservation policy was the most recommended action to improve the status of the koala by both scientists and non-government conservation organizations (Fig. 2). The final two senate committee recommendations focused on this: that the Commonwealth externally review the national koala strategy ([#]18) and adequately resource and implement the Strategy ([#]19). The lack of a coordinated, resourced federal management plan was identified by a number of submissions. A recently completed independent review of the *National Koala Conservation and Management Strategy 2009–2014* found that the strategy had limited effectiveness and did not translate into actual on-ground outcomes, such as the prevention of localized extinctions. It advised that recovery planning should proceed and incorporate among other things 'best practice' guidelines, greater government accountability at all levels and adequate funding (McAlpine et al., 2014). This makes it clear that any next generation strategy will need to be effectively implemented, not just drafted and approved, with implementation supported by adequate funding for research, monitoring, evaluation and reporting carried out within an adaptive framework. In view of the differential listing status of koala populations, it is important that a renewed national Strategy still exists in order to have an overview of the issues facing koala management throughout their entire range, and should apply to the overcrowded populations in Victoria and South Australia as much as to the shrinking populations in NSW and Queensland.

While the EPBC listing is a welcome addition for increased protection of koalas, it does have limitations. One such limitation pertains to the injury, death and displacement of koalas by the forestry sector, and the fact that koala management and welfare in RFA areas (including within plantations) is a matter for state governments. In fact, the EPBC Act does not apply once an RFA is in place. This means that in forested areas such as south-east NSW where the RFA applies, and where there is ongoing public debate about woodchipping and koalas (Lunney, 2005; submissions to the committee), the EPBC Act does not come into play. Koalas are also beyond the reach of the EPBC Act in Victoria and South Australia, due to their exclusion from conservation listing.

Since the koala was not a threatened species when the Senate Committee reported in September 2011, the idea of a recovery plan was not part of its remit. If a species is listed, and action is required to reverse the slide to extinction, a recovery plan is a standard procedure; and while a recovery plan for the koala (combined populations of QLD, NSW, ACT) is under development (Department of the Environment, 2015b), it was not yet in place in July 2015, despite the expiration of the *National Koala Conservation and Management Strategy 2009–2014*. Even if and when the recovery plan is complete, and agreed upon by all parties, to be effective it needs actions, funding, and monitoring and reporting procedures.

In the meantime, progress will continue to rely on State and local government actions and decisions for on-ground conservation, only some of which are likely to be ecologically effective.

3.4. Missing issues

Some significant management problems were notably absent from both the submissions and the report's recommendations. There was a low level of concern regarding fire, and even if fire was regarded as an issue linked to climate change, it still was not ranked highly. Of particular concern is the low level of the recognition of the contribution of drought to the plight of the koala, particularly in western QLD and NSW, where they have suffered greatly from drought (Davies et al., 2013; Lunney et al., 2012a; Santika et al., 2014; Seabrook et al., 2011; Smith et al., 2013), as well as the koalas of coastal south-eastern NSW (Lunney et al., 2014). This is an ecological matter, linked to climate change, and exacerbated by clearing. In addition, the issue of mining also needs to be discussed. The direct impact of mining is only part of a bigger picture: the infrastructure is also of great ecological importance, particularly roads, and the heavy vehicle traffic, and thus roadkill, associated with a mine (Lunney et al., 2012b; Tucker and Clifton, 2013). We draw the conclusion that this lack of emphasis on fire, drought and mining is a reflection of the location of the majority of the submissions to the inquiry, and a failure of the inquiry itself to look for information beyond the submissions and public hearings.

4. Conclusions and recommendations

Despite Strategies, Recovery Plans, a Senate Committee Report and Threatened species listing, the slide to extinction continues for many northern koala populations. What underpins this recurring policy failure is not transparent in the Senate Committee Report, but it is by inference. Modern Australia, as it expands and develops, diminishes the area of koala habitat, fragments what remains, and in this process, other threats such as dog attacks, roadkill and disease gain momentum. This will be compounded by climate change, manifesting as drought, fire and rising temperatures, especially heatwaves, though this issue did not feature in the Senate Committee report. Indeed, the visible image in the public imagination is of a never-ending expansion of our human footprint, which rises with both population growth and increasing techno-logical capacity to transform the landscape, and among the imperceptible costs is the continued decline of Australia's unique wildlife. The impact of human population growth and develop-ment seems to be largely absent from official reports, but it should be prominent; it is a major driver of change, loss of habitat and the increase in climate change (Allendorf and Allendorf, 2012; Lunney, 2013; Lunney et al., 2007).

The great strengths of the Senate Inquiry's report are that it canvassed a wide range of viewpoints, took an Australia-wide perspective, made all the material submitted to it available for future reference, and published its findings and reasoning. This has allowed others to appreciate the report's valuable contribution, but also to look critically on matters not covered. A limitation of the report is that it is concentrated on what the Commonwealth government could, or even should, do without really acknowledging that most of the authority to act lies in State legislation, and the potential of local government to implement policy and conservation actions. Another limitation was that it reflected the submissions and spoken evidence, and did not carry out an independent review, so it became a snapshot of existing local arguments and issues, which carried neither a substantial historical dimension nor canvassed the koala's long-term future, such as under climate change. The Committee's bias to current issues is reflected in its recommendations. Six of the report's recommendations focused on roads, wild dogs, and research

into koala disease, including the viability of vaccination programs and the effect of changes in leaf chemistry. Let us suppose that if a vaccine were to be found, and we did understand leaf chemistry, both worthy goals, and then combine that with good road management, and dog control, would we have stopped the decline of the northern koala populations? We would argue not, especially if their implementation were to be carried out without a sound ecological basis and adaptive monitoring program.

There is a clear need for long-term koala conservation that is evidence-based, ecological in its framework, and that recognizes the long timeframes involved in assessing change, restoration and both the successful and failed conservation outcomes. Habitat restoration and the benefits of long-term studies should have been included as an option in the recommendations, and ecological history should not have been overlooked as a complex aspect of how the koala arrived at such a difficult place ecologically. Drought and climate change were not considered in the recommendations, nor were the impacts of urban development (despite being one of the highest submission concerns). Our research shows they are all of critical importance. While the committee's report brought together information from various sources, we recommend that in future inquiries, an independent scientific review should be commissioned to ensure all aspects of species conservation and management are presented accurately and without bias. In addition, the relative merits of each recommendation were not considered, and an economic analysis would be more effective in identifying how funding might be allocated for maximum return. Indeed, introducing cost-effective prioritization of conservation management actions was identified as a potential improvement for more effective species management in Australia (McDonald et al., 2015). Funding is germane to our central concern with the 2011 Report of the Senate Committee into the status of koalas, especially as Australia is ranked 38th in the most highly underfunded countries for biodiversity conservation given its relative level of economic development and GDP (Waldron et al., 2013). If the recommendations of the Committee were to be funded without a critical ecological appraisal to assess costs and priorities, then we will have missed the mark as to identifying and funding the most important research, conservation and policy actions. Without adequate funding, koala conservation will stall, and any aspirations to conserve and sustainably manage koala populations will be diminished, or become increasingly costly as the koala continues to slide into regional extinction or increase to the detriment of individual koalas and their habitats.

The possibility that recovery planning may be based in some part on the Committee's recommendation cannot be overlooked, and a misdirected list of recommendations is likely to be detrimental and lead to ineffective recovery planning. The Senate Committee's report of its 2011 inquiry into the koala was a major, but inaccurate, achievement that needs to be viewed ecologically to avoid poor policy and inefficient actions following from its recommendations. Inaction takes time to witness, however as each decade passes, and if little well directed research and conservation action is taken, then losses will become measurable and the cost of recovery and population management ever greater.

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