



KOALA EXTINCTION RISK NSW

What is the worst-case for NSW koalas going extinct?

Koalas are on track to face extinction in NSW as early as 2050 based on current trends and expert knowledge, without a significant reduction in tree clearing, mitigation of climate change and major expansion of protected areas.

The listing advice of the federal Threatened Species Scientific Committee (TSSC) which formed the basis for the listing of the koala in Qld, NSW and ACT as ‘vulnerable’ to extinction in 2012 gave two population estimates based on best available evidence.¹ The TSSC estimated a 33% decline from 31,400 to 21,000 across the two decades from 1990-2010. The worst-case extinction year would be 2050 based on linear extrapolation from these two points (A in Fig. 1). Another study collated expert opinions on the size of the 2012 population and trends over succeeding 3 generations. Estimates averaged ~36,000 (range ~14,000–73,000) with an average decline of -28% (range -55% to +3%) over the next 15-21 years which if extrapolated leads to worst case extinction in the 2040-2070 time range (B and C Fig. 1).

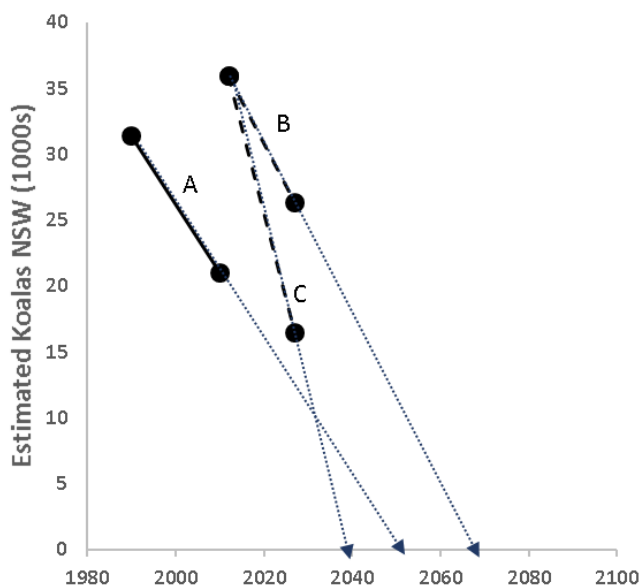


Fig 1. Estimates of total NSW population declines and linear extrapolations to extinction: (A) based on TSSC population estimates (B) based on Adams-Hosking et al. (2016)² for a 15 year decline from the average population at the average rate (-28%) guessed by experts, and (C) as for B but for a 15 year decline from the average population at the low end of the range of rates of decline (-55%).

Note that only linear extrapolation is possible without more data points on the timeline for population estimates.

Such linear extrapolation can rightly be criticised, but with only two points no other extrapolation is possible at present.

¹ http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104

² Adams-Hosking, C., et al. 2016. Use of expert knowledge to elicit population trends for the koala (*Phascolarctos cinereus*). *Diversity and Distributions*, 22, 249-262.

These extrapolations also carry two implicit assumptions that

- a) declines at the rates indicated happen homogeneously across all NSW subpopulations. For extinction to happen statewide, all subpopulations would have to go extinct.
- b) threats causing the observed past population decline continue the same into future (ie homogeneous in time).

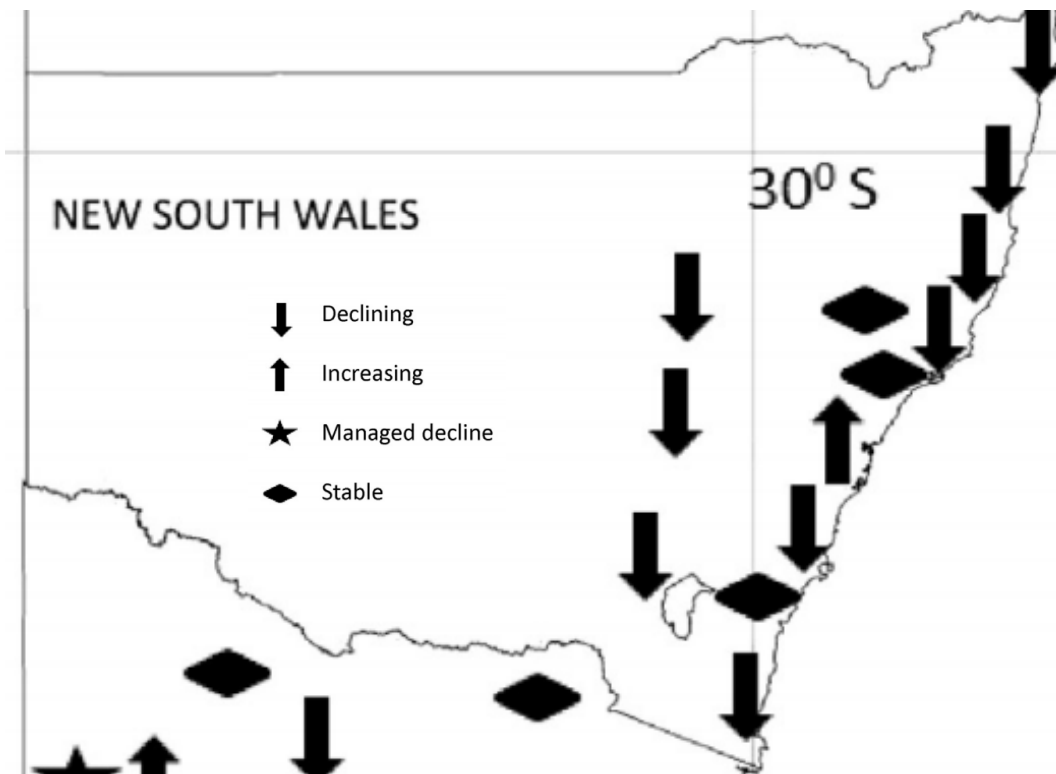
Whilst precise prediction is impossible, even the best-case scenario projects koalas becoming extinct in the wild in NSW this century. The uncertainty in the range of projected extinction dates (2040 to 2070) should be viewed in the context of the estimated declines of koalas across Australia since 1788 of perhaps more than 95% (see ‘Historical context’ below).

In the following section, we examine these assumptions.

SUBPOPULATIONS DECLINE AT HOMOGENOUS RATES

Although decline is general in NSW, and subpopulations have gone extinct or are close to it,³ most but not all subpopulations are in decline (Fig. 2), and the assumption of uniform decline is not supported, even if nearly so. For example, even if koalas were to go extinct elsewhere, surely those in national parks could still persist even if numbers are low? In the ACT, the small residual population is largely confined to national parks.⁴ On this basis, the whole-of-state predictions of extinction time are biased towards being too early (Fig. 1).

However, as we will argue below, even subpopulations that appear to be likely to persist while others go extinct may be in trouble because assumption of homogeneity of threats is not met as discussed below, with threats highly likely to get worse.



³ Iluka subpopulation is believed extinct, while the Tweed/Brunswick, Hawk’s Nest/Tea Gardens and Pittwater koala subpopulations are all endangered.

⁴ <http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-listing-advice.pdf>

Fig. 2 Trends of main koala subpopulations in NSW (McAlpine et al. 2012)⁵ The small Campbelltown population is shown as increasing, but in the text, it appears that this is uncertain given ongoing bulldozing of forests for urban and infrastructure development, vehicle collisions and dog attacks.

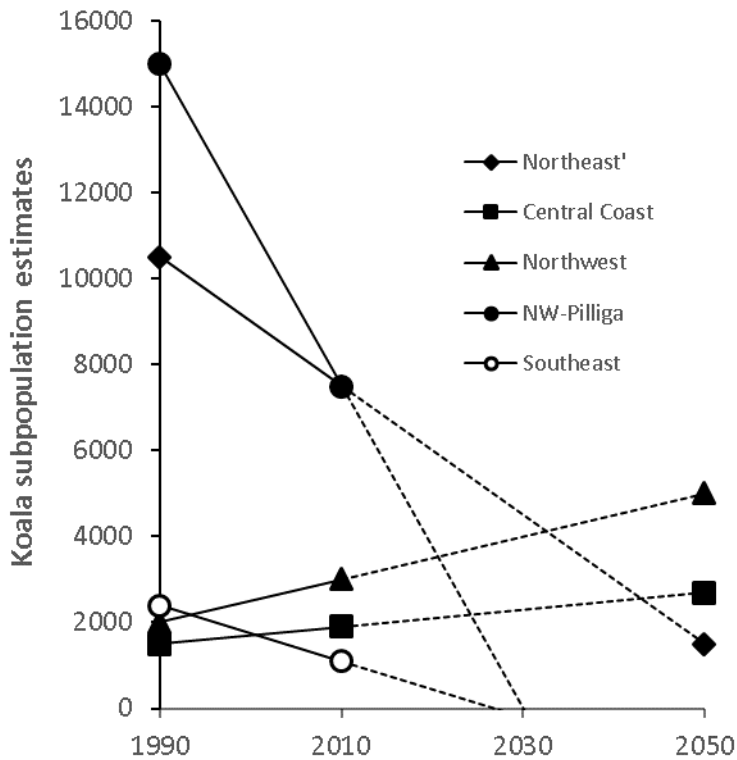


Fig 3. Subpopulation trends projected linearly forward to 2050 from the TSSC 2012 listing advice.⁶

⁵ Extracted from Fig 1 in McAlpine, C., et al. 2015. Conserving koalas: a review of the contrasting regional trends, outlooks and policy challenges. *Biological Conservation*, 192, pp.226-236.

⁶ http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104

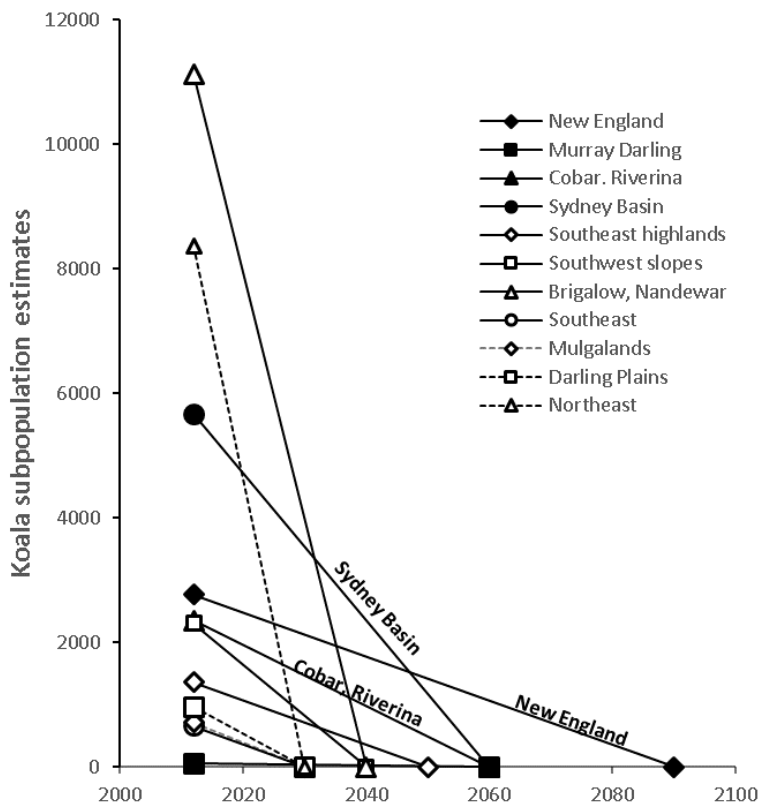


Fig. 4. Expert opinions on average subpopulation sizes in 2012 and the low range of opinions on trends projected linearly to extinction.⁷

The two source studies shown in Fig 1, contained population and trend estimates for subpopulations which show considerable heterogeneity of decline.

The TSSC (2012) listing advice found one subpopulation, Northeast, with extinction time extrapolated to 2060, while two small subpopulations of Central Coast and Northwest showed increasing not declining trends.

However,:

- For the Northeast subpopulation, the TSSC notes that the reliability of estimates is only moderate and “north-east NSW is uncertain and population surveys are required”.
- For the Central Coast subpopulation, numbers from around Campbelltown dominate, level of confidence is moderate, and numbers are based on extrapolations on expert opinions as per Adams-Hosking *et al.* (2016). It seems unlikely that the populations there would remain secure as “they remain exposed to proposals for increased urban and motorway development”.⁸ Expert worst case predictions for Sydney Basin (the equivalent bioregion) extrapolate to 2060 as extinction time (Fig 4).
- For the Northwest subpopulation (which excludes Pilliga Forest), TSSC population estimates are low confidence. The fact they are dramatically at variance with Pilliga estimates –also in the same region – but which have the large Pilliga subpopulation go extinct very early around 2030 (Fig.3). This makes the prediction of stability or increase in the same region (Fig. 3) highly unlikely. This is even less likely when one considers that the Northwest is a land clearing

⁷ Adams-Hosking, C., *et al.* 2016. Use of expert knowledge to elicit population trends for the koala (*Phascolarctos cinereus*). *Diversity and Distributions*, 22, 249-262.

⁸ McAlpine, C., *et al.* 2015. Conserving koalas: a review of the contrasting regional trends, outlooks and policy challenges. *Biological Conservation*, 192, pp.226-236.

hotspot where we recently recorded a doubling of destruction of koala habitat after the repeal of the *Native Vegetation Act* in 2017 (see below).

The worst cases for extinctions of subpopulations in the Adams-Hosking *et al.* (2016) study range from 2030 to 2090 (Fig. 4). Only one subpopulation in New England would survive beyond 2030 to 2090 (Fig. 4). However, as noted above for the Northwest population, tree clearing has nearly tripled in the areas around Moree and Collaranebri in the NSW Northwest region in the past year, calling into question the reliability of the New England (Fig. 4) and Northwest predictions of relatively slow decline or even increase respectively (Fig. 3).

THREATS REMAIN AT SAME LEVEL INTO THE FUTURE

This assumption is not supported, but in a direction that predicts extinction times *earlier* than expected in Fig 1, not later. Not only are threats to koalas and their habitats unlikely to significantly abate in future, they are likely to get worse.

- A decline of 20% in community koala sightings in northwest NSW was found over a ten year period 2004-2014, equivalent to 40% over two decades, which exceeds the 33% reported by the TSSC for 1990-2010 but not the worst case from the Adams-Hoskings *et al.* (2016) study (Fig. 1) (Predavec *et al.* 2018).⁹
- The NSW government found that 99% of koala habitat on private land would be put at risk of destruction by the 2017 repeal of the *Native Vegetation Act* in NSW, and that tree clearing would increase by 45% state-wide as a result, as borne out by the following evidence.¹⁰
- Koala habitat destruction has more than doubled, and all clearing nearly tripled, around Moree and Collarenebri in north central NSW following the repeal of the *Native Vegetation Act* in NSW, suggesting we can expect higher rates of population decline than estimated for a period within which stronger controls over NSW tree clearing were enacted (Fig 1).¹¹
- Based on widespread community-led on-ground surveys – as opposed to expert opinions - koala experts stated in the *Proposal for a Western Woodlands Koala Park* stated “[o]f the 97 local populations identified, most appear to be in decline or have already declined to an extent that their ongoing presence remains uncertain. Less than 10% of local populations appear to be stable or increasing in numbers. The latter are found in the higher altitude tableland and highland regions and suggest modelled climate change impacts upon Koala distribution may already be occurring.”¹² Importantly, the population estimates in the TSSC 2012 listing advice and Adam-Hoskings *et al.* (2016) predate this report. Sub-population estimates based on actual on-ground surveys for this report take into account population declines and threats that occurred subsequent to the TSSC and Adam-Hoskings *et al.* estimates. Note, the Western Woodlands proposal relied upon geographically extensive on-ground koala surveys led by koala expert David Paull and supported by local wildlife enthusiasts, but often were inhibited by numbers of koala spotters.
- Dramatic contractions are predicted for the koala’s suitable climate envelope toward coastal regions and highlands in response to climate change (Fig 3), precisely into those areas around Sydney and the Central Coast where human population growth is expected to be greatest. The dramatic declines of inland koala populations following recent heatwaves and droughts supports

⁹ Predavec, M., *et al.* 2018. Using repeat citizen science surveys of koalas to assess their population trend in the north-west of New South Wales: scale matters. *Australian Mammalogy*, 40, 47-57.

¹⁰ <https://www.theguardian.com/australia-news/2018/aug/04/clearing-of-native-vegetation-in-nsw-jumps-800-in-three-years>

¹¹ <https://www.nature.org.au/media-releases/2018/09/new-report-shows-14ha-of-koala-habitat-bulldozed-each-day/>

¹² Paul, D, and Hughes, B. (2016). *Proposal for a Western Woodlands Koala Park: Identification of Critical Conservation Lands - A landscape approach to preserving Koala populations in western New South Wales*. Report prepared for the Western Woodlands Alliance, 92 pp.

this prediction.¹³ Increasing drought and temperature are also implicated in the decline of koalas in the largely undeveloped forests around Eden in southern coastal NSW.¹⁴ Foliage nutritional value is expected to decline under climate change affecting populations on protected areas or otherwise equally.¹⁵ Forest fire incidence is increasing under climate change, which may also increase mortality of koalas in protected areas. Climate change-increased heat, drought and fire may also kill off forested habitats themselves, reducing the niche space further for koalas.¹⁶ Populations in largely protected remnant bushland in southeast Queensland have shown significant decline from 1996 to 2012, despite being in relatively protected or untouched bushland. Whether this decline resulted from disease, climate change or other cross-tenure threats is unclear.¹⁷



Fig. 3. Predicted suitable climate envelopes for koalas in NSW at present (left) and in 2070 (right) under climate change according to Adams-Hosking (2011).¹⁸

¹³ 25% death rate after the 2009 heatwave around Gunnedah NSW found by Lunney, D., et al. 2012. Koalas and climate change: a case study on the Liverpool Plains, north-west New South Wales. *Wildlife and climate change: towards robust conservation strategies for Australian fauna*. (Eds D. Lunney and P. Hutchings.), pp.150-168

Also, 80% decline in Qld mulgaland koalas during the millennium drought found by Seabrook, L et al, 2011. Drought-driven change in wildlife distribution and numbers: a case study of koalas in south west Queensland. *Wildlife Research*, 38, 509-524.

¹⁴ Lunney, D., Stalenberg, E., Santika, T. and Rhodes, J.R., 2014. Extinction in Eden: identifying the role of climate change in the decline of the koala in south-eastern NSW. *Wildlife Research*, 41(1), pp.22-34.

¹⁵ Reckless, H.J., Murray, M. and Crowther, M.S., 2018. A review of climatic change as a determinant of the viability of koala populations. *Wildlife Research*, 44(7), pp.458-470.

¹⁶ McDowell, N.G. and Allen, C.D., 2015. Darcy's law predicts widespread forest mortality under climate warming. *Nature Climate Change*, 5(7), p.669.

¹⁷ De Villiers 2015 PhD thesis cited in McAlpine, C., et al. 2015. Conserving koalas: a review of the contrasting regional trends, outlooks and policy challenges. *Biological Conservation*, 192, pp.226-236.

¹⁸ Extracted from Fig 2 in Adams-Hosking, C., et al, 2011. Modelling climate-change-induced shifts in the distribution of the koala. *Wildlife Research*, 38, 122-130.

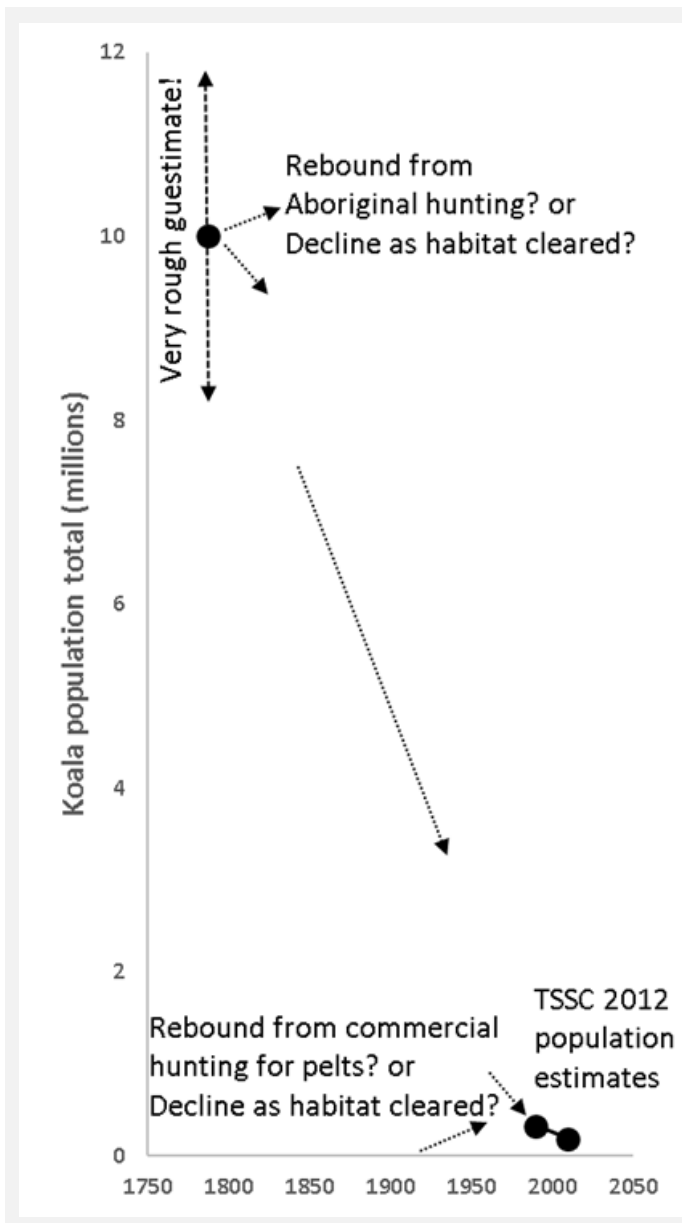


Fig 5. The three time points for koala populations in Australia. Best guess for pre-European population (1788) and the TSSC estimates for 1990 and 2010. The long tenuous drop from 1788 to 1990 hides what is likely to have been a highly variable population change record with populations potentially rebounding after cessation of Aboriginal hunting, only to be devastated in the late 19th and early 20th century by hunting of many millions of koalas for pelts, and massive habitat destruction, perhaps rebounding again mid 20th century after hunting ceased.

HISTORICAL CONTEXT

Arguments about rate and extent of recent decline have to be seen in context of the comparatively massive and much steeper historical decline of koalas from an estimated 10 million animals¹⁹ Australia wide prior to European arrival, down to less than 200,000 according to the TSSC in 2010, with even rough population trajectories in the intervening years unknown (Fig 5). What is known is that Australia exported eight millions of koala pelts in the early 20th century until hunting was eventually banned in the 1930s (*Ibid*). Hunting had already exterminated koalas in Victoria and South Australia prior to that, and mainland populations had to be restarted from colonies transferred earlier to offshore islands.²⁰

¹⁹ Sect 2.48 in Senate Standing Committees on Environment and Communications 2011. *The koala—saving our national icon*. https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Completed_inquiries/2010-13/koalas/report/c02. The population estimate of 10 million koalas prior to 1788 was provided by Bill Phillips, *Koalas: The little Australians we'd all hate to lose*, Australian Government Publishing Service, Canberra, 1990, pp 20–26. In addition, the Australian Koala Foundation relied upon historical records to reveal "...at least 8 million Koalas were killed for the fur trade, with their pelts shipped to London, the United States and Canada between 1888 and 1927", available for viewing at <https://www.savethekoala.com/about-us/news-events/akf-shocking-figures-reveal-devastating-impact-koala-fur-trade>, viewed 21 September 2018.

²⁰ McAlpine, C., et al. 2015. Conserving koalas: a review of the contrasting regional trends, outlooks and policy challenges. *Biological Conservation*, 192, pp.226-236.

This information suggests Australia's koala population may have fallen by perhaps more than 95% since 1788.

CONCLUSION

On available evidence koalas could become extinct in NSW between mid and end of the 21st century due to a combination of as-yet poorly abated threats:

- Increasing habitat destruction and fragmentation due to recent repeal of the *Native Vegetation Act*; forest fragmentation increases mortality of koalas from disease, stress and such ground-based sources as cars and dogs;
- Disease;
- Climate change induced changes in forest composition, fire frequency, droughts, heatwaves and foliar nutrition.

Climatic and disease threats and to some extent degradation effects operate even over protected areas, meaning that even protected subpopulations may also be sent into decline, despite being free of the risk of direct habitat destruction.

Climate change is a global problem that requires a global response.

However, one key threat that can be effectively abated at the state or national level of government is habitat destruction. Unfortunately, the repeal of the NSW *Native Vegetation Act* has only worsened this threat.