

Reptiles on the brink: the Australian terrestrial snake and lizard species most at risk of extinction

In brief

The conservation of Australian reptiles is often overlooked relative to the concern given to birds and mammals (which typically have higher public profiles). However, many of Australia's reptiles are declining. An important first step in preventing their extinctions is identifying the species at greatest risk.

Our team of almost 30 reptile experts from universities, museums and government agencies across the country has identified the 20 Australian snakes and lizards at greatest risk of extinction, and estimated the probability that they will be lost within 20 years if there is no change in management.

Invasive species were the most common threats to the most imperilled snakes and lizards, followed by agriculture, altered fire regimes and climate change.

Although most of the species identified were historically more widespread, each of them now occurs in a relatively small area. This makes them vulnerable to extinctions caused by a single catastrophic event, such as a large fire.

Increased resourcing and conservation actions are urgently needed to prevent extinctions of Australian reptiles. Our study reveals that business-as-usual could result in the extinction of up to 11 species by 2040.

Background

Australia is a hotspot for reptiles; it is home to about 10% of the world's known species (the largest number of any country), and over 90% of Australian reptile species are found nowhere else.

Many reptiles are experiencing ongoing declines in Australia. A lack of conservation action to address this has been compounded by a general lack of knowledge about Australian reptiles; many species are poorly known (evidenced by the high rate of description of new Australian species); and there has been limited monitoring for most species. Without adequate monitoring, it is difficult to assess population trends and the impacts of threats, and managers may lose opportunities to prevent reptile extinctions because severe population declines are not detected with sufficient time to respond. Undetected extinctions are likely to have already taken place.

The Australian Government has committed to averting extinctions, and this first requires identification of the species at most immediate risk. This can forewarn governments, conservation managers and the community so that they can implement emergency care and recovery actions to prevent extinctions before it is too late.

No 15 Roma earless dragon, *Tympanocryptis wilsoni*, Queensland.
Image: Stephen Zozaya



BELOW TOP: No 10 Mount Surprise slider, *Lerista storri*, Queensland. Image: Stephen Zozaya

BELOW BOTTOM: No 4 Arnhem Land gorges skink, *Bellatorias obiri*, Northern Territory. Image: Chris Jolly



About the research

We identified 60 Australian snakes and lizards (collectively known as squamates) of high conservation concern for consideration in this project, based on internationally recognised criteria (IUCN Red List). For each of these species, we estimated the probability of extinction (in the wild) by 2040 to identify and rank the species at most immediate risk.

To do this, we gathered all available information on the ecology, threats and population trends for each species, and provided it to 27 reptile experts from across the country. Each expert was then asked to estimate the probability of extinction of each species over the next two decades, assuming a continuation of current management. Participants could decline to provide an estimate for a particular species if they did not have any first-hand experience with it. We collected an average of 19 expert estimates of extinction risk for each species and performed statistical

modelling to measure and test the expert predictions.

We mapped the distributions of the most imperilled species in order to identify priority regions for research and management. We also examined the key threats affecting these species.

Our assessments of extinction probability preceded the 2019–20 wildfires, which are likely to have severely worsened the conservation outlook for many of the species included in our study, and also for many others that were not included (but for which the fires may have warranted their inclusion).

Additionally, we assessed the probability of successfully re-establishing wild populations of two Extinct in the Wild lizards endemic to Christmas Island for which reintroduction trials are currently underway (Lister's gecko, *Lepidodactylus listeri*; and the blue-tailed skink, *Cryptoblepharus egeriae*).

Key findings

We identified six species that are more likely to go extinct than to persist over the next two decades, assuming no improvements to current management. These include three skinks, two dragons and one blind snake. We found that the species at greatest extinction risk are not always in the higher categories such as Critically Endangered.

See Table 1 for a list of the 20 species at greatest risk and their probability of extinction by 2040.

Based on the estimated extinction probabilities of all 60 species considered, up to 11 snakes and lizards could become extinct by 2040 unless management improves. This would represent a marked increase in the rate of extinction

of Australian reptiles, relative to historic levels.

Comparable assessments have also been applied to Australian mammals, birds and freshwater fishes. The number of reptiles identified as being at high risk of extinction within 20 years is lower than for freshwater fishes, but similar to the number for birds and higher than for mammals.



Conrad Hoskin in *Saltuarius eximius* habitat. Image: Conrad Hoskin

No 12 Pinnacles leaf-tailed gecko,
Phyllurus pinnaclensis, Queensland.
Image: Stephen Zozaya



Table 1. The 20 Australian terrestrial snakes and lizards at greatest risk of extinction in Australia, their estimated probabilities of extinction in the wild by 2040, their locations, IUCN Red List conservation status and Environmental Protection and Biodiversity Conservation Act 1999 (EPBC) status – Critically Endangered (CR), Endangered (EN), Vulnerable (VU), unassessed due to recent taxonomic revision or description (N/A) and Not listed.

Rank	Species	Probability of extinction	State	IUCN status	EPBC Act status
1	Victoria grassland earless dragon <i>Tympanocryptis pinguicolla</i>	93%	Vic	N/A	EN
2	Fassifern blind snake <i>Anilius insperatus</i>	75%	Qld	CR	Not listed
3	Lyons grassland striped skink <i>Austroblepharus barrylyoni</i>	71%	Qld	CR	Not listed
4	Arnhem Land gorges skink <i>Bellatorias obiri</i>	69%	NT	CR	EN
5	Bathurst grassland earless dragon <i>Tympanocryptis mccartneyi</i>	62%	NSW	N/A	EN (as part <i>T. pinguicolla</i>)
6	Gravel Downs ctenotus <i>Ctenotus serotinus</i>	52%	Qld	CR	Not listed
7	Allan's lerista <i>Lerista allanae</i>	46%	Qld	CR	EN
8	Christmas Island blind snake <i>Ramphotyphlops exocoeti</i>	41%	CI	EN	VU
9	Cape Melville leaf-tailed gecko <i>Saltuarius eximius</i>	39%	Qld	EN	Not listed
10	Mount Surprise slider <i>Lerista storri</i>	37%	Qld	N/A	Not listed
11	McIlwraith leaf-tailed gecko <i>Orraya occultus</i>	31%	Qld	VU	Not listed
12	Pinnacles leaf-tailed gecko <i>Phyllurus pinnaclensis</i>	28%	Qld	CR	Not listed
13	Condamine earless dragon <i>Tympanocryptis condaminensis</i>	25%	Qld	EN	EN
14	Lake Disappointment dragon <i>Ctenophorus nguyarna</i>	21%	WA	VU	Not listed
15	Roma earless dragon <i>Tympanocryptis wilsoni</i>	19%	Qld	EN	Not listed
16	Lake Disappointment ground gecko <i>Diplodactylus fulleri</i>	18%	WA	VU	Not listed
17	Canberra Grassland earless dragon <i>Tympanocryptis lineata</i>	18%	ACT	N/A	EN (as part <i>T. pinguicolla</i>)
18	Christmas Island forest gecko <i>Cyrtodactylus sadleiri</i>	17%	CI	EN	EN
19	Lancelin Island ctenotus <i>Ctenotus lanceolini</i>	17%	WA (LI)	CR	VU
20	Limbless fine-lined slider <i>Lerista ameles</i>	15%	Qld	EN	Not listed

Key findings (continued)

Where are the at-risk species?

All of the species occur in a single state or territory. More than half (55%) of the 20 species at greatest risk occur only in Queensland. Three species occur only on islands: two on Christmas Island, and one on Lancelin Island (a tiny low-lying sand island off the coast of Western Australia).

All of the species are restricted in range, with a maximum area of occupancy of 56 km². Most (65%) of the 20 species at greatest risk have an area of occupancy of 16 km² or less, and several species are known from only one location. These small distributions increase their risk of extinction as a result of a single catastrophic event, such as a large bushfire.

Many of the species persist in remnant pockets of vegetation adjacent to highly developed areas (e.g., the Bathurst grassland earless dragon *Tympanocryptis mcartneyi* and Allan's lerista *Lerista allanae*), where they face a high risk of extinction due to continued habitat loss, fragmentation and edge effects.

The rough location of species distributions is shown in Figure 1.

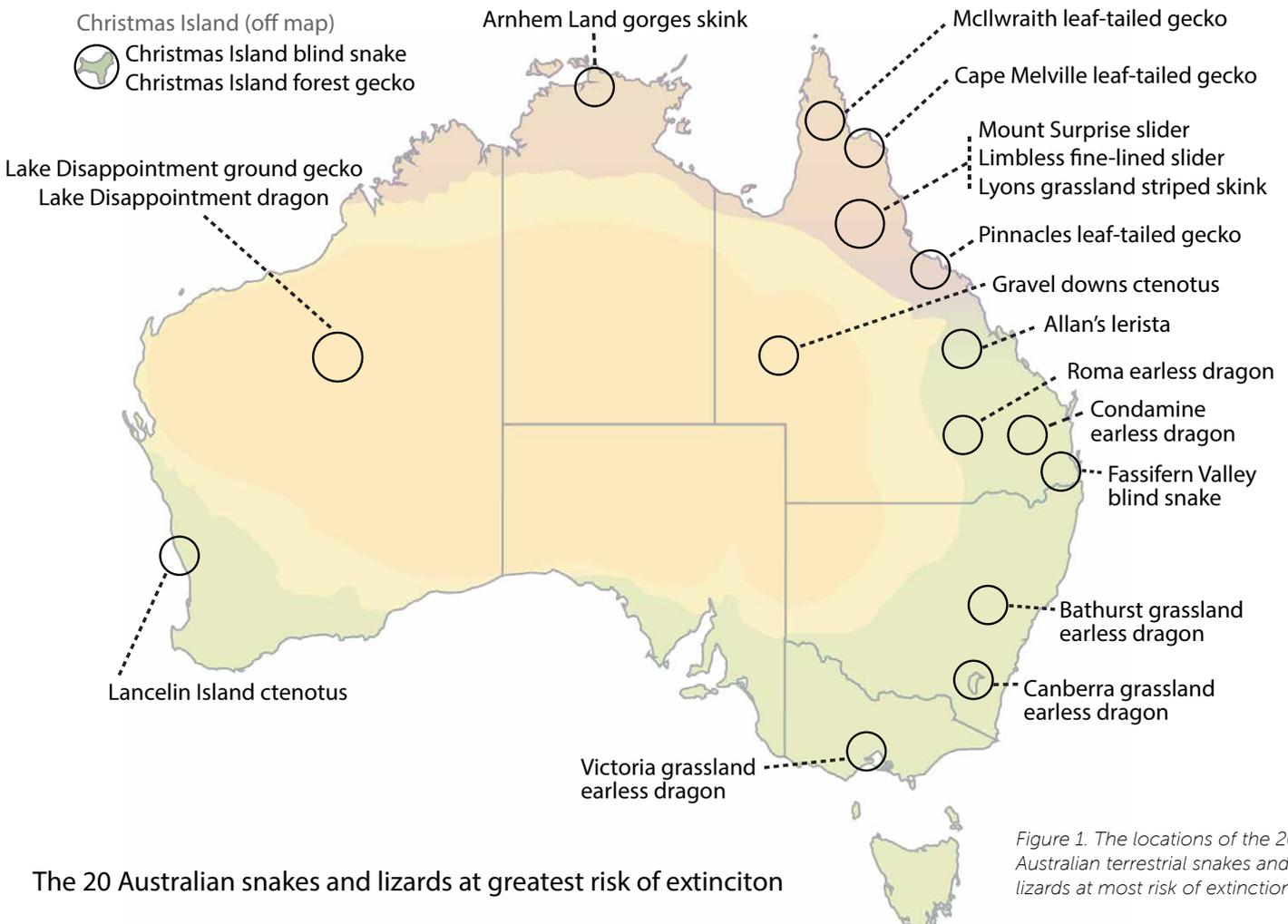


Figure 1. The locations of the 20 Australian terrestrial snakes and lizards at most risk of extinction.

The 20 Australian snakes and lizards at greatest risk of extinction

No 18 Christmas Island forest gecko, *Cyrtodactylus sadleiri*, Christmas Island.
Image: Jon-Paul Emery



Threats

Considering all 62 reptile species in our assessment (including the two Extinct in the Wild Christmas Island species), we found that invasive animals and plants were the most common threat, impacting 67% of species. Weeds impacted the most species (40%), followed by predation by feral cats (29%) and red foxes (16%). Other invasive animals (black rats, feral pigs, deer, feral horses, invasive invertebrates, oriental wolf snakes and

cane toads) were a problem for 21% of the reptile species considered (due to predation, poisoning or direct habitat destruction).

Agriculture (impacting 45% of species), changing fire regimes (impacting 36% of species), and climate change and severe weather (impacting 31% of species) were also important threats facing the most imperilled terrestrial snakes and lizards.

The increasing impacts of climate change are not yet well understood,

and may have been underestimated in our study. At least 23 of Australia's reptile species were substantially affected by the 2019–20 Black Summer bushfires, including five considered in this study. It is still too early to determine the short- and long-term impacts of the fires for individual species, but it is possible that the fires have increased their likelihood of extinction.

See Figure 2 for the full list of threats and how many species they impact.

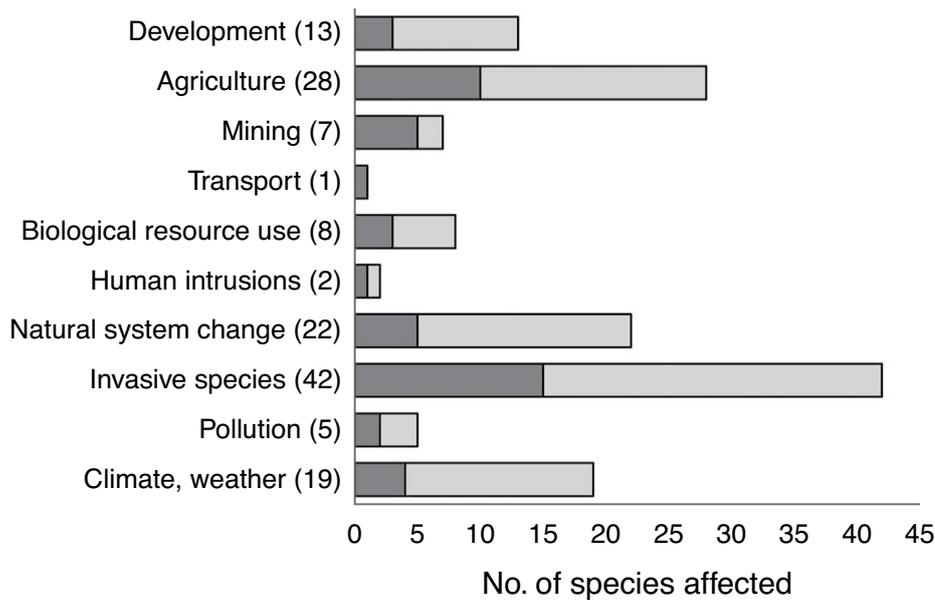


Figure 2. The number of Australian terrestrial snakes and lizards affected by different threats. Dark grey bars represent the 20 species at greatest risk, while light grey bars represent all other species considered in this study. The total number of species affected by each threat is provided in brackets. Note that natural system change includes changes to fire patterns.

BELOW: No 16 Lake Disappointment ground gecko, *Diplodactylus fulleri*, Western Australia. Image: Brad Maryan



Pinnacles leaf-tailed gecko habitat. Image: Conrad Hosking

No 9 Cape Melville leaf-tailed gecko *Saltuarius eximius*, Queensland. Image: Tim Lamman



BELOW: No 19 Lancelin Island ctenotus, *Ctenotus lanceolini*, Western Australia.
Image: Brad Maryan

Cited material

This factsheet summarises the key findings of the following paper, which can be referred to for further detail including a full description of the research method and findings:

Geyle, H.M., Tingley, R., Amey, A.P., Cogger, H., Couper, P.J., Cowan, M., Craig, M.D., Doughty, P., Driscoll, D.A., Ellis, R.J., Emery, J-P., Fenner, A., Gardner, M.G., Garnett, S.T., Gillespie, G.R., Greenlees, M.J., Hoskin, C.J., Keogh, J.S., Lloyd, R., Melville, J., McDonald, P., Michael, D.R., Mitchell, N.J., Sanderson, C. Shea, G.M., Sumner, J., Wapstra, E., Woinarski, J.C.Z., and Chapple D. (2020). Reptiles on the brink: identifying the Australian terrestrial snake and lizard species most at risk of extinction. *Pacific Conservation Biology*. <https://doi.org/10.1071/PC20033>

Additional reading:

Tingley, R., et al. (2019). Geographic and taxonomic patterns of extinction risk in Australian squamates. *Biological Conservation* 238, 108203.



Implications and recommendations

The probability of up to 11 extinctions of Australian terrestrial snakes and lizards by 2040 is high without improvements in conservation investment and management.

Snakes and lizards have received relatively little conservation resourcing compared to mammals and birds; this must change if extinctions are to be prevented.

By identifying the species at greatest risk, this research may forewarn governments, conservation managers

and the community so that they can implement emergency care and recovery actions to prevent potential extinctions before it is too late.

Our findings will be of importance to policy-makers in state, territory and Commonwealth government agencies and funding bodies, as well as conservation land managers and researchers looking to prioritise and apply research and management actions for threatened terrestrial snakes and lizards.

Further Information

David Chapple – David.Chapple@monash.edu
Hayley Geyle – hayley.geyle@cdu.edu.au