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Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list the Kaputar Rock Skink *Egernia roomi* Wells & Wellington 1985 as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act. Listing of Critically Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Egernia roomi is eligible for listing as Critically Endangered under Clause 4.3 (a) (d) (e ii, iii, iv) because: i) the distribution of the species is very highly restricted with an extent of occurrence and area of occupancy of 8 km^2; ii) the species is known from only one location; and iii) there is a continuing decline in the geographic distribution and the area, extent and quality of the habitat of the species.

The NSW Threatened Species Scientific Committee has found that:

1. *Egernia roomi* is described by Swan *et al.* (2017) as "dark chocolate brown to grey-brown above, often paler on head and nape; dark brown variegations on head and nape form a broad, mottled dark brown ventral stripe, or two paravertebral stripes, that break up behind shoulders into dark brown bars along back. A broad, very dark upper lateral zone over face and neck breaks up behind shoulders. Throat bluish grey, belly dull orange. Snout to vent length 103-121mm". This species differs from *E. saxatilis* and *E. mcpheei* by having smooth (or slightly grooved) dorsal scales, rather than sharply or bluntly keeled scales (Swan *et al.* 2017).

2. Although unofficially recognised as a distinct taxon for over 25 years (Sadlier *et al.* 2019) and listed as an unnamed species of *Egernia* in popular literature for over 15 years (Swan *et al*. 2004; 2017), the formal description of *Egernia roomi* has only recently been published in peer-reviewed literature (Sadlier *et al.* 2019).

3. *Egernia roomi* is endemic to NSW, Australia. The species is restricted to the Nandewar Ranges, located in the Northern Tablelands region of NSW, where it is has been recorded from only three locations near the summit of Mount Kaputar and adjacent peaks (Sadlier *et al*. 2019). The sites are a maximum of 3 km straight-line-distance apart. The species has so far only been recorded from habitats between 1360 and 1480 metres in elevation. All known sites are within Mount Kaputar National Park (NP).

4. *Egernia roomi* is known only from high elevation outcrops of volcanic rock-habitat (Sadlier *et al.* 2019). Habitat may also include volcanic intrusions such as plugs and dykes, though these areas are yet to be surveyed sufficiently for the species (R. Sadlier *in litt*. August 2019). High elevation rock escarpment habitat across the Nandewar Range extends down to 1200 m in elevation and covers an area of 122 km^2.

5. Potentially suitable rocky escarpment habitat extends down to around 1000 m in elevation on the eastern sector of the Nandewar Range, but it is not known if the species inhabits these lower elevations (Sadlier *et al.* 2019). The rocky habitat at 1000 m elevation and above in the Range covers an area of 241 km^2. The western section of the Nandewar Range has not been investigated for this species (R. Sadlier *in litt.* August 2019) but herpetological surveys undertaken around Mt Yulludunida (~8 km from known locations of species), with a summit at around 1160 m, did not detect the species, despite having potentially suitable rocky habitat (R. Sadlier *in litt.* August 2019).

6. The species appears to prefer sheltering sites of rock overlying rock, (not rock in soil) and areas adjacent to rock habitat with appropriate exposure for basking (thermoregulatory) activity (Sadlier *et al*. 2019).

7. The diet of *Egernia roomi* is unknown, but likely to be similar to other members of the genus, which are omnivorous, consisting predominantly of invertebrates, including beetles, ants, grasshoppers and cockroaches. There may be some reliance on vegetation adjacent to rock habitats to provide part of the species diet during some seasons (Brown 1991; Chapple 2003; O'Connor and Shine 2003; R. Sadlier *in litt*. August 2019).

8. There have been no detailed behavioural or ecological studies on this species. The population structure is not known, but other related rock-dwelling (or rock-dependant) members of the genus (e.g. *Egernia saxatilis*) form social groups or occur as related 'families' in areas of rock habitat (O'Conner and Shine 2003). It is likely the species has a defined home range rather than random movement through the landscape.

9. No information is available on generation length for this species but based on information on related species in the genus *Liopholis* and *Egernia*, this species could potentially mature at around two to three years and may live for up to 10 years (O'Connor and Shine 2003). For *Egernia roomi*, the time to maturity may be longer given the species is restricted to high elevation and the daily and seasonal activity periods for young individuals to undertake necessary activities to reach maturity (forage/bask) are likely to be shorter (R. Sadlier *in litt*. August 2019).

10. The distribution of *Egernia roomi* is considered to be highly restricted. Using the recorded occurrences of the species (ALA 2020; Sadlier *et al*. 2019), *Egernia roomi* occupies an extent of occurrence (EOO) estimated to be 1 km^2, based on a minimum convex polygon enclosing all known mapped occurrences of the species, the method of assessment recommended by IUCN (2019). The area of occupancy (AOO) for all records was estimated to be 8 km^2, based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2019). Note: 'If the EOO is less than AOO, EOO should be changed to make it equal AOO to ensure consistency with the definition of AOO as an area within EOO' (IUCN 2019). Therefore, the EEO is also 8 km^2.

11. The species is likely to occur in suitable habitat across the Nandewar Range within its altitudinal limitations, however, the extent of interconnectivity of this type of

habitat has yet to be determined and it is likely that the species is fragmented by areas of unsuitable habitat (i.e. areas lacking essential sheltering sites). Areas of outcropping rock habitat away from the escarpment have yet to be thoroughly investigated and if they are not utilised by the species, may increase the degree of known unutilised habitat (R. Sadlier *in litt*. August 2019). The extent to which *Egernia roomi* can move between populations or habitat patches is unknown but will likely depend on its ability to utilize alternative sheltering and foraging sites in the intervening areas between its preferred habitat (R. Sadlier *in litt*. August 2019).

12. The population size of *Egernia roomi* is unknown and requires investigation. No systematic targeted surveys have been undertaken for the species. To date it has only been found at three sites (ALA 2020; Sadlier *et al.* 2019).

13. Natural fires occur at low frequency in the subalpine and alpine landscape, and post fire regeneration of vegetation in these areas is slow (Williams *et al.* 2009). In late 2019 and early 2020, wildfires burnt around 30% of Mount Kaputar NP (DPIE 2020), including large areas of the sub-alpine zone (i.e. above 1200 m; ~ 63%). Conservatively, the extent of *Egernia roomi* habitat (which includes all known records, likely habitat above 1200 m, and potential occupied areas, down to 1000 m a.s.l.), impacted by the wildfire is estimated to be around 50% of its range. While the impact of fire on the species is unknown, the rock habitat of *Egernia roomi* may provide refugia during fire events and individuals may survive the direct impacts of the fire. However, resident populations would likely be adversely affected by the loss of surrounding vegetation, potentially resulting in reduced food availability, increased predation pressure, fragmentation of suitable habitat, and altered microclimate (Atkins *et al.* 2015; Fenner and Bull 2007; Pianka and Goodyear 2012). The impact of fire, even of low intensity, could further be exacerbated if proceeded or followed by an extended period of drought, by reducing the cover surrounding sheltering and foraging sites with the possible flow-on effect of reduced availability to food sources (R. Sadlier *in litt.* August 2019). Extensive drought-related defoliation of *Eucalyptus* species and shrub-death were observed within the Mount Kaputar National Park in the period preceding the 2019 fire (A. Fawcett pers. comm. May 2020). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*.

14. Climate change is likely to have a negative impact on species such as *Egernia roomi* as it is adapted to a narrow, high elevational range of climatic conditions and occurs in isolated and fragmented populations. As such, it has limited scope for uphill migration in response to increasing temperatures and changes to habitat which are likely to make sites unsuitable, resulting in a reduction in habitat patch size and increased distance between habitat patches and fragmentation (Haines *et al*. 2017; R. Sadlier *in litt*. August 2019). The direct and indirect impacts of climate change on the life cycle and health of the species are unknown but are likely to be deleterious. Identified impacts of climate change on cool-adapted reptile species include a reduction in daily activity periods, physiological stress, and increased competition from other species in the face of a shrinking ecosystem (Haines *et al*. 2017; Sinervo *et al*. 2010). Associated impacts correlated with, or exacerbated by,

climate change include an increase in the severity and frequency of fire (Flannigan *et al.* 2009), an increase in the intensity and frequency of hot days and heatwaves, and intensifying drought conditions (William *et al.* 2009), all of which are likely to directly impact the species itself or may reduce the quality and/or extent of the habitat for the species. 'Anthropogenic Climate Change' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*.

15. The disturbance and altering of the placement of bushrock by humans is considered to negatively impact rock dependant reptiles by disrupting the microenvironment and structural attributes beneath the rock, rendering it unsuitable to utilize as sheltering sites (Pike *et al.* 2010; R. Sadlier *in litt.* August 2019). Human-mediated disturbance of *Egernia roomi* habitat has been recorded within Mt Kaputar NP particularly at sites close to the edge of cliff lines that are readily accessible by walking tracks. Trampling of vegetation and rock disturbance were observed at 'Mt Dowe', 'The Governor' and elsewhere in Mt Kaputar NP during field studies in 2015 (Sadlier *et al*. 2019). For the related *E. saxatilis intermedia* on the Central Tablelands of NSW, rock disturbance resulted in a reduction of sheltering sites (Sadlier *et al*. 2019). 'Bushrock removal' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*.

16. Goat disturbance has been recorded within in the Kaputar Range (Hunter 2015) and goat control has been identified as a management priority for Mount Kaputar NP (DEC 2006). However, the extent to which the current goat populations impact on preferred habitat at the escarpment edge is unknown. Browsing of vegetation and fouling of rock habitat by goats alters the ecology of rocky habitat and the areas immediately adjacent (Coblentz 1978; Murphy 1996 NSW Scientific Committee 2004). This may result in exposing areas adjacent to sheltering sites for *Egernia roomi* and therefore affecting their suitability for foraging activities. This reduction of cover may also increase the risk of predation on foraging individuals (R. Sadlier *in litt.* August 2019). The impact of goats on the landscape is likely to extend beyond areas near sheltering sites to habitat used by individuals during any migration between subpopulations. 'Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*.

17. *Egernia roomi* Wells & Wellington 1985 is eligible to be listed as a Critically Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Appendix 1
Assessment against Biodiversity Conservation Act criteria
The Clauses used for assessment are listed below for reference.

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Data Deficient

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 - Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)
Assessment Outcome: Critically Endangered under Clause 4.3 (a) (d) (e ii, iii, iv).
[Equivalent to IUCN Criterion B via B1ab (i, ii, iii, iv) and B2ab (i, ii, iii, iv)]

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,
		(iv)	the number of locations in which the species occurs or of populations of the species,
	(f)	extreme fluctuations occur in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,

		(iii)	the number of locations in which the species occur or of populations of the species.

Clause 4.4 - Low numbers of mature individuals of species and other conditions
(Equivalent to IUCN criterion C)
Assessment Outcome: Data Deficient

The estimated total number of mature individuals of the species is:						
	(a)	for critically endangered species			very low, or	
	(b)	for endangered species			low, or	
	(c)	for vulnerable species			moderately low,	
and either of the following 2 conditions apply:						
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):				
		(i)	for critically endangered species		very large, or	
		(ii)	for endangered species		large, or	
		(iii)	for vulnerable species		moderate,	
	(e)	both of the following apply:				
		(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and			
		(ii)	at least one of the following applies:			
			(A)	the number of individuals in each population of the species is:		
				(I)	for critically endangered species	extremely low, or
				(II)	for endangered species	very low, or
				(III)	for vulnerable species	low,
			(B)	all or nearly all mature individuals of the species occur within one population,		
			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.		

Clause 4.5 - Low total numbers of mature individuals of species
(Equivalent to IUCN criterion D)
Assessment Outcome: Data Deficient

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability
(Equivalent to IUCN criterion E)
Assessment Outcome: Data Deficient

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

Clause 4.7 - Very highly restricted geographic distribution of species– vulnerable species
(Equivalent to IUCN criterion D2)
Assessment Outcome: Vulnerable
[Equivalent to IUCN Criterion D via D2]

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.

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Supporting Documentation:

Bray C, Rowley J (2020) Conservation Assessment of *Egernia roomi* Wells & Wellington 1985 (Scincidae). NSW Threatened Species Scientific Committee.

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