Notice of Preliminary Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Preliminary Determination to support a proposal to list the shrub *Leionema scopulinum* B.M. Horton & Crayn as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act.

How to make a submission

The NSW TSSC welcomes public involvement in the assessment process and places preliminary determinations on public exhibition on the NSW TSSC pages on the Department of Planning, Industry and Environment (DPIE) website. This public exhibition provides an opportunity for the public to comment on this preliminary determination as well as provide any additional information that is relevant to the assessment.

Postal submissions regarding this Preliminary Determination may be sent to:

Secretariat
NSW Threatened Species Scientific Committee
Locked Bag 5022
Parramatta NSW 1481.

Email submissions in Microsoft Word or PDF formats may be sent to:

scientific.committee@environment.nsw.gov.au

Submissions close 1st March 2024.

What happens next?

After considering any submissions received during the public exhibition period the NSW TSSC will make a Final Determination and a notice will be placed on the DPIE website to announce the outcome of the assessment. If the Final Determination is to support a listing, then it will be added to the Schedules of the Act when the Final Determination is published on the legislation website. www.legislation.nsw.gov.au.

Privacy information

The information you provide in your submission may be used by the NSW TSSC in the assessment to determine the conservation status and listing or delisting of threatened or extinct species, threatened populations and threatened or collapsed ecological communities or to assess key threatening processes.

The NSW TSSC may be asked to share information on assessments with NSW Government agencies, the Commonwealth Government and other State and Territory governments to collaborate on national threatened species assessments using a common assessment method and to assist in the management of species and ecological communities.

If your submission contains information relevant to the assessment it may be provided to state and territory government agencies and scientific committees as part of this collaboration.

If you wish your identity and personal information in your submission to be treated as confidential you must:

- ***request your name be treated as confidential***, and
- ***not include any of your personal information in the main text of the submission or attachments so that it can be easily removed.***

Professor Caroline Gross
Acting Chairperson
NSW Threatened Species Scientific Committee

Public Exhibition period: 01/12/2023 – 01/03/2024

Preliminary Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Preliminary Determination to support a proposal to list the shrub *Leionema scopulinum* B.M. Horton & Crayn as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Leionema scopulinum B.M. Horton & Crayn was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (b) (d) (e i). The main reasons for this species being eligible for listing are: i) it has a highly restricted geographic distribution (EOO 450 km^2); ii) it occurs at two threat-defined locations; and iii) there is inferred continuing decline in the number of mature individuals of the species due to susceptibility to drought and fire, which are both becoming more severe and frequent due to the effects of anthropogenic climate change.

The NSW Threatened Species Scientific Committee has found that:

1. *Leionema scopulinum* B.M. Horton & Crayn (Rutaceae) was formally described by Horton *et al.* (2004). *Leionema scopulinum* is described by PlantNET (2022) as "Shrub, inhabiting rocky ledges and clefts. Branchlets angled, stellate-hairy. Lamina 24–65 mm long, 4.5–10.0 mm wide, margins frequently serrulate. Inflorescence erect with 9–32 flowers. Petals valvate, 6.6–8.1 mm long, 1.5–2.0 mm wide, greenish-yellow to yellow. Fruit a schizocarp capsule; cocci 5.5–7.0 mm high, rostrate, the beak 1.5–3.0 mm long." *Leionema scopulinum* has also been known as *Leionema* sp. 'Nullo Mountain' and *Leionema* sp. Lee Creek (PlantNET 2022).

2. *Leionema scopulinum* is endemic to New South Wales, known only from limited areas of pagoda habitat in Wollemi National Park at 660–900 m above sea level (Horton *et al.* 2004). The main cluster of *L. scopulinum* localities is located in the northwest of Wollemi National Park on the ridges of the Lee Creek and Growee River catchment and in the vicinity of Nullo Mountain (Horton *et al.* 2004). The species has been recorded at two additional sites: one ~55 km to the south of the main cluster on cliffs above the tributary of Canobla Creek; and a second ~11 km east of the main cluster around Emu Creek (Royal Botanic Gardens NSW 2022). The species is replaced by *Leionema sympetalum* in areas of pagoda habitat between the northern localities and the southern site. (S. Clarke *in litt*. May 2022). The two species are not known to co-occur (NSW Government 2022b; Royal Botanic Gardens NSW 2022) and *L. scopulinum* can be distinguished by its larger leaves and cocci and erect inflorescence (Horton *et al.* 2004).

3. *Leionema scopulinum* sites are discrete, scattered on rocky ledges and ridgetops and in clefts among sandstone pagoda formations (Horton *et al.* 2004; H. Washington *in litt.* July 2022). The species grows in sandy soil in heath under a sparse overstorey characterised by *Eucalyptus oreades* and *E. sparsifolia* (Horton *et al.* 2004).

4. *Leionema scopulinum* has a highly restricted geographic distribution, with an estimated area of occupancy (AOO) of 72 km^2, calculated by overlaying 2 km x 2 km grid cells over validated occurrence records. The species occupies an estimated extent of occurrence (EOO) of 450 km^2, based on a minimum convex polygon enclosing all validated records. Both AOO and EOO fall within the Endangered geographic range as defined by the IUCN (AOO <500 km^2, EOO <5,000 km^2, IUCN 2022).

5. A precise population estimate is not available for *Leionema scopulinum*. Horton *et al.* (2004) estimated that there were <1,500 plants, including mature individuals and others, in the initial occurrences reported in 2004 (H. Washington *in litt.* July 2022). Since this time >240 plants have been recorded at additional sites (Royal Botanic Gardens NSW 2022).

6. *Leionema scopulinum* occurs at two threat-defined locations (as defined by IUCN 2022), based on the most serious plausible threat of recurrent short-interval fires exceeding sensitivity thresholds. Occasional large bushfires (such as the 2019-20 fire) could plausibly cover all *L. scopulinum* localities; however, it is unlikely that all plants would be burnt due to the rock outcrop habitat and patchy nature of bushfire.

7. *Leionema scopulinum* is very likely an obligate seed regenerator with fire-cued recruitment from a soil-stored seedbank, a common fire response in rocky outcrop habitats (Clarke *et al.* 2009; Hunter 2003). All adult plants were observed to be killed by fire at one site burnt by medium–extreme severity fire in 2019–20, with strong post-fire recruitment from soil-stored seed reported (NSW Department of Planning and Environment 2020; S. Clarke *in litt.* June–September 2022). Time to maturity is inferred to be 5–8 years based on other rock outcrop *Leionema* species that are seed regenerators (Clarke *et al.* 2009). The longevity of *L. scopulinum* plants and their seedbank are unknown.

8. The primary threats to *Leionema scopulinum* are adverse fire regimes and increasing frequency and duration of drought due to the effects of climate change, with grazing by feral goats a potential threat. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' and 'Anthropogenic Climate Change' are Key Threatening Processes under the *Biodiversity Conservation Act 2016*.

9. As a fire-sensitive species, *Leionema scopulinum* is vulnerable to recurrent short-interval fires exceeding sensitivity thresholds. Recurrent fires can remove fire-killed species by killing plants before they reach maturity and thus compromise seedbank replenishment (Clarke *et al.* 2009). The pagoda habitat which *L.*

scopulinum occupies likely shelters the species to an extent from low-severity fire (H. Washington *in litt.* July 2022). However, with fire weather predicted to become more frequent and severe (Canadell *et al.* 2021; CSIRO 2022), and high-severity fire having greater capacity to encroach into pagoda habitat (G. Purcell *in litt.* July 2022), this habitat is likely to burn with greater frequency. The minimum fire interval for *L. scopulinum* is estimated to be 11–16 years based on other rocky outcrop *Leionema* species (Burrows *et al.* 2008; Clarke *et al.* 2009). The existing pattern of fires exceeding this threshold (<11 years) at 54% of localities, together with projected increases in fire severity (Canadell *et al.* 2021; NSW Department of Planning and Environment 2021), means it can be reasonably inferred that *L. scopulinum* localities will burn too frequently in future, and that a proportion of the 56% of localities burnt in 2019–20 (NSW Department of Planning and Environment 2020) will be re-exposed to fire within sensitivity thresholds. Repeated high-severity fires at <11-year intervals would severely compromise the species' capacity to recruit and recover, resulting in a decline in the number of mature individuals, and potentially to localised extinction from impacted sites if seedbanks are exhausted (Clarke *et al.* 2009). As *L. scopulinum* appears to have limited ability to disperse, it is unclear whether the species could recolonise lost habitat.

10. Drought is a recurrent threat, which is projected to become more frequent due to the effects of climate change (NSW Government Local Land Services 2016; CSIRO 2022). In 2018, during the 2017–19 drought, an estimated 50% reduction in the number of *Leionema scopulinum* plants, compared with 2003 levels, was observed at one site, with a second unquantified decline observed at a second site (H. Washington *in litt.* August–September 2022). In addition to desiccation and dieback, warmer and drier conditions impact woody plants by reducing average seed production and seedling survival (Benwell 2007; Enright *et al.* 2014, 2015). Thus, drought is expected to contribute to species decline for *L. scopulinum* by exacerbating impacts from fire, reducing resilience and seedbank maintenance prior to fire, and reducing seedling establishment if occurring post-fire.

11. With the risk of fire and drought increasing for the region (NSW Government Local Land Services 2016; NSW Government 2022*a*; CSIRO 2022), *Leionema scopulinum* is likely to be subjected to higher-frequency and overlapping disturbance events increasingly in future. As a result, the observed drought- and fire-induced declines in the number of mature individuals are inferred to continue into the future.

12. Feral goats may negatively impact *Leionema scopulinum* through herbivory if not managed appropriately. While outcrop-restricted flora are highly susceptible to impacts from feral browsers compared with surrounding vegetation (Hunter 2003), goat numbers in Wollemi National Park are currently very low and stable due to control programs on park and surrounding private property (G. Purcell *in litt.* July 2022; M. Sharp *in litt.* August 2022).

13. *Leionema scopulinum* B.M. Horton & Crayn is not eligible to be listed as a Critically endangered species.

14. *Leionema scopulinum* B.M. Horton & Crayn is eligible to be listed as an Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a very high risk of extinction in Australia in the near future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Assessment against *Biodiversity Conservation Regulation 2017* criteria
The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: *Leionema scopulinum* is Endangered under Clause 4.3 (b) (d) (e i)

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: Endangered under Clause 4.3 (b) (d) (e i)

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: Not met

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: Not met

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.

Professor Caroline Gross
Acting Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Kelly AS (2023) Conservation Assessment of *Leionema scopulinum* B.M. Horton & Crayn (Rutaceae). NSW Threatened Species Scientific Committee.

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NSW Government Local Land Services (2016) Climate change in the Central Tablelands. Available at: http://www.cwcewa.com.au/s/DOC17-36721-Climate-Change-in-the-Central-Tablelands-Factsheet.pdf [Verified 15 August 2022]

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