# THREATENED SPECIES SCIENTIFIC COMMITTEE

**Established under the *Environment Protection and Biodiversity Conservation Act 1999***

The Threatened Species Scientific Committee finalised this assessment on <mark>DD Month Year</mark>.

# Consultation on Species Listing Eligibility and Conservation Actions

## *Leionema coxii* (Cox's leionema)

You are invited to provide your views and supporting reasons related to:

1)      the eligibility of *Leionema coxii* (Cox's leionema) for inclusion on the EPBC Act threatened species list; and

2)    the necessary conservation actions for the above species.

The purpose of this consultation document is to elicit additional information to better understand the status of the species and help inform on conservation actions and further planning. As such, the below draft assessment should be considered to be **tentative** as it may change following responses to this consultation process.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing by email to: species.consultation@awe.gov.au

Please include species scientific name in Subject field.

or by mail to:

The Director
Bushfire Affected Species Assessments Section
Department of Agriculture, Water and the Environment
John Gorton Building, King Edward Terrace
GPO Box 858
Canberra ACT 2601

**Responses are required to be submitted by 2 March 2022**.

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**General background information about listing threatened species**

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at: https://www.awe.gov.au/environment/biodiversity/threatened.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at: http://www.awe.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2021.pdf.


As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at: https://www.awe.gov.au/environment/biodiversity/threatened/nominations.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at: https://www.awe.gov.au/environment/biodiversity/threatened/recovery-plans.

**Privacy notice**

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the 'Common Assessment Method' (CAM). As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: https://www.awe.gov.au/about/commitment/privacy .

**Information about this consultation process**

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

**CONSULTATION QUESTIONS FOR *Leionema coxii* (Cox's leionema)**

## SECTION A - GENERAL

1. Is the information used to assess the nationally threatened status of the species/subspecies robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.

2. Can you provide additional data or information relevant to this assessment?

3. Have you been involved in previous state, territory or national assessments of this species/subspecies? If so, in what capacity?

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## PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

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## SECTION B    DO YOU HAVE ADDITIONAL INFORMATION ON THE ECOLOGY OR BIOLOGY OF THE SPECIES/SUBSPECIES? (If no, skip to section C)

**Biological information**

4. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?

5. Do you have any additional information on the ecology or biology of the species/subspecies not in the current advice?

## SECTION C    ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES/SUBSPECIES? (If no, skip to section D)

**Population size**

6. Has the survey effort for this taxon been adequate to determine its national adult population size? If not, please provide justification for your response.

7. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species/subspecies? If not, please provide justification for your response.

8. If not, can you provide a further estimate of the current population size of mature adults of the species/subspecies (national extent)? Please provide supporting justification or other information.

   If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species/subspecies numbers, and also choose the level of confidence you have in this estimate:

   Number of mature individuals is estimated to be in the range of:

   ☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

   Level of your confidence in this estimate:

   ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

   ☐ 31–50% - more than a guess, some level of supporting evidence

   ☐ 51–95% - reasonably certain, information suggests this range

   ☐ 95–100% - high level of certainty, information indicates quantity within this range

   ☐ 99–100% - very high level of certainty, data are accurate within this range

## SECTION D   ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES/SUBSPECIES? (If no, skip to section E)

9. Does the current and predicted rate of decline used in the assessment seem reasonable? Do you consider that the way this estimate has been derived is appropriate? If not, please provide justification of your response.

**Evidence of total population size change**

10. Are you able to provide an estimate of the total population size during the 1970s or early 1980s *(at or soon after the start of the most recent three generation period)*? Please provide justification for your response.

    If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species/subspecies numbers, and also choose the level of confidence you have in this estimate.

    Number of mature individuals is estimated to be in the range of:

    ☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

    Level of your confidence in this estimate:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, information suggests this range

☐ 95–100% - high level of certainty, information indicates quantity within this range

☐ 99–100% - very high level of certainty, data are accurate within this range

11. Are you able to comment on the extent of decline in the species' total population size over the last approximately 30–60 years (i.e. three generations)? Please provide justification for your response.

    If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

    Decline estimated to be in the range of:

    ☐ 1–30% ☐ 31–50% ☐ 51–80% ☐ 81–100% ☐ 90–100%

    Level of your confidence in this estimated decline:

    ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

    ☐ 31–50% - more than a guess, some level of supporting evidence

    ☐ 51–95% - reasonably certain, suggests this range of decline

    ☐ 95–100% - high level of certainty, information indicates a decline within this range

    ☐ 99–100% - very high level of certainty, data are accurate within this range

12. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

## SECTION E ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES/SUBSPECIES? (If no, skip to section F)

**Current Distribution/range/extent of occurrence, area of occupancy**

13. Does the assessment consider the entire geographic extent and national extent of the species/subspecies? If not, please provide justification for your response.

14. Has the survey effort for this species/subspecies been adequate to determine its national distribution? If not, please provide justification for your response.

15. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.

16. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.

17. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy.

    If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

    **Current extent of occurrence** is estimated to be in the range of:

    ☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

    Level of your confidence in this estimated extent of occurrence

    ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

    ☐ 31–50% - more than a guess, some level of supporting evidence

    ☐ 51–95% - reasonably certain, data suggests this range of decline

    ☐ 95–100% - high level of certainty, data indicates a decline within this range

    ☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

**Current area of occupancy** is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

## SECTION F    ARE YOU AWARE OF TRENDS IN THE TOTAL RANGE OF THE SPECIES/SUBSPECIES? (If no, skip to section G)

**Past Distribution/range/extent of occurrence, area of occupancy**

18. Do you consider that the way the historic distribution has been estimated is appropriate? Please provide justification for your response.

19. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy.

    If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

**Past extent of occurrence** is estimated to be in the range of:

☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

**Past area of occupancy** is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% -high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

## PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

**SECTION G    DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES/SUBSPECIES? (If no, skip to section H)**

20. Do you consider that all major threats have been identified and described adequately?

21. To what degree are the identified threats likely to impact on the species/subspecies in the future?

22. Are the threats impacting on different populations equally, or do the threats vary across different populations?

23. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species/subspecies at any stage of its life cycle?

24. Can you provide supporting data/justification or other information for your responses to these questions about threats?

**SECTION H    DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES/SUBSPECIES? (If no, skip to section I)**

25. What planning, management and recovery actions are currently in place supporting protection and recovery of the species/subspecies? To what extent have they been effective?

26. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species/subspecies?

27. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation actions for this species/subspecies?

**SECTION I** **DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE RECOVERY OF THE SPECIES/SUBSPECIES?**

28. Are you aware of other knowledge (e.g. traditional ecological knowledge) or individuals/groups with knowledge that may help better understand population trends/fluctuations, or critical areas of habitat?

29. Are you aware of any cultural or social importance or use that the species/subspecies has?

30. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species/subspecies?

31. How aware of this species/subspecies are land managers where the species/subspecies is found?

32. What level of awareness is there with individuals or organisations around the issues affecting the species/subspecies?

    a. Where there is awareness, what are these interests of these individuals/organisations?

    b. Are there populations or areas of habitat that are particularly important to the community?

**PART 3 – ANY OTHER INFORMATION**

33. Do you have comments on any other matters relevant to the assessment of this species/subspecies?

# Conservation Advice for
# *Leionema coxii* (Cox's leionema)

<div style="border:2px solid black">

**This draft document is being released for consultation on the species listing eligibility and conservation actions**

The purpose of this consultation document is to elicit additional information to better understand the status of the species and help inform conservation actions, further planning and a potential recovery plan. The draft assessment below should therefore be considered **tentative** at this stage, as it may change as a result of responses to this consultation process.

Note: Specific consultation questions relating to the below draft assessment and preliminary determination have been included in the consultation cover paper for your consideration.

</div>

This document combines the approved conservation advice and listing assessment for the species. It provides a foundation for conservation action and further planning.

The survey effort is not considered adequate and there is insufficient scientific evidence to support the assessment.



*Leionema coxii* © Copyright, M Fagg ([Australian National Botanic Gardens](Australian National Botanic Gardens))

# Conservation status

*Leionema coxii* (Cox's leionema) is not listed as a threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act).

*Leionema coxii* was assessed by the Threatened Species Scientific Committee to be ineligible for listing under the EPBC Act. The Committee's assessment is at Attachment A. The Committee assessment of the species' eligibility against each of the listing criteria is:

- Criterion 1: Insufficient data

- Criterion 2: Insufficient data

- Criterion 3: Insufficient data

- Criterion 4: Insufficient data

- Criterion 5: Insufficient data

The main factors that make the species ineligible for listing are a lack of survey effort and a lack of information about the key threats to the species.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the [Species Profile and Threat Database](#).

# Species information

### Taxonomy
Conventionally accepted as *Leionema coxii* (F.Muell.) Paul G.Wilson (Wilson 1998) (family Rutaceae). The specific epithet (coxii) honours Dr James Charles Cox, a medical practitioner of Sydney in the 19th century.

Originally described in 1884 by Ferdinand von Mueller as *Eriostemon coxii* from specimens collected 'at the sources of the Clyde' (i.e. Sugarloaf Mountain). It was transferred to *Phebalium* by Maiden & Betche in 1916 and more recently to *Leionema* by Wilson in 1998 (Wilson 2013). There does not appear to be a common name in regular use, however the name Cox's leionema has been inferred from the scientific name and naming conventions in other leionemas.

### Description
Cox's leionema is a medium-sized shrub typically 1–3 m high, rarely a small tree 7–8 m high. It has narrow leaves 3–7 cm in length, with finely toothed margins and a glossy dark green upper surface. It produces terminal clusters of 10–30 flowers, each with creamy to yellowish white petals c. 5 mm long (PlantNet 2021).

Like other Rutaceae, the leaves are aromatic. Investigations of the phytochemistry of leionemas and other Rutaceae have revealed a large number of essential oils and other secondary plant metabolites which may be sources of novel natural products (Jusaitis 2000).
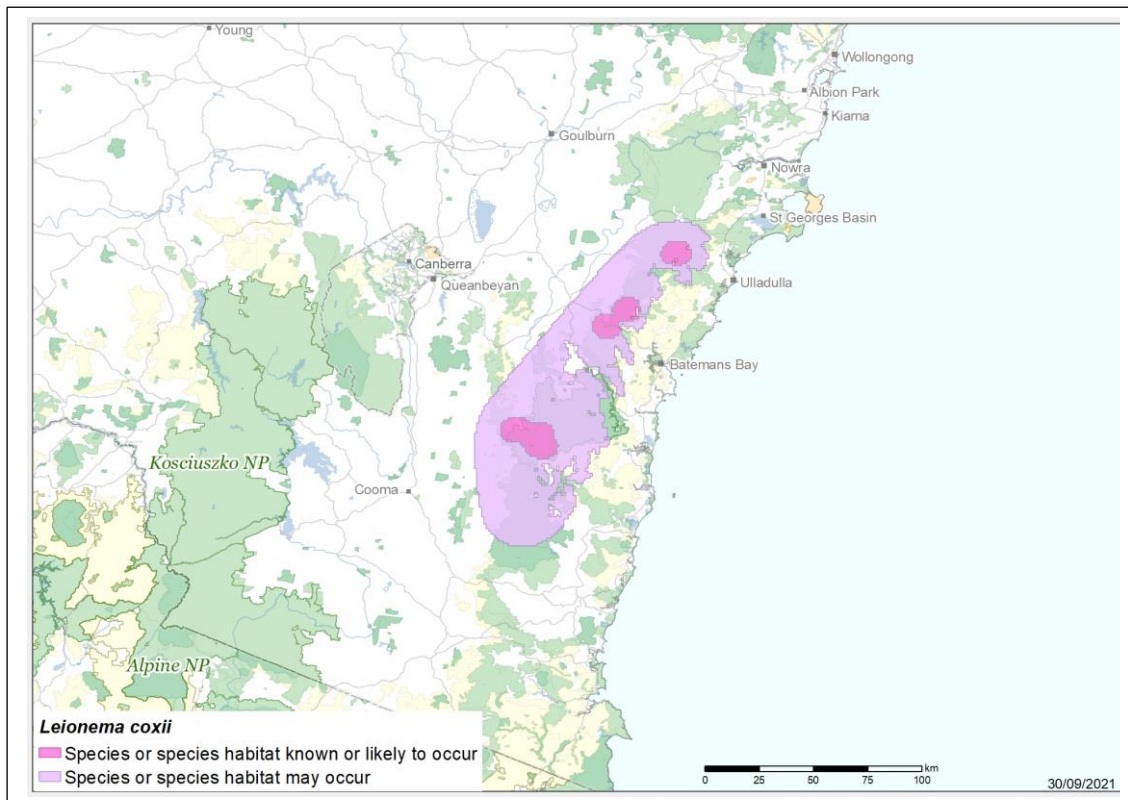
### Distribution
Cox's leionema is restricted to six subpopulations in three areas in southern NSW, from Morton National Park south to the Upper Tuross Range, chiefly in the Budawang Range (PlantNet 2021). It is poorly known. A variety of botanists with experience in the region were consulted during

the development of this document but few had seen the species or could provide estimates of abundance. Therefore, the known distribution (Table 1) relies entirely on herbarium collections, many of which were made before 1990.

**Table 1 Known subpopulations of Cox's leionema**

| Subpopulation | Abundance | Year collected | Fire history (DPIE 2021) | Location notes (if available) |
|---|---|---|---|---|
| Endrick (Budawangs) | "Frequent" "Uncommon" (The Castle) | 1985, 1986, 2002 1958 | 2019-20: burnt 1968-69: burnt | Below Folly Point; 3km N of the Castle. |
| Monolith Valley (Budawangs) | | 1969 | 2019-20: burnt 1978-79: presc. burn 1968-69: burnt | Monolith Valley |
| Mt Budawang (Budawangs) | | 1971 | 2019-20: burnt 1938-39: burnt | Mt Budawang |
| Mt Budawang, Sugarloaf, Clyde Mountains (Budawangs) | "Locally frequent (1979)" | 1926, 1909, 1978, 1915, 1889, 2000, 1979, 2006, 1995, 1884 | 2019-20: burnt 1953-54: burnt 1938-39: burnt | Found on summit (Sugarloaf) |
| Big Badja (Deua) | | 1989, 1976 1987 1975 1971 | 2019-20: burnt | Currumbene Creek crossing on Pikes Saddle to Dampier Rd 2.4 km from Pikes Saddle to Dampier Trig |
| Mother Woila (Deua) | | 1975 1976 2009 | 2019-20: burnt | 1.5 km 180° Dampier Trig; Ridge NE of Mother Woila and 3.7 km 205° Dampier Trig; Mother Woila; E of Scout Hat, Woila Crk; Tabletop. |

**Map 1 Modelled distribution of Cox's Leionema**



Source: Base map Geoscience Australia; species distribution data Species of National Environmental Significance database.
**Caveat**: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.
**Species distribution mapping**: The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

## Cultural and community significance

This section describes some published examples of this significance but is not intended to be comprehensive, applicable to, or speak for, all Indigenous Australians. Such knowledge may only be held by Indigenous groups and individuals who are the custodians of this knowledge.

Aboriginal Australians have a long history of management of country on which Cox's leionema occurs. The species occurs across the Batemans Bay, Bodalla and Wagonga Local Aboriginal Land Councils (NSW Aboriginal Land Council 2021).

There is little published information about the cultural significance of leionemas. However, given the aromatic leaves, it is possible that there may have been traditional uses by Aboriginal Australians. Other fragrant Rutaceae were used by Aboriginal Australians to alleviate aches and pains or colds, while the New Zealand species *L. nuda* was used by the Maori as a body rub and fragrant leaves were worn (Ghisalberti 1998).

## Relevant biology and ecology

Very little is known about the biology and ecology of Cox's leionema. It flowers in September and October, and produces seed in late December (ANBG 2021).

Cox's leionema has been recorded growing in mountainous and often remote areas in steep gullies along creek banks, or on ridges or mountain summits. In the northern Budawangs, it grows in sandy soil along river banks and in steep gorges in wet sclerophyll forest with *Eucalyptus* and *Ceratopetalum* species. At Mt Budawang, it grows in wet sclerophyll forest with *Eucalyptus fraxinoides* (white ash) and an understorey of *Tasmannia lanceolata* (mountain pepperbush) and *Eucryphia moorei* (eastern leatherwood). At the type location at Mount Sugarloaf, it grows on rocky ridges up to exposed mountain tops, in shrubby communities at the junction of *Eucalyptus dendromorpha* (giant mallee ash) forest and *E. baeuerlenii* (Baeuerlen's gum) mallee. In Deua National Park, it grows in wet sclerophyll forest along creek banks or in steep gullies, or in shrubby communities on steep rocky ridges and exposed mountainous areas. In Deua, a few plants were seen in a single deep gully but were subsequently not observed post-fire, although specific searches were not conducted and other gullies in the area were not burnt which suggests that some plants may have escaped the fire (G. Phillips pers. comm. 2021).

Relatively little is known about the biology and ecology of other leionemas. Many species are self-incompatible and/or require insects for pollination, while a few species are bird pollinated (Armstrong 1979; Jusaitis 2000). There are no data available on the reproductive ecology of Cox's leionema, although the clustered, yellow flowers probably indicates insect pollination, possibly by beetles or flies (Armstrong 1979).

*Seed ecology:*

The seed dispersal mechanism is unknown in Cox's leionema, but likely to be localised. Other leionemas typically have initial ballistic seed dispersal from the plant (up to 1 m) followed by secondary ant dispersal (Jusaitis 2000; Auld 2001). In cultivation, complex dormancy requirements make seed germination of Cox's leionema challenging (ANBG 2021). In other leionemas, seed germination is improved by seed scarification followed by soaking in gibberrellic acid (Jusaitis 2000; Martyn et al. 2009). Other Rutaceae found in fire-prone habitats have physiologically dormant seeds with fire-related germination cues, after-ripening and seasonal dormancy (Mackenzie et al. 2021).

In the case of Cox's leionema, there are complex seed dormancy issues, consequently cuttings provide a reasonable method of propagation (ANBG 2021).

*Fire ecology:*

The effects of fire on Cox's leionema are unknown. Most leionemas are obligate seeders that are fire sensitive, i.e. adult plants are killed by hot fires, with a soil seedbank that germinates following fire (Jusaitis 2000; Auld 2001; Clarke et al. 2009). However, at least three species – *L. ralstonii* (Ralston's leionema), *L. carruthersii* (Carruther's leionema) and *L. westonii* (Weston's leionema) – are rhizomatous and re-sprout following low intensity fires but may be killed by high intensity fires (NSW NPWS 2002). Weston's leionema is only known from a single subpopulation in Oxley Wild Rivers National Park which was severely burnt in the 2019-20 fires, and no evidence of regeneration was observed 10-12 months post-fire suggesting that underground rhizomes may have died (NSWSC 2021).

## Habitat critical to the survival

All habitat for this species (see description above) should be considered important for the species' long-term survival.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

## Important populations

In this section, the word population is used to refer to subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation.

All populations of Cox's leionema are important for the long-term recovery and survival of this species.

## Threats

Given the limited available information on the biology and ecology of Cox's leionema, it is difficult to define the major threats and how they may affect the species. Based on inference from related species, inappropriate fire regimes are almost certainly a threat, and it is likely that disease (*Phytophthora cinnamomi* root rot) is also a threat. Climate change is likely to increase the frequency of fires which may impact the species.

**Table 2 Threats impacting Cox's leionema**

| Threat | Status and severity[a] | Evidence |
|---|---|---|
| Habitat disturbance and modification | | |
| Inappropriate fire regimes | • Timing: current<br>• Confidence: suspected<br>• Consequence: severe<br>• Trend: unknown<br>• Extent: across the entire range | Inappropriate fire regimes are likely to be a key threat, although evidence is inferred from related taxa. If, like most other leionemas, Cox's leionema is killed by fire, a short interval between consecutive fires would be a threat as there would be insufficient time for seedlings to reach maturity and replenish the soil seed bank with genetically diverse seeds, leading to population declines or possibly extinctions. Additionally, out-of-season fires (i.e. during cooler months) can lead to delayed and reduced levels of seedling emergence in species with physiologically dormant seeds (Ooi 2007), potentially leading to reduced recruitment and population decline. If, like Weston's leionema, Cox's leionema is rhizomatous, populations could be threatened by fire-drought interactions, high fire severity and high fire frequency. |
| Disease | | |

| | | |
|---|---|---|
| Dieback caused by *Phytophthora cinnamomi* | • Timing: current<br>• Confidence: inferred<br>• Consequence: severe<br>• Trend: unknown<br>• Extent: across the entire range | No data are available on Cox's leionema, but Ralston's leionema is moderately susceptible to *P. cinnamomi* (O'Gara et al. 2005), while other members of the Rutaceae family vary from field resistant (tolerant) to highly susceptible (Barker & Wardlaw 1995; Reiter et al. 2004; O'Gara et al. 2005). The remote location of subpopulations may reduce the likelihood of phytophthora introduction. |
| Climate change | | |
| Increased temperatures, droughts and fire danger weather, and changes in precipitation | • Timing: future<br>• Confidence: observed/projected<br>• Consequence: moderate<br>• Trend: increasing<br>• Extent: across the entire range | In the south-east and tablelands region of NSW, there is a projected increase in minimum and maximum temperatures, the number of hot days (above 35℃), fire danger weather and extreme events (e.g. drought), and changes to precipitation patterns (increased precipitation in autumn and decreased precipitation in spring) (OEH 2014). During 2017-19, south-eastern NSW experienced severe drought (Bureau of Meteorology 2020).<br><br>Drought may cause plant mortality in forest ecosystems, as many plants are vulnerable to drought stress and hydraulic failure (Allen et al. 2010). Drought may be a particular issue for plants which grow at sites with low water holding capacity, e.g. rocky outcrops along ridgetops. However, in these areas the species may be adapted to surviving dry spells; drought-induced dieback was not observed during dry spells in Ralston's leionema, which grows on dry, rocky outcrops in southern NSW (NSW NPWS 2002).<br><br>Following severe drought, catastrophic bushfire conditions resulted in unprecedented, extensive bushfires across Australia in 2019-20. Pre-fire and post-fire droughts are likely to reduce survival and recruitment rates (Burgman & Lamont 1992; Pratt et al. 2014). Climate change may also exacerbate threats posed by inappropriate fire regimes through mechanisms such as interval squeeze (Enright et al. 2015). These fires burnt an estimated 52% of the modelled range of the species, and 97% of herbarium occurrences overlapped with the extent of the fire (Gallagher 2020). Although the fire extent covered most or all subpopulations, it is possible that some plants or subpopulations were |

| | | unburnt, or only burnt at low severity. |
| | | The south-east of NSW is expected to undergo an increase in severe and average Forest Fire Danger Index values, which are used as an indicator of fire risk (OEH 2014). These increases are projected for summer and spring, which represent peak fire risk season (OEH 2014). These changes to fire conditions will likely increase the frequency of bushfires, and may negatively impact Cox's leionema into the future. |

Timing—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 2 in terms of the extent that it is operating on the species. The risk matrix (Table ) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with in-house expertise using available literature.

**Table 3 Cox's leionema risk matrix**

| Likelihood | Consequences | | | | |
| --- | --- | --- | --- | --- | --- |
| | Not significant | Minor | Moderate | Major | Catastrophic |
| Almost certain | Low risk | Moderate risk | Very high risk | Very high risk | Very high risk |
| Likely | Low risk | Moderate risk | High risk **Increased temperatures, droughts and fire danger weather, and changes in precipitation** | Very high risk **Inappropriate fire regimes** | Very high risk |
| Possible | Low risk | Moderate risk | High risk | Very high risk **Phytophthora dieback** | Very high risk |
| Unlikely | Low risk | Low risk | Moderate risk | High risk | Very high risk |
| Unknown | Low risk | Low risk | Moderate risk | High risk | Very high risk |

**Categories for likelihood are defined as follows:**

Almost certain – expected to occur every year

Likely – expected to occur at least once every five years

Possible – might occur at some time

Unlikely – such events are known to have occurred on a worldwide basis but only a few times

Unknown – currently unknown how often the incident will occur

**Categories for consequences are defined as follows:**

Not significant – no long-term effect on individuals or populations

Minor – individuals are adversely affected but no effect at population level

Moderate – population recovery stalls or reduces

Major – population decreases

Catastrophic – population extirpation/extinction

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be 'very high' or 'high'. For those threats with an unknown or low risk outcome it may be more appropriate to identify further research or maintain a watching brief.

# Conservation and recovery actions

## Primary conservation outcome

By 2030, the population of Cox's leionema will have increased in abundance and subpopulations are sustained in habitats in which key threats are managed effectively.

## Conservation and management priorities

### Fire

- Develop and implement a fire management strategy that optimises the survival of Cox's leionema, including:

    – Avoid planned burns in all subpopulations (particularly recently burnt subpopulations), until the fire ecology of the species is better understood.

    – Avoid impacts to subpopulations during fire-fighting operations, or other fire management works, by ensuring accurate location information of the species is available on databases used by the relevant fire management agencies.

### Disease

- Determine the susceptibility of Cox's leionema to *P. cinnamomi* and other plant pathogens.

- Implement a *P. cinnamomi* management plan to ensure it is not introduced into known locations of Cox's leionema and the spread in surrounding areas is limited, if the species is determined to be susceptible. Refer to the threat abatement plan for *P. cinnamomi* (DOEE 2018).

- Ensure that appropriate hygiene protocols are adhered to when entering or exiting the known locations of Cox's leionema, such as those outlined in the *Arrive Clean, Leave Clean* guidelines (C'wealth of Australia 2015).

### Climate change

- Identify and protect habitat likely to remain or become suitable habitat for the species under future climate change scenarios.

### Breeding, seed collection, propagation and other ex situ recovery action

- To manage the risk of losing genetic diversity, undertake appropriate seed collection and storage in appropriate institutions (such as the NSW Plantbank Royal Botanic Gardens Sydney). Best practice seed storage guidelines and procedures should be adhered to, to

maximise seed viability and germinability (refer to Martyn Yenson et al. 2021). Seeds from all major natural subpopulations should be collected and stored.

- If appropriate, undertake ex situ propagation and translocations in accordance with the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander et al. 2018). Translocations should be monitored to document recruitment and show that the translocated subpopulation(s) are self-sustaining and contribute to the conservation of the species.

## Stakeholder engagement/community engagement

- Encourage participation of relevant community groups and Traditional Owners in surveys, monitoring and implementation of conservation actions for the species.

- Liaise with the local community and government agencies to ensure that up-to-date population data and scientific knowledge inform the implementation of conservation actions for this species.

- Inform managers of sites where there are known subpopulations, and consult with these groups regarding options for conservation management and protection of the species.

## Survey and monitoring priorities

- Undertake surveys to improve knowledge of the extent, size and structure of subpopulations.

- Develop and maintain a monitoring program to:

  - document the number of plants in all subpopulations,
  - record responses to future bushfires (particularly the length of the juvenile period and whether the species is an obligate seeder or resprouter),
  - determine trends in population size and distribution,
  - determine threats and their impacts; and
  - monitor the effectiveness of management actions and the need to adapt them if necessary.

- Survey areas of likely habitat for new subpopulations.

## Information and research priorities

- Investigate the basic ecology of the species, including whether it is an obligate seeder or a rhizomatous resprouter, and its method of pollination.

- Identify fire regimes that have a negative effect on plants.

- Improve understanding of germination biology and the factors that influence seedling recruitment.

- Investigate the susceptibility of the species to *P. cinnamomi*.

## Recovery plan decision

A decision about whether there should be a Recovery Plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

# Links to relevant implementation documents

[Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi* (2018)](#)

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# Attachment A: Listing Assessment for *Leionema coxii*

## Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC.

## Assessment of eligibility for listing

This assessment uses the criteria set out in the [EPBC Regulations](#). The thresholds used correspond with those in the [IUCN Red List criteria](#) except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

## Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

**Table 4 Key assessment parameters**

| Metric | Estimate used in the assessment | Minimum plausible value | Maximum plausible value | Justification |
|---|---|---|---|---|
| **Number of mature individuals** | unknown | unknown | unknown | There are no data on population size. The species occurs in remote terrain and is likely more widespread than currently known. Nevertheless, the species was originally known from only one mountain, and in 2021 is still only known from six subpopulations. Descriptions from herbarium collections imply the species is localised at known subpopulations. |
| **Trend** | unknown | | | There is no evidence to determine whether population size is increasing or decreasing or stable. It is possible that the number of mature individuals has declined as a result of the 2019-20 fires which burnt 52 percent of the species' modelled range (Gallagher 2020) including all known subpopulations (Table 1). |
| | | | | Due to the ongoing effects of climate change, the south-east of NSW is expected to undergo an increase in severe and average Forest Fire Danger Index values, which are used as an indicator of fire risk (OEH 2014). These increases are projected for summer and spring, which represent peak fire risk season (OEH 2014). These changes to fire conditions will likely increase the frequency of bushfires, which could lead to a decline in the number of mature indiviuals. |

| Metric | Estimate used in the assessment | Minimum plausible value | Maximum plausible value | Justification |
|---|---|---|---|---|
| **Generation time (years)** | 10–20 years | 5 | >20 | No specific data are available for Cox's leionema. Other leionemas are known to take 5-10 years to reach maturity, e.g. *L. rotundifolium* juvenile period 8 years, *L. dentatum* 5 years (Clarke et al. 2009), *L. equestre* 8 years and *L. hillebrandii* 5 years (Jusaitis 2000). Given the larger size of *L. coxii*, a generation time of 10-20 years seems reasonable. In addition, most of the range of Cox's leionema was not burnt for >50 years prior to the 2019-20 bushfires and therefore plants were likely well established and fairly old. |
| **Extent of occurrence** | 2000–3000 km$^2$ | 1888 km$^2$ | 4000 km$^2$ | Based on herbarium records, the extent of occurrence (EOO) is estimated at 1888 km$^2$. Given the species is found in remote areas that are probably rarely visited by people familiar with the species, the EOO is likely to be larger than this estimate. However, the species appears to be restricted to the Budawang and Deua areas, and based on this, a rudimentary estimate of maximum EOO (performed in GeoCAT) is ~4000 km$^2$. |
| **Trend** | unknown | | | There is no available information on EOO trends. |
| **Area of Occupancy** | 50–100 km$^2$ | <40 km$^2$ | >100 km$^2$ | Based on herbarium records, the area of occupancy is estimated at 48 km$^2$. Given the species is found in remote areas, there are likely to be undiscovered subpopulations and therefore the AOO is likely to be larger than this estimate. However, the species does appear to be localised within its range, suggesting it is unlikely to be widespread. Until further information is available, an estimate of 50–100 km$^2$ is used here. |
| **Trend** | unknown | | | There is no available information on AOO trends. |

| Metric | Estimate used in the assessment | Minimum plausible value | Maximum plausible value | Justification |
|---|---|---|---|---|
| **Number of subpopulations** | 6 | 6 | >10 | As herbarium collections are the only available records for the species, it is difficult to determine how widespread plants are outside these records and therefore which records reflect different subpopulations. Dispersal distances are unlikely to be large in this species, due to the combination of insect pollination and short-range ballistic/ant-mediated dispersal. In this case, herbarium collections separated by >5 km are likely far enough apart to comprise distinct subpopulations. |
| **Trend** | unknown | | | There is no available information on subpopulation trends. |
| **Basis of assessment of subpopulation number** | As herbarium collections are the only available records for the species, it is difficult to determine how widespread plants are outside these records and therefore which records reflect different subpopulations. Dispersal distances are unlikely to be large in this species, due to the combination of insect pollination and short-range ballistic/ant-mediated dispersal. In this case, herbarium collections separated by >5 km are likely far enough apart to comprise distinct subpopulations. | | | |
| **No. locations** | 1–2 | 1 | >3 | Based on current knowledge, inappropriate fire regimes is considered the highest threat. All known subpopulations were burnt during the 2019-20 fires, although there are likely to be unburnt patches (e.g. gully near Mother Woila Mountain containing Cox's leionema was burnt but other unburnt gullies in area noted; Phillips 2021 pers. comm. 29 September). If Cox's leionema is an obligate seeder, then another fire before 2030 may destroy seedlings before they are able to adequately replenish the soil seed bank. On the other hand, if the species is a resprouter, it may have already been impacted by the 2019-20 fires, and another high severity fire may further impact unburnt plants. It is possible, although perhaps unlikely, that a single fire could impact both the northern Budawangs subpopulations and the Deua subpopulations, but it is reasonable to assume single fires could impact all Budawang/Clyde subpopulations and all Deua subpopulations. Therefore, the number of locations has been estimated as 1–2. |
| **Trend** | Unknown | | | There is no available information on location trends. |

| Metric | Estimate used in the assessment | Minimum plausible value | Maximum plausible value | Justification |
|---|---|---|---|---|
| **Basis of assessment of location number** | Based on current knowledge, inappropriate fire regimes are considered the highest threat. All known subpopulations were burnt during the 2019-20 fires, although there are likely to be unburnt patches (e.g. gully near Mother Woila Mountain containing Cox's leionema was burnt but other unburnt gullies in area noted; Phillips 2021 pers. comm. 29 September). If Cox's leionema is an obligate seeder, then another fire before 2030 may destroy seedlings before they are able to adequately replenish the soil seed bank. On the other hand, if the species is a resprouter, it may have already been impacted by the 2019-20 fires, and another high severity fire may further impact unburnt plants. It is possible, although perhaps unlikely, that a single fire could impact both the northern Budawangs subpopulations and the Deua subpopulations, but it is reasonable to assume single fires could impact all Budawang/Clyde subpopulations and all Deua subpopulations. Therefore, the number of locations has been estimated as 1–2. | | | |
| **Fragmentation** | Not considered fragmented. Long distance dispersal of seed unlikely, due to short-range ballistic/ant dispersal. However, given the remote and difficult to access terrain the species occupies, and the large tracts of relatively intact habitat, there are likely to be additional subpopulations between the known subpopulations. The region where the species occurs remains largely intact, thus it is unlikely that habitat clearing has resulted in fragmentation. | | | |
| **Fluctuations** | The number of mature individuals is likely to fluctutate following fire. However, based on available information, it is not possible to determine if the species exhibits extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals – there is no evidence to suggest that any parameter was changed by an order of magnitude by the 2019-20 fires. | | | |

## Criterion 1 Population size reduction

| Reduction in total numbers (measured over the longer of 10 years or 3 generations) based on any of A1 to A4 | | | |
|---|---|---|---|
| | **Critically Endangered Very severe reduction** | **Endangered Severe reduction** | **Vulnerable Substantial reduction** |
| **A1** | ≥ 90% | ≥ 70% | ≥ 50% |
| **A2, A3, A4** | ≥ 80% | ≥ 50% | ≥ 30% |

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a*) *cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

Based on any of the following

(a) direct observation [except A3]
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
(d) actual or potential levels of exploitation
(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

## Criterion 1 evidence
**Insufficient data to determine eligibility**

There are no estimates of population size. Therefore, the Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

**Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy**

| | | **Critically Endangered** <br> **Very restricted** | **Endangered** <br> **Restricted** | **Vulnerable** <br> **Limited** |
|---|---|---|---|---|
| **B1.** | Extent of occurrence (EOO) | **< 100 km²** | **< 5,000 km²** | **< 20,000 km²** |
| **B2.** | Area of occupancy (AOO) | **< 10 km²** | **< 500 km²** | **< 2,000 km²** |
| **AND at least 2 of the following 3 conditions:** | | | | |
| (a) | Severely fragmented OR Number of locations | **= 1** | **≤ 5** | **≤ 10** |
| (b) | Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals | | | |
| (c) | Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals | | | |

## Criterion 2 evidence
### Insufficient data to determine eligibility

Following assessment of the data the Committee has determined that the geographic distribution is restricted, however there are insufficient data available to judge whether there are threats operating that would make the species' geographic distribution precarious for its survival. The species' EOO, AOO and number of locations meets the threshold for Endangered, however there are insufficient data available to suggest continuing decline or extreme fluctuations in any category. Therefore, there is currently insufficient information to determine whether the species has met this required element of this criterion.

However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

## Criterion 3 Population size and decline

| | | Critically Endangered Very low | Endangered Low | Vulnerable Limited |
|---|---|---|---|---|
| Estimated number of mature individuals | | < 250 | < 2,500 | < 10,000 |
| AND either (C1) or (C2) is true | | | | |
| **C1.** An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future) | | Very high rate 25% in 3 years or 1 generation (whichever is longer) | High rate 20% in 5 years or 2 generation (whichever is longer) | Substantial rate 10% in 10 years or 3 generations (whichever is longer) |
| **C2.** An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions: | | | | |
| (a) | (i) Number of mature individuals in each subpopulation | ≤ 50 | ≤ 250 | ≤ 1,000 |
| | (ii) % of mature individuals in one subpopulation = | 90 – 100% | 95 – 100% | 100% |
| (b) Extreme fluctuations in the number of mature individuals | | | | |

# Criterion 3 evidence
**Insufficient data to determine eligibility**

There are no available data on population size. There is no evidence of a decline in the number of mature individuals, or any data on the number of individuals in each subpopulation. Therefore, the Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

**Criterion 4 Number of mature individuals**

| | Critically Endangered Extremely low | Endangered Very Low | Vulnerable Low |
|---|---|---|---|
| **D.** Number of mature individuals | < 50 | < 250 | < 1,000 |
| **D2.**[1] *Only applies to the Vulnerable category*<br>Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time | | | D2. Typically: area of occupancy < 20 km² or number of locations ≤ 5 |

[1] The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the *common assessment method*.

# Criterion 4 evidence
## Insufficient data to determine eligibility

There are no available data on population size. Therefore, the Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

According to the IUCN guidelines, species may qualify for Vulnerable under subcriterion D2 if the area of occupancy is very restricted (typically <20 km²) or exists at typically five or fewer locations, and if there is a plausible natural or anthropogenic threat which may lead the species to become Critically Endangered or Extinct within one or two generations, or three to five years, whichever is longer (IUCN 2019). Therefore, it is possible that the species may meet the criteria for Vulnerable under subcriterion D2, as the number of locations is assessed as one or two, and repeated fires within a short period are a plausible threat which may rapidly (within one or two generations) impact the species. However, given the lack of available data on the species' response to fire, it is not possible to determine whether it would lead to the species becoming Critically Endangered or Extinct within one or two generations.

However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

**Criterion 5 Quantitative analysis**

|  | **Critically Endangered**<br>**Immediate future** | **Endangered**<br>**Near future** | **Vulnerable**<br>**Medium-term future** |
|---|---|---|---|
| **Indicating the probability of extinction in the wild to be:** | ≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.) | ≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.) | ≥ 10% in 100 years |

## Criterion 5 evidence
**Insufficient data to determine eligibility**

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

## Adequacy of survey
The survey effort is not adequate and there is insufficient scientific evidence to support the assessment.

## Version history table

| Document type | Title | Date [dd mm yyyy] |
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