

Rarity or decline: Key concepts for the Red List of Australian eucalypts

Research overview

This project has undertaken a comprehensive review of the conservation status of Australian eucalypts (*Eucalyptus*, *Corymbia* and *Angophora*), including individual assessments of all 822 Australian species. It has been a collaboration between Botanic Gardens Conservation International, Botanic Gardens Australia and New Zealand, the NESP Threatened Species Recovery Hub, and the Australian Government.

Assessments were undertaken against the International Union for the Conservation of Nature (IUCN) Red List criteria. The assessments will inform the global IUCN Red List of Threatened Species and the threatened species listing under Australian legislation. The assessments will be provided to the Commonwealth, state and territory governments at the completion of the project.

A major data source developed during the project was digitised coverages defining the geographic range of each species. The geographic range of each species was intersected with a continental land-use coverage to estimate past population decline. This estimate was then augmented by the habitat preference of each species that was derived from expert elicitation and peer-reviewed literature. Given that vegetation clearance is now regulated by all Australian state jurisdictions, land clearing for agriculture was only

considered to be a cause of past decline in eucalypt populations. Future decline was inferred in areas subject to urbanisation and current or inevitable mineral extraction, or where there was clear evidence of an association between other threatening processes and ongoing population declines, such as die-back and lack of regeneration.

A total of 193 (23%) species were assessed to meet the criteria for listing as threatened, in the Vulnerable, Endangered or Critically Endangered categories. Many species met multiple criteria for listing and at the time of this assessment only two Australian eucalypts were listed as threatened on the IUCN Red list. Of the eucalypt taxa accepted as assessable species in this project, 62 are currently listed as threatened under Australian national environmental law, while 87 species are listed in at least one state jurisdiction.

Under this project, 128 species were assessed as threatened under Criterion A2 only, including 90 as Vulnerable, 36 as Endangered and two as Critically Endangered. Only 13 of these species are currently listed in state or federal legislation. Of the additional 65 species assessed as threatened, 29 as Vulnerable, 22 as Endangered and 14 as Critically Endangered. Thirty-three of these species are currently listed under state or federal legislation. Thirty-two species currently listed under state or

federal legislation were assessed as Near Threatened or Least Concern in this study. An additional 11 currently listed species were assessed as Data Deficient due to uncertain taxonomy.



Eucalyptus macrocarpa. Photo: Malcolm French

Eucalyptus macrocarpa, with the Noongar name of mottlecah, was assessed as Vulnerable under IUCN Criterion A due to population declines of between 30-50%. The species is found on sandy or lateritic soils in the wheatbelt of south-western Western Australia. There has been heavy clearing in this region associated with wheat cropping. Mottlecah is a mallee that grows to 5 m with large blue-grey leaves. The flower buds have a white, waxy surface and open to red blooms that produce large fruits up to 7 cm wide.

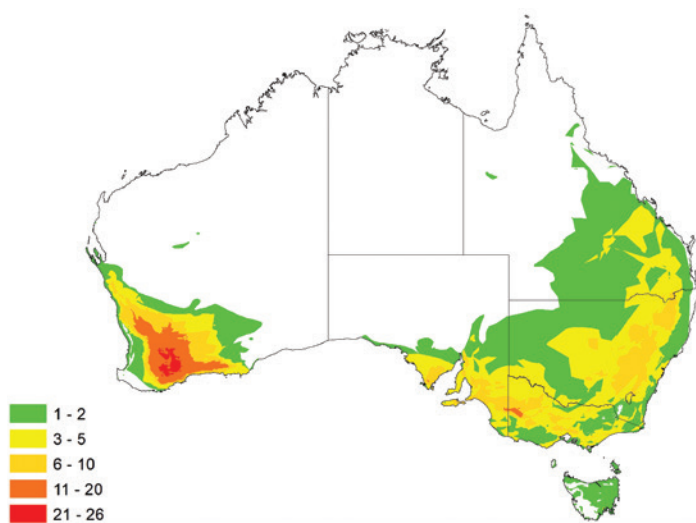


Figure 1: Distribution of eucalypts assessed as threatened under the IUCN criteria.

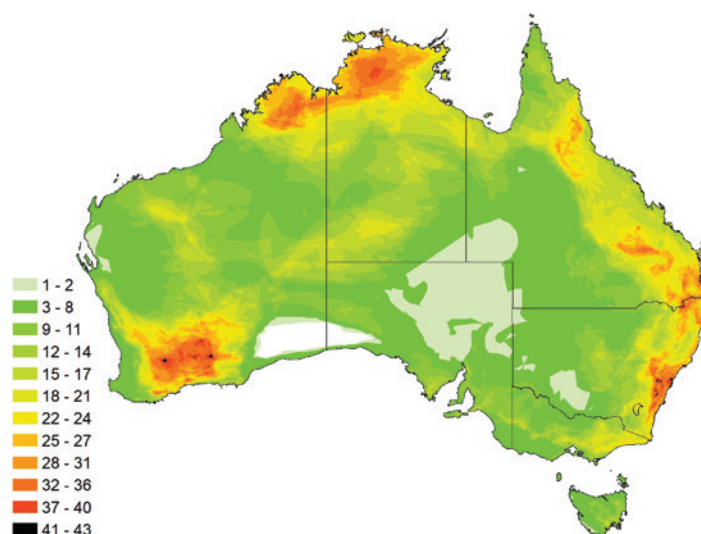


Figure 2: Distribution of eucalypt species richness in Australia.

IUCN Criteria A

A total of 134 eucalypt species were assessed as eligible under IUCN Criterion A2. These species had undergone a past and irreversible population decline of at least 30% over the past 210 years of colonisation. These species are primarily found in the wheat-growing districts of south-western Western Australia, and the Wimmera district of western Victoria and eastern South Australia.

Table 1: Eucalypts assessed as eligible under Criterion A2.

Category	No. of species	Eligible Species
Critically Endangered >80% decline	4	<i>E. foliosa</i> , <i>E. morrisbyi</i> , <i>E. ornans</i> , <i>E. silvestris</i>
Endangered 50-80% decline	38	<i>E. absita</i> , <i>E. aequioptera</i> , <i>E. behriana</i> , <i>E. calycogona</i> , <i>E. cretata</i> , <i>E. cuprea</i> , <i>E. dissimulata</i> , <i>E. dolichorhyncha</i> , <i>E. erythronema</i> , <i>E. forrestiana</i> , <i>E. froggattii</i> , <i>E. fulgens</i> , <i>E. goniocarpa</i> , <i>E. gunnii</i> , <i>E. kitsoniana</i> , <i>E. kondininensis</i> , <i>E. longicornis</i> , <i>E. microcarpa</i> , <i>E. mimica</i> , <i>E. myriadena</i> , <i>E. neutra</i> , <i>E. occidentalis</i> , <i>E. odorata</i> , <i>E. orthostemon</i> , <i>E. peninsularis</i> , <i>E. petiolaris</i> , <i>E. platypus</i> , <i>E. recta</i> , <i>E. rhodantha</i> , <i>E. rigens</i> , <i>E. sargentii</i> , <i>E. spathulata</i> , <i>E. splendens</i> , <i>E. strzeleckii</i> , <i>E. valens</i> , <i>E. woollsiiana</i> , <i>E. wubinensis</i> , <i>E. yarraensis</i>
Vulnerable 30-50% decline	92	<i>E. aggregata</i> , <i>E. albens</i> , <i>E. albida</i> , <i>E. alipes</i> , <i>E. angulosa</i> , <i>E. angustissima</i> , <i>E. annulata</i> , <i>E. arenicola</i> , <i>E. armillata</i> , <i>E. aromaphloia</i> , <i>E. baueriana</i> , <i>E. blakelyi</i> , <i>E. bridgesiana</i> , <i>E. buprestium</i> , <i>E. burracoppinensis</i> , <i>E. cadens</i> , <i>E. cambageana</i> , <i>E. camfieldii</i> , <i>E. captiosa</i> , <i>E. cephalocarpa</i> , <i>E. cladocalyx</i> , <i>E. clivicola</i> , <i>E. cneorifolia</i> , <i>E. conica</i> , <i>E. cyanophylla</i> , <i>E. dawsonii</i> , <i>E. dielsii</i> , <i>E. diminuta</i> , <i>E. diversifolia</i> , <i>E. dumosa</i> , <i>E. extensa</i> , <i>E. falciformis</i> , <i>E. fasciculosa</i> , <i>E. flocktoniae</i> , <i>E. gittinsii</i> , <i>E. glaucina</i> , <i>E. gomphocephala</i> , <i>E. gonicalyx</i> , <i>E. haemastoma</i> , <i>E. halophila</i> , <i>E. hawkeri</i> , <i>E. hebetifolia</i> , <i>E. ignorabilis</i> , <i>E. indurata</i> , <i>E. kartzoffiana</i> , <i>E. kessellii</i> , <i>E. kochii</i> , <i>E. lane-poolei</i> , <i>E. largiflorens</i> , <i>E. latens</i> , <i>E. leptophylla</i> , <i>E. leucoxyton</i> , <i>E. litoralis</i> , <i>E. longifolia</i> , <i>E. loxophleba</i> , <i>E. luemanniana</i> , <i>E. macrocarpa</i> , <i>E. mckieana</i> , <i>E. melliodora</i> , <i>E. merrickiae</i> , <i>E. moderata</i> , <i>E. moluccana</i> , <i>E. nicholii</i> , <i>E. nova-anglica</i> , <i>E. obtusiflora</i> , <i>E. ovata</i> , <i>E. phaenophylla</i> , <i>E. phenax</i> , <i>E. pileata</i> , <i>E. pleurocarpa</i> , <i>E. pluricaulis</i> , <i>E. populnea</i> , <i>E. porosa</i> , <i>E. pyriformis</i> , <i>E. quaerenda</i> , <i>E. risdonii</i> , <i>E. sabulosa</i> , <i>E. salmonophloia</i> , <i>E. sheathiana</i> , <i>E. sporadica</i> , <i>E. squamosa</i> , <i>E. subangusta</i> , <i>E. suggrandis</i> , <i>E. thamnoides</i> , <i>E. tumida</i> , <i>E. uncinata</i> , <i>E. varia</i> , <i>E. vegrandis</i> , <i>E. vesiculosa</i> , <i>E. wandoo</i> , <i>E. wimmerensis</i> , <i>E. xanthonema</i>

Eucalyptus ovata (Swamp Gum) was assessed to be Vulnerable under IUCN Criterion A due to an irreversible population decline of between 30–50%. The species is found on fertile valley bottoms on clay soils in south-eastern Australia. These habitats have been heavily cleared for agriculture. Swamp Gum is a tree to 20 m with rough grey-brown bark and small white flowers.



Eucalyptus ovata. Photo: Krzysztof Ziarnik, Kenraiz, CC BY-SA 4.0 Wikimedia Commons

IUCN Criteria B

The 22 species assessed as eligible under Criterion B are under high risk of future decline due or predominantly due to mining or urbanisation. These species have a narrow geographic range and are subject to threatening processes that occur over a small number of locations. Severe fragmentation was rarely used to assess species under Criterion B, as the associated threats to genetic integrity are often assumed but rarely tested in eucalypt genetic studies.

Table 2: Summary of eucalypts listed under criterion B

Category	No. of species	Eligible Species
Critically Endangered	7	<i>E. carolaniae</i> , <i>E. crenulata</i> , <i>E. imlayensis</i> , <i>E. impensa</i> , <i>E. ornans</i> , <i>E. purpurata</i> , <i>E. yarriambiack</i>
Endangered	9	<i>E. argophloia</i> , <i>E. benthamii</i> , <i>E. johnsoniana</i> , <i>E. kabiana</i> , <i>E. platydisca</i> , <i>E. rhomboidea</i> , <i>E. rugulata</i> , <i>E. splendens</i> , <i>E. stoatei</i>
Vulnerable	6	<i>E. cerasiformis</i> , <i>E. georgei</i> , <i>E. infera</i> , <i>E. jutsonii</i> , <i>E. magnificata</i> , <i>E. steedmanii</i>

IUCN Criteria C

There were 17 species assessed as eligible under Criterion C. These species have both small total populations and sub-population sizes, with ongoing decline. For example, *Eucalyptus johnsoniana* is known from 647 individuals spread over 36 sub-populations the mid-west region of Western Australia and is threatened by mineral extraction.

Table 3: Summary of eucalypts listed under criterion C

Category	No. of species	Eligible Species
Critically Endangered	6	<i>E. beardiana</i> , <i>E. dalveenica</i> , <i>E. imlayensis</i> , <i>E. morrisbyi</i> , <i>E. ornans</i> , <i>E. recurva</i>
Endangered	9	<i>E. aurifodina</i> , <i>E. conglomerata</i> , <i>E. desmondensis</i> , <i>E. johnsoniana</i> , <i>E. nudicaulis</i> , <i>E. paludicola</i> , <i>E. petrensis</i> , <i>E. stoatei</i> , <i>E. synandra</i>
Vulnerable	2	<i>E. jutsonii</i> , <i>E. macarthurii</i>

Interesting findings

Very few tropical eucalypts qualified for listing as threatened and no threatened eucalypts occurred in the Northern Territory. The majority of these species occur in habitats that are not subject to intensive land use.

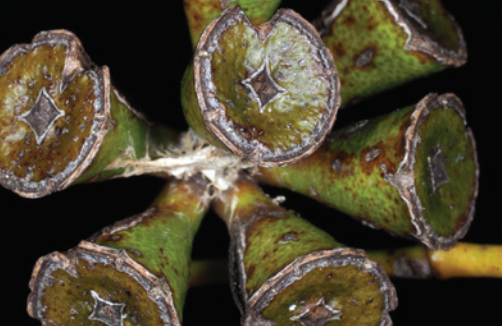
Of the 102 Angophora and Corymbia species, none were assessed as threatened. The majority of these species (82) occur in low productivity habitats that have not been cleared for agriculture. Only two species were found to occur on productive landscapes, although both were widespread and had not undergone significant past decline.

South-western Western Australia was the hotspot for threatened eucalypts. Of the species assessed as threatened, 54% (105) occurred in Western Australia.

No eucalypt species were threatened by timber harvesting.

Too-frequent fire was rarely a threat for eucalypt species. Most eucalypts have adaptive traits that allow post-fire recovery and many occur in low-productivity landscapes where fuel loads do not accumulate rapidly.

This project provides a quantitative method for assessing decline under Criterion A2, with broad relevance for listing threatened species where historic land clearing is the cause of population decline.



Eucalyptus dalveenica (*Dalveen Blue Box*) was assessed to be Critically Endangered under IUCN Criterion C. The species was described in 2019 and there are less than 250 mature individuals. The species grows on clay soils near Dalveen at the Queensland-New South Wales border. These habitats have been heavily cleared for agriculture and pastoralism leaving the species restricted to roadsides and gardens on private property. *Dalveen Blue Box* is a tree to 15 m with flaky grey bark.

Eucalyptus dalveenica. Photo: Tim Collins

IUCN Criteria D

The 36 species that were assessed as eligible under Criterion D are scattered across the southern parts of Australia with hotspots in south-western Western Australia and western Victoria. These species have either small total population sizes or a very restricted geographic range with plausible future population declines.

Table 4: *Eucalypts* assessed as eligible under Criterion D

Category	No. of species	Eligible Species
Critically Endangered <50 mature individuals	7	<i>E. dolorosa</i> , <i>E. filiformis</i> , <i>E. imlayensis</i> , <i>E. morrisbyi</i> , <i>E. ornans</i> , <i>E. recurva</i> , <i>E. walshii</i>
Endangered <250 mature individuals	6	<i>E. absita</i> , <i>E. arcana</i> , <i>E. brevipes</i> , <i>E. elaeophloia</i> , <i>E. erectifolia</i> , <i>E. molyneuxii</i>
Vulnerable	23	<i>E. annettae</i> , <i>E. articulata</i> , <i>E. bensonii</i> , <i>E. brandiana</i> , <i>E. calcicola</i> , <i>E. conferta</i> , <i>E. crucis</i> , <i>E. farinosa</i> , <i>E. fracta</i> , <i>E. halophila</i> , <i>E. jutsonii</i> , <i>E. mcquoidii</i> , <i>E. megacornuta</i> , <i>E. mitchelliana</i> , <i>E. newbeyi</i> , <i>E. nutans</i> , <i>E. praetermissa</i> , <i>E. pumila</i> , <i>E. relictata</i> , <i>E. semota</i> , <i>E. suberea</i> , <i>E. vesiculosa</i> , <i>E. virginea</i>

Species currently listed under Australian legislation

Some eucalypt taxa that are currently listed as threatened under Australian legislation were assessed as Data Deficient under this project due to uncertain taxonomy. These taxa were either highly likely to be hybrids or synonymous with another species. Other currently listed species were assessed as Near Threatened or Least Concern on the basis of decline below the thresholds in the criteria or a lack of evidence to substantiate an association between threats and ongoing population declines. The latter could be considered for formal delisting.

Table 5: *Eucalypts* currently listed as threatened, which were assessed as Data Deficient, Near Threatened or Least Concern

Category	No. of species	Eligible Species
Data Deficient due to uncertain taxonomy	11	<i>E. aquatica</i> , <i>E. canobolensis</i> , <i>E. castrensis</i> , <i>E. copulans</i> , <i>E. crispata</i> , <i>E. forresterae</i> , <i>E. lateritica</i> , <i>E. leprophloia</i> , <i>E. paedoglauca</i> , <i>E. phoenix</i> , <i>E. pruiniramis</i>
Near Threatened	15	<i>A. inopina</i> , <i>C. clandestina</i> , <i>C. leptoloma</i> , <i>C. rhodops</i> , <i>C. xanthope</i> , <i>E. argutifolia</i> , <i>E. boliviana</i> , <i>E. broviniensis</i> , <i>E. dunnii</i> , <i>E. hallii</i> , <i>E. insularis</i> , <i>E. macarthurii</i> , <i>E. mooreana</i> , <i>E. sturgissiana</i> , <i>E. taurina</i>
Least Concern	17	<i>A. robur</i> , <i>C. petalophylla</i> , <i>E. approximans</i> , <i>E. beaniana</i> , <i>E. burdettiana</i> , <i>E. ceracea</i> , <i>E. coronata</i> , <i>E. corticosa</i> , <i>E. langleyi</i> , <i>E. largeana</i> , <i>E. pachycalyx</i> , <i>E. parvula</i> , <i>E. pulverulenta</i> , <i>E. saxatilis</i> , <i>E. scoparia</i> , <i>E. sicilifolia</i> , <i>E. tetrapleura</i>

Further Reading

Fensham, R., Laffineur, B., Collingwood, T., Beech, E., Bell, S., Hopper, H., Phillips, G., Rivers, M., Walsh, N., and White, M. (2020). Rarity or decline: Key concepts for the Red List of Australian eucalypts. *Biological Conservation*. 243 (2020) 108455, <https://doi.org/10.1016/j.biocon.2020.108455>

Further Information

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