

# Threatened Species Assessment

## *Eucalyptus hawkeri* Arapiles Peppermint-box

### Taxonomy

#### *Eucalyptus hawkeri* Rule

Prior to its formal description in 2004, the taxon was listed as *Eucalyptus* aff. *wimmerensis* (Mt Arapiles) in the seventh edition of *A Census of the Vascular Plants of Victoria* (Ross and Walsh 2003) and as *Eucalyptus* sp. aff. *odorata* (Mt Arapiles) in the *Advisory List of Rare or Threatened Plants in Victoria* (DSE 2005) (Rule 2005).

### Current conservation status

Categorised as Vulnerable in the 2014 Advisory list of rare or threatened flora (DEPI 2014).

### Proposed conservation status

Endangered in Australia

Criteria A2bcde+3cde+4bcde; B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v); C1

### Species Information

#### Description and Life History

The taxon is a mallee or slender tree to 15 m tall; bark rough, dark grey-brown, box-type, extending to mid-trunk, smooth above. Juvenile leaves petiolate, alternate, narrowly lanceolate to narrowly elliptic, to 12 cm long, 1.8 cm wide, slightly discolorous, dull, blue-green or somewhat glaucous; adult leaves petiolate, alternate, narrowly lanceolate or lanceolate, sometimes falcate, 7-12 cm long, 0.8-1.7 cm wide, glossy, olive-green, sometimes slightly bluish; side veins acute; reticulation dense with numerous, large, irregular island and intersectional oil glands. Inflorescences axillary, simple; peduncles to 1.1 cm long, 7-11-flowered; buds pedicellate, ovoid or fusiform, to 0.7 cm long, 0.4 cm diam., often glossy, no scar; operculum conical; stamens irregularly inflexed; anthers adnate, globoid; ovules in 4 vertical rows; flowers white. Fruit pedicellate, subcylindrical or barrel-shaped, to 0.7 cm long, 0.4(-0.5) cm diam.; disc descending; valves 3 or 4, below rim; seed dark brown, ovoid and slightly flattened, surface finely reticulate, helium ventral. Flowers in autumn (VicFlora 2018). Apparently hybridises with *E. microcarpa* where these two taxa co-occur.

#### Generation Length

The generation length of *Eucalyptus hawkeri* is inferred to be 60 to 150 years. It is estimated to lie within the range of 40-100 years or more with a best estimate of at least 60 years, based on field observations of apparently mature trees that are estimated to be 40-60 years old. The biology of the taxon has not been investigated, and the observed age structure of the type population is likely to be an artefact of a long history of physical site disturbance, particularly on the northern fringes of the Arapiles massif, and possibly also the imposition of modified fire and grazing regimes. Adult plants of mallee form are likely to have resprouted repeatedly from the lignotuber following successive bushfires, grazing, or clearing, and their true age is likely to greatly exceed the age of the current crowns (Rule 2005).

#### Distribution

The taxon is apparently restricted to areas of remnant woodland around Mt Arapiles (e.g. Mt Arapiles-Toonan State Park and Nurcough Flora Reserve) (VicFlora 2018), where it is scattered around the northern, south-western and southern bases of the mountain, rising to 230 m above sea level on the north-western escarpment, and with a now

fragmented extension to the southern edge of Mitre Rock to the north (Rule 2004; 2005). A small outlier population occurs at Jane Duff Reserve, on the north side of the Natimuk-Frances Road in the Nurcoung district, approximately 8 km to the west of Mt. Arapiles (Rule 2004). Mt Arapiles is located in the Tooan East district, 10 km west of Natimuk and 34 km west of Horsham.

## Habitat

The taxon occurs in pure stands, and forms woodland communities with *E. leucoxylon* subsp. *stephaniae*, and *E. macrocarpa*, and abuts stands of *E. largiflorens* when adjacent to poorly drained, lower sites. It also occurs in mallee communities where it mixes with variants of *E. wimmerensis*, *E. phenax*, *E. costata* subsp. *murrayana*, *E. macmahonii* and *E. leptophylla* (Rule 2004).

The taxon occurs, often as the dominant eucalypt, in stands of Shallow Sands Woodland on shallow soils overlying sandstone. It occurs mostly at the foot of a prominent escarpment, occasionally scaling the escarpment to an elevation of 100 m above the surrounding plain (Rule 2004; 2005). At the type location, the taxon occurs at the interface between the Wimmera bioregion (at lower elevations) and a highly disjunct outlier of the Greater Grampians bioregion (at higher elevations), whilst the outlying population at Nurcoung occurs within the Wimmera bioregion (DSE FIS 2005; Rule 2005). The annual rainfall of nearby Horsham is approximately 500 mm, most of which falls in winter (Rule 2004).

## Threats

The taxon is relatively abundant around the northern, north-western, western and south-western bases of Mt. Arapiles. The survival of these stands appears secure with the park's current management regime, however, the few stands and individuals which exist outside the park may be vulnerable to further clearing (Rule 2004).

Historically, the taxon is inferred to have suffered significant decline and possibly also local extinction through habitat loss, particularly through clearing for grazing and cropping, although the extent of this decline is undocumented. Circumstantial evidence is provided by a comparison of 1750 and extant Ecological Vegetation Class (EVC) mapping (DSE CGDL 2006), which indicates that the most favourable habitat, Shallow Sands Woodland, has been greatly depleted in the Tooan and Nurcoung districts, and is now listed as a vulnerable EVC (DSE EVC 2006) in both the Wimmera and Greater Grampians bioregions (Rule 2005).

Some stands, particularly around the northern perimeter of Mt Arapiles, appear to have been scalped in the past for gravel extraction, resulting in soil erosion, weed invasion, floristic simplification of the native vegetation, and an unnaturally dense "whipstick" mallee growth form in the dominant eucalypts. Whilst this practice has ceased within the Mount Arapiles-Tooan State Park, the vegetation will require several generations of natural recruitment to regain a more natural age class structure (Rule 2005).

The imposition of unfavourable fire regimes is considered the greatest long-term threat to the survival of the taxon. Forests in state parks and reserves are routinely subjected to planned burns, which have the potential to suppress or eliminate seedling recruitment. If such regimes are maintained for more than a single generation, affected populations may be threatened with local extinction, particularly if the fire interval is shorter than the time required for seedling recruits to attain reproductive maturity (Rule 2005). In the longer term, habitat modification resulting from climate change and associated changes in the prevailing fire regime may exacerbate this threat. Specifically, the likely increase in the frequency of intense bushfire as a result of global warming is likely to increase the risk of repeat fires at short intervals (Rule 2005).

Habitat degradation, as a result of habitat fragmentation and edge effects such as exposure to herbicides and pesticides, rabbit browsing, stock grazing, and weed invasion, is an ongoing threat, particularly to those stands on roadsides and on freehold farmland, and may lead to recruitment failure in these most vulnerable stands (Rule 2005). Mature individuals directly abutting roads and tracks may be threatened by roadworks and future road realignment (Rule 2005), and by firewood collection, particularly as Mt Arapiles attracts large numbers of visitors, many of whom camp on-site for very extended periods in the pursuit of high quality rock climbing experiences (Rule 2005).

### IUCN Criteria

Criterion A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p> <p style="text-align: center;"><i>based on any of the following:</i></p> <ul style="list-style-type: none"> <li>(a) direct observation [except A3]</li> <li>(b) an index of abundance appropriate to the taxon</li> <li>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</li> <li>(d) actual or potential levels of exploitation</li> <li>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</li> </ul>			

### Evidence:

#### Eligible under Criterion A2 as Endangered

The population reduction over the past 180 to 450 years is inferred to be 50 to 75%, based on (b), (c), (d) and (e) above.

Past decline is based on extensive clearing for agricultural cropping across much of the western Wimmera, noting 6 of the 10 subpopulations are in small isolated habitat fragments on roadsides in cleared agricultural landscapes or on freehold land.

The causes of the reduction may not have ceased, be understood or be reversible.

#### Eligible under Criterion A3 as Endangered

The population reduction over the next 100 years is projected to be 30 to 75% (midpoint 50%), based on (c), (d) and (e) above.

Future decline is based on current and projected threats, which include the imposition of unfavourable fire regimes and, in particular, the risk of repeat fire events, climatic drying and warming which are likely to increase the risk of repeat fires at short intervals. Subpopulations in fragmented landscapes are also threatened by habitat degradation and fragmentation, edge effects including exposure to herbicides and pesticides, rabbit browsing, stock grazing, and weed invasion which may lead to recruitment failure, particularly to stands on roadside and freehold farm land. Some sites are also threatened by road works and firewood collection, particularly at Mt Arapiles.

#### Eligible under Criterion A4 as Endangered

# *Eucalyptus hawkeri* Arapiles Peppermint-box

The population reduction over any 180 to 450 year period, including both past and future (up to 100 years in the future), is inferred to be 50 to 75%, based on (b), (c), (d) and (e) above. The causes of reduction may not have ceased, be understood or be reversible.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy)			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
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			

## Evidence:

### Eligible under Criterion B1 as Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 342 km<sup>2</sup>, based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented naturally and anthropogenically at the landscape scale, with negligible capacity to recolonise in the event of local extinction since the taxon has no special adaptation for long-distance dispersal.

It is estimated to have 2 locations, and has a continuing decline in (i), (ii), (iii), (iv) and (v) above, based on current and future threats.

### Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 40 km<sup>2</sup>, based on accepted, post-1970 records from the VBA. As above, the taxon is severely fragmented, has 2 locations, and has a continuing decline in (i), (ii), (iii), (iv) and (v) above.

# Eucalyptus hawkeri

## Arapiles Peppermint-box

Criterion C. Small Population size and decline		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND 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			

### Evidence:

#### Eligible under Criterion C1 as Endangered

It is estimated that there are 1,280 to 2,000 mature individuals, based on field-based estimates of population size of each subpopulation. There is estimated to be a continuing decline of 30 to 75% (midpoint 50%) within 2 generations.

Criterion D. Very small or restricted populations		Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)		< 50	< 250	< 1,000
D2. Only applies to the VU category 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: AoO < 20 km <sup>2</sup> or number of locations ≤ 5

### Evidence:

#### Eligible under criterion D as Vulnerable

The taxon is estimated to be very restricted.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

### References

DEPI (2014). *Advisory list of rare or threatened plants in Victoria - 2014*. Department of Environment and Primary Industries, Melbourne. Retrieved from: [https://www.environment.vic.gov.au/\\_\\_data/assets/pdf\\_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf](https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf)



# *Eucalyptus hawkeri* Arapiles Peppermint-box

DSE (2005). *Advisory list of rare or threatened plants in Victoria - 2005* Department of Sustainability and Environment, Melbourne

Rule, K. (2004). New taxa in Eucalypts (Myrtaceae) for Victoria and notes on Victorian populations of *Eucalyptus calycogona*. *Muelleria*, 20, 9-32.

Rule, K.J. (2005). Species Information Sheet - *Eucalyptus hawkeri*. Species Profile and Threat Database.

VicFlora (2018). Flora of Victoria Royal Botanic Gardens Victoria: *Eucalyptus hawkeri*. Retrieved from: <https://vicflora.rbg.vic.gov.au/flora/taxon/dd3b0938-2505-4974-9f73-8d5d0749893b>

Walsh, N.G and Ross, J.H. (2003). *A census of the vascular plants of Victoria*. South Yarra, Vic: National Herbarium of Victoria, Royal Botanic Gardens Victoria