

Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion as a CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY in Part 1 of Schedule 2 of the Act and, as a consequence, to omit reference *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion from Part 2 of Schedule 2 (Endangered Ecological Community) of the Act. Listing of Critically Endangered Ecological communities is provided for by Part 4 of the Act.

This determination contains the following information:

- Parts 1 & 2:** Section 1.6 of the Act defines an ecological community as “an assemblage of species occupying a particular area”. These features of *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion are described in Parts 1 and 2 of this Determination, respectively.
- Part 3:** Part 3 of this Determination describes the eligibility for listing of this ecological community in Part 1 of Schedule 2 of the Act according to criteria as prescribed by the *Biodiversity Conservation Regulation 2017*.
- Part 4:** Part 4 of this Determination provides additional information intended to aid recognition of this community in the field.

Part 1. Assemblage of species

- 1.1 *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion (hereafter referred to as *Melaleuca armillaris* Tall Shrubland) is characterised by the assemblage of species listed below.

<i>Breynia oblongifolia</i>	<i>Cayratia clematidea</i>
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	<i>Commelina cyanea</i>
<i>Crassula sieberiana</i>	<i>Dichelachne micrantha</i>
<i>Dichondra repens</i>	<i>Digitaria parviflora</i>
<i>Einadia hastata</i>	<i>Eragrostis leptostachya</i>
<i>Eucalyptus tereticornis</i>	<i>Geitonoplesium cymosum</i>
<i>Glycine clandestina</i>	<i>Hydrocotyle sibthorpioides</i>
<i>Indigofera australis</i>	<i>Leucopogon juniperinus</i>
<i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	<i>Microlaena stipoides</i>
<i>Oplismenus imbecillis</i>	<i>Pellaea falcata</i>
<i>Plectranthus parviflorus</i>	<i>Poa labillardierei</i> var. <i>labillardierei</i>
<i>Rytidosperma longifolium</i>	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>
<i>Sporobolus creber</i>	<i>Themeda triandra</i>
<i>Veronica plebeia</i>	<i>Xerochrysum bracteatum</i>
<i>Zieria granulata</i>	

NSW Threatened Species Scientific Committee

- 1.2 The total species list of the community across all occurrences is likely to be considerably larger than that given above. Due to variation across the range of the community, not all of the above species are present at every site and many sites may also contain species not listed above (see section 4).

Characteristic species may be abundant or rare and comprise only a subset of the complete list of species recorded in known examples of the community. Some characteristic species show a high fidelity (are relatively restricted) to the community, but may also occur in other communities, while others are more typically found in a range of communities.

The number and identity of species recorded at a site is a function of sampling scale and effort. In general, the number of species recorded is likely to increase with the size of the site and there is a greater possibility of recording species that are rare in the landscape.

Species presence and relative abundance (dominance) will vary from site to site as a function of environmental factors such as soil properties (chemical composition, texture, depth, drainage), topography, climate and through time as a function of disturbance (e.g. fire, logging, grazing) and weather (e.g. flooding, drought, extreme heat or cold).

At any one time, above ground individuals of some species may be absent but the species may be represented below ground in the soil seed bank or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers.

The species listed above are vascular plants, however the community also includes micro-organisms, fungi and cryptogamic plants as well as vertebrate and invertebrate fauna. These components of the community are less well documented.

Part 2. Particular area occupied by the ecological community

- 2.2 The assemblage of species listed in Part 1.1 above which characterises *Melaleuca armillaris* Tall Shrubland occurs within the Sydney Basin Bioregion. This Bioregion is defined by SEWPaC (2012) Interim Biogeographic Regionalisation for Australia, Version 7. Department of Sustainability, Environment, Water, Population and Communities.
<http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/maps.html>
- 2.3 It is the intent of the NSW Threatened Species Scientific Committee that all occurrences of the ecological community (both recorded and as yet unrecorded, and independent of their condition) that occur within this bioregion be covered by this Determination.

Part 3. Eligibility for listing

- 3.1 *Melaleuca armillaris* Tall Shrubland was listed as an Endangered Ecological Community under the Threatened Species Conservation (TSC) Act 1995 in 2002 under the name *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion and was subject to a minor amendment in 2011. The NSW Threatened Species Scientific Committee has undertaken a new conservation assessment of this Ecological Community using IUCN criteria as required under the Biodiversity Conservation Act 2016.
- 3.1.1 *Melaleuca armillaris* Tall Shrubland has undergone a large reduction in geographic distribution; based on ELA (2007), Tozer *et al.* (2010) and DRNSW (2018) it is estimated that less than 30 % of its original area remains. Remnants are typically small, isolated, fragmented and occur in a predominantly cleared landscape (OEH 2016).
Melaleuca armillaris Tall Shrubland occurs on ridgetops on shallow rocky volcanic soil derived from Bumbo Latite. Clearing for agriculture in the Kiama/Albion Park area started in the mid nineteenth century, and quarrying started around 1880 (Shellharbour City Council 2020). A significant part of the land in this area currently quarried for blue metal is likely to have supported *Melaleuca armillaris* Tall Shrubland due to the community's affinity for this geology. Clearing of *Melaleuca armillaris* Tall Shrubland is likely to continue due to its occurrence on a valuable mineral resource. Approximately 60 ha (30 % of the remaining area) of *Melaleuca armillaris* Tall Shrubland occurs on land identified as containing mineral resources of State and regional significance under section 117 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (OEH 2016; DPIE 2014).
- 3.1.2 The geographic distribution of *Melaleuca armillaris* Tall Shrubland is very highly restricted. The best estimate of the area of occupancy (AOO) is 100 km² based on a single 10 x 10 km grid cell (with a minimum of 1 % occupied by the Community), the scale recommended for assessing AOO by IUCN (2016). The best estimate of the extent of occurrence (EOO) is 65 km², based on a minimum convex polygon enclosing likely occurrences of the community, although this estimate must be raised to 100 km² in order to conform with the requirement that EOO is not less than AOO as recommended by IUCN (Bland *et al.* 2017).
- 3.1.3 *Melaleuca armillaris* Tall Shrubland is subject to threatening processes that have caused severe declines in biotic processes and interactions throughout its range and are likely to cause continuing decline in the future.
- 3.1.4 Weeds detrimentally affect *Melaleuca armillaris* Tall Shrubland by competition for light, water and nutrients. *Lantana camara* is particularly detrimental to the community because it forms dense thickets, out-competing small plants for light and water and prevents recruitment of over-storey plants. Invasion, establishment and spread of Lantana (*Lantana camara*) has been listed in Schedule 3 of the BC Act as a key threatening process. Lemmon (in litt. 2019) reports the following key weed species as adversely impacting the community: *Lantana camara*, *Ehrharta erecta*, *Stenotaphrum secundatum*, *Bidens pilosa*,

NSW Threatened Species Scientific Committee

Opuntia sp., *Olea europaea* subsp. *cuspidata*, *Tagetes minuta*, *Passiflora subpeltata*, *Solanum mauritianum*, *Chrysanthemoides monilifera*, *Melinis repens*, *Phytolacca octandra*, *Solanum nigrum*, *Conyza* sp., *Senna pendula*, *Sida rhombifolia*, *Verbena bonariensis*, *Delairea odorata*, *Galinsoga parviflora*, *Senecio madagascariensis*, *Ochna serrulata* and *Araujia sericifera*. The opportunistic Australian species *Acacia longifolia* appears to exploit conditions of low competition in areas disturbed by mining and may rapidly dominate those areas to the exclusion of other species. Although *A. longifolia* may occur naturally within the community, the state in which it is dominant appears to be unnatural, and indicative of decline due to biotic processes.

- 3.1.5 Grazing and trampling by cattle, goats, rabbits and deer have been identified as threats to *Melaleuca armillaris* Tall Shrubland (Lemmon in litt. 2019). The wallaroo (*Macropus robustus*) and swamp wallaby (*Wallabia bicolor*) have been recorded from remnants in the Dunmore area (Gaia Research 2009 in DECCW 2011) and may, in combination with introduced herbivores, be contributing to decline due to unsustainable levels of herbivory. Grazing and trampling cause losses of plant species and structural diversity and consequent changes in community composition by favouring resilient species. 'Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus* (L.)' is listed as a Key Threatening Process under the Act.
- 3.1.6 In recent years, significant dieback of canopy species within *Melaleuca armillaris* Tall Shrubland has been observed (Lemmon in litt. 2019). The recent, prolonged drought exacerbated by shallow soils with a low available water content, is a likely cause of this phenomenon. The Southern Slopes climate projection region in which *Melaleuca armillaris* Tall Shrubland occurs has shown a drying trend in rainfall since 1960, especially in autumn (Grose *et al.* 2015; BOM / CSIRO 2018). In the future, droughts affecting *Melaleuca armillaris* Tall Shrubland are likely to be more frequent, of longer duration and more severe (Grose *et al.* 2015). Cumulative losses of overstorey species over successive drought events are likely because the re-establishment of a mature canopy is likely to require a decadal time scale. In the absence of an overstorey, the community is exposed to an increased risk of weed invasion which, unless controlled, could render structural changes irreversible.
- 3.1.7 DECCW (2011) reported that "no fires have occurred in the study area for many decades, and oral history indicates that the last major fire was in 1972". The Threatened Species Hazard Reduction List (RFS 2004) records that *Melaleuca armillaris* Tall Shrubland requires a minimum fire interval of at least 10 years. *Melaleuca armillaris* is killed by fire; seeds are held in woody capsules and released after the death of the branchlet (Benson and McDougall 1998). No information is available on the effect of long periods without fire. A long period without fire might facilitate replacement by another community, such as Illawarra Complex Dry Rainforest (PCT 3077) which also favours shallow soils on basalt ridges in the area (OEH 2016). Given the small area covered by *Melaleuca armillaris* Tall Shrubland, and that it exists in small areas of native vegetation surrounded by agriculture, fire is likely to be excluded from the community throughout its range which may facilitate such a transition.

NSW Threatened Species Scientific Committee

3.1.8 Areas of *Melaleuca armillaris* Tall Shrubland have been degraded by the dumping of waste and off-road vehicle access (DECCW 2011).

3.1.9 Defoliation of *Melaleuca armillaris* by insects has not been observed within *Melaleuca armillaris* Tall Shrubland, however Hadlington and Johnston (1996) report that Sawfly larvae (*Pterygophorus* spp., *Lophyrotoma* spp.) can cause considerable defoliation of *Melaleuca armillaris*. The Australian Museum (2019) describe the foraging habits of the commonly occurring Long-tailed Sawfly (*Pterygophorus facielongus*) larvae: “One of their favourite food plants is *Melaleuca armillaris*. At first the small larvae skeletonise leaves. The larger larvae eat whole leaves and can strip all the leaves from the top of the crown, feeding during both day and night”. *Melaleuca armillaris* Tall Shrubland is vulnerable to insect attack because its remnants are fragmented and isolated which results in lower numbers of birds and mammals capable of controlling insect outbreaks.

3.2 Criteria for listing

Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion is eligible to be listed as a Critically Endangered Ecological Community in accordance with Part 4 of the Act as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate future, as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Appendix 1

Assessment against Biodiversity Conservation Act criteria

The Clauses used for assessment are listed below for reference.

Clause 4.9 – Reduction in geographic distribution of ecological community (Equivalent to IUCN criterion A)

Assessment Outcome: Endangered under Clause 4.9 (b)

The ecological community has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of its component species:		
(a)	for critically endangered ecological communities	a very large reduction in geographic distribution
(b)	for endangered ecological communities	a large reduction in geographic distribution
(c)	for vulnerable ecological communities	a moderate reduction in geographic distribution

NSW Threatened Species Scientific Committee

Clause 4.10 - Restricted geographic distribution of ecological community (Equivalent to IUCN criterion B)

Assessment Outcome: Critically Endangered under Clause 4.10 (a)(d i, ii, iii)(e)(fi)

The ecological community's geographic distribution is:			
	(a)	for critically endangered ecological communities	very highly restricted.
	(b)	for endangered ecological communities	highly restricted.
	(c)	for vulnerable ecological communities	moderately restricted.
and at least 1 of the following conditions apply:			
	(d)	there is a projected or continuing decline in any of the following:	
		(i)	a measure of spatial extent appropriate to the ecological community,
		(ii)	a measure of environmental quality appropriate to characteristic biota of the ecological community,
		(iii)	a measure of disruption to biotic interactions appropriate to characteristic biota of the ecological community,
	(e)	There are threatening processes that are likely to cause continuing decline in either geographic distribution, environmental quality or biotic interactions within the near future,	
	(f)	The ecological community exists at:	
		(i)	for critically endangered ecological communities an extremely low number of locations.
		(ii)	for endangered ecological communities A very low number of locations.
		(iii)	For vulnerable ecological communities A low number of locations.

Clause 4.11 – Environmental degradation of ecological community (Equivalent to IUCN criterion Clause C)

Assessment Outcome: Data Deficient under Clause 4.11

The ecological community has undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large degree of environmental degradation.
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions.
	(c)	for vulnerable ecological communities	a moderate degree of environmental degradation.

NSW Threatened Species Scientific Committee

Clause 4.12 – Disruption of biotic processes or interactions in ecological community

(Equivalent to IUCN criterion D)

Assessment Outcome: Data Deficient under Clause 4.12

The ecological community has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large disruption of biotic processes or interactions
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions
	(c)	for vulnerable ecological communities	a moderately large disruption of biotic processes or interactions

Clause 4.13 – Quantitative analysis of probability of collapse of ecological community

(Equivalent to IUCN criterion E)

Assessment Outcome: Data deficient under Clause 4.13

The probability of collapse of the ecological community is estimated to be:			
	(a)	for critically endangered species	extremely high
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions
	(c)	for vulnerable species	high

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Part 4. Additional information about the ecological community

The following information is additional to that required to meet the definition of an ecological community under the Act. It is provided to assist in the recognition of *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion (hereafter referred to as *Melaleuca armillaris* Tall Shrubland) in the field. Given natural variability, along with disturbance history, *Melaleuca armillaris* Tall Shrubland may sometimes occur outside the typical range of variation in the features described below.

- 4.3 *Melaleuca armillaris* Tall Shrubland is characteristically dominated by an often dense canopy of the shrub *Melaleuca armillaris*, up to about 5 m high. A low shrub layer often includes *Leucopogon juniperinus* and *Breyntia oblongifolia*, while *Zieria granulata* and *Indigofera australis* are less common. The ground strata have usually been found to include *Microlaena stipoides*, *Plectranthus parviflorus*, *Rytidosperma longifolium*, *Poa labillardierei* var. *labillardierei*, *Cheilanthes sieberi* subsp. *sieberi*, *Commelina cyanea*, *Eragrostis leptostachya*, *Oplismenus imbecillis*, *Xerochrysum bracteatum*, *Cayratia clematidea*, *Sigesbeckia orientalis* subsp. *orientalis*, *Crassula sieberiana*,

NSW Threatened Species Scientific Committee

Einadia hastata, *Glycine clandestina* and *Pellaea falcata*. Other common herbs and grasses include *Dichondra repens*, *Digitaria parviflora*, *Hydrocotyle sibthorpioides*, *Themeda triandra*, *Veronica plebeia*, *Dichelachne micrantha*, *Geitonoplesium cymosum* and *Sporobolus creber*. *Eucalyptus tereticornis* has been recorded in the community at some sites.

- 4.4 *Melaleuca armillaris* Tall Shrubland is known from ridgetops on shallow rocky volcanic soil with outcropping Bumbo Latite. It has been found in the Dunmore, Jamberoo, Shell Cove and Kiama areas within the Kiama and Shellharbour LGAs. Most remnants of *Melaleuca armillaris* Tall Shrubland occur at an altitude of between 40 m and 150 m (OEH 2016, USGS 2000). Rainfall at the locations of samples of the community ranges from 1300mm – 1500mm approx (DPIE 2020a).
- 4.5 *Melaleuca armillaris* Tall Shrubland is partially equivalent to HL p46 (Basalt Hilltop Scrub) of Tozer *et al.* (2010). The analysis by Tozer *et al.* (2010) of their three sites classified as Basalt Hilltop Scrub included a single depauperate site near Milton which has been excluded from the group of sites comprising *Melaleuca armillaris* Tall Shrubland in analysis by DPIE (2020b). Areas of well drained shallow rocky volcanic soil with outcropping Milton Monzonite near Milton support a community structurally similar to *Melaleuca armillaris* Tall Shrubland, however they are dominated by *Kunzea ambigua*, with *Melaleuca armillaris* absent. These areas are not considered to be part of *Melaleuca armillaris* Tall Shrubland.

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NSW Threatened Species Scientific Committee

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NSW Threatened Species Scientific Committee

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