

NSW Threatened Species Scientific Committee

Conservation Assessment of *Melaleuca armillaris* Tall Shrubland

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***Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion**

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed

Current NSW BC Act Status: Endangered

Proposed listing on NSW BC Act and EPBC Act: Critically Endangered

Conservation Advice: *Melaleuca armillaris* Tall Shrubland

Summary of Conservation Assessment

Melaleuca armillaris Tall Shrubland was found to be eligible for listing as Critically Endangered under Criterion B1a(i, ii, iii)bc +B2a(i, ii, iii)bc

The main reasons for this community being eligible are i) very highly restricted geographical range; ii) continuing decline in area due to clearing, iii) dieback due to drought, and the likelihood of continued and more severe drought in the future; iv) grazing and trampling by domestic and feral animals; and v) competition by weeds.

Description and Syntaxonomy

Melaleuca armillaris Tall Shrubland is equivalent to Paperbark Tall Shrubland (map unit 5.1) described by Kevin Mills & Associates (2001) as "...a dense, tall and dry shrubland dominated by the large shrub species Bracelet Honey-myrtle *Melaleuca armillaris*". Other co-occurring species are *Dodonaea viscosa*, *Cheilanthes sieberi* and *Plectranthus graveolens* (Kevin Mills & Associates 2001).

In a draft analysis by DPIE (2020b), a group of 7 sites from the Dunmore area corresponding to *Melaleuca armillaris* Tall Shrubland has been identified as Plant Community Type 3872, Illawarra Basalt *Melaleuca* Scrub. Fidelity analysis from DPIE (2020b) has been used as the basis for the following description of *Melaleuca armillaris* Tall Shrubland. *Melaleuca armillaris* Tall Shrubland is characteristically dominated by an often dense canopy of the shrub *Melaleuca armillaris*, up to approximately 5 m high. A low shrub layer often includes *Leucopogon juniperinus* and *Breynia 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*, *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* occurs occasionally in the community.

The following were found to be diagnostic species (group frequency much higher than non-group frequency) for this small dataset of 7 sites (DPIE 2020b): *Melaleuca*

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armillaris subsp. *armillaris*, *Leucopogon juniperinus*, *Microlaena stipoides*, *Rytidosperma longifolium*, *Plectranthus parviflorus*, *Poa labillardierei* var. *labillardierei*, *Breynia oblongifolia*, *Cheilanthes sieberi* subsp. *sieberi*, *Commelina cyanea*, *Eragrostis leptostachya*, *Oplismenus imbecillis*, *Xerochrysum bracteatum*, *Cayratia clematidea* and *Sigesbeckia orientalis* subsp. *orientalis*.

Melaleuca armillaris Tall Shrubland is partially equivalent to HL p46 (Basalt Hilltop Scrub) of Tozer *et al.* (2010). The Tozer *et al.* (2010) analysis of their three sites classified as Basalt Hilltop Scrub included a single depauperate site near Milton which has now been excluded from the group of sites comprising *Melaleuca armillaris* Tall Shrubland in analysis by DPIE (2020b) and this site is no longer considered to be a part of the community. 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. Stands of *Melaleuca armillaris* occur in other locations within NSW such as on volcanic soils on headlands in the Port Stephens area and on limestone in the Bendethera area. These stands are not included within *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion.

Distribution and Abundance

Melaleuca armillaris Tall Shrubland has been found in the Dunmore, Jamberoo, Shell Cove and Kiama areas within the Kiama and Shellharbour LGAs.

The extent of *Melaleuca armillaris* Tall Shrubland remaining is estimated to be between 200 ha (OEH 2016) and 276 ha (DPIE 2020c).

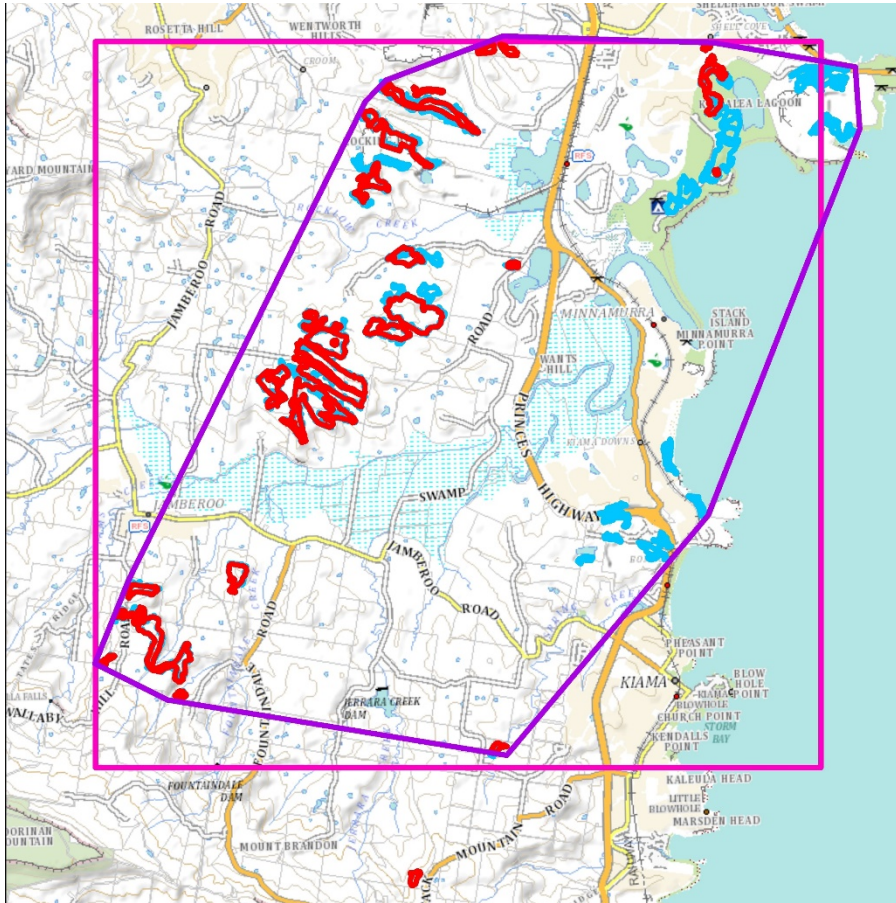


Figure 1. Distribution of *Melaleuca armillaris* Tall Shrubland from OEH (2016) (red) and DPIE (2020c) (blue), and AOO and EOO.

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 (Bland *et al.* 2017). 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). The estimates of EOO and AOO were calculated using the compilation map Illawarra Veg Plant Community Types (OEH 2016) and draft modelling by DPIE (2020c).

Ecology

Melaleuca armillaris Tall Shrubland is known from ridgetops on shallow rocky volcanic soil with outcropping Bumbo Latite. 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 (DPIE 2020a).

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Threats

Melaleuca armillaris Tall Shrubland is subject to a number of 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.

Clearing of Vegetation

Melaleuca armillaris Tall Shrubland has been subject to clearing of vegetation for mining, agriculture and infrastructure. Clearing for agriculture in the Kiama/Albion Park area started in the mid-nineteenth century, and quarrying started in about 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).

Weeds

Weeds detrimentally affect *Melaleuca armillaris* Tall Shrubland through 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*, *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.

Grazing and trampling

Grazing and trampling by cattle, goats, rabbits and deer have been identified as a threat 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 cause 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.

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Increased frequency of drought associated with climate change

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 thin, rocky and skeletal soils, 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 will occur over decades. 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.

Long-term absence of fire

Melaleuca armillaris is killed by fire; seeds are held in woody capsules and released after the death of the branchlet (Benson and McDougall 1998). The Threatened Species Hazard Reduction List (RFS 2004) records that *Melaleuca armillaris* Tall Shrubland requires a minimum fire interval of at least 10 years to develop a seedbank. No information is available on the effect of long periods without fire. 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”. 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).

Dumping of waste and vehicle access

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

Insect attack through increasing fragmentation

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.

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Melaleuca armillaris* Tall Shrubland has been adequate and there is sufficient scientific evidence to support the listing outcome.

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Criterion A Reduction in geographic distribution

Assessment Outcome: Endangered under Criterion A3

Justification: Based on analysis by Tozer *et al.* (2006) and ELA (2007), and reference to mapping of suitable geology by DRNSW (2018) it is estimated that less than 30 % of the pre-1750 area of *Melaleuca armillaris* Tall Shrubland remains.

Criterion B Restricted geographic distribution

Assessment Outcome: Critically Endangered under Criterion B1a(i, ii, iii)bc +B2a(i, ii, iii)bc

Justification: The geographic distribution of *Melaleuca armillaris* Tall Shrubland is very highly restricted. 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). The community has an EOO under the threshold for the Critically Endangered category.

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 (Bland *et al.* 2017). *Melaleuca armillaris* Tall Shrubland has an AOO under the threshold for the Critically Endangered category.

In addition to these thresholds, at least one of three other conditions must be met. These conditions are:

- a) An observed or inferred continuing decline in **ANY OF**:
 - i. a measure of spatial extent appropriate to the ecosystem;

Assessment Outcome: Sub-criterion Ba (i) is met

Justification: Clearing of *Melaleuca armillaris* Tall Shrubland for mining and infrastructure is likely to continue because the community occurs on an important geological resource.

- ii. a measure of environmental quality appropriate to characteristic biota of the ecosystem;

Assessment Outcome: Sub-criterion Ba (ii) is met

Justification: In recent years significant dieback of canopy species within *Melaleuca armillaris* Tall Shrubland has been observed (Lemmon in litt. 2019). Recent prolonged drought is probably the major contributor to this phenomenon. Rainfall for the last 20 years in south eastern Australia has been well below the 100-year average (BOM/CSIRO 2018). The projected increased incidence and severity of drought in the area (Grose *et al.* 2015) is likely to be detrimental to the community.

- iii. a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem.

Assessment Outcome: Sub-criterion Ba (iii) is met

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Justification: Grazing and trampling by cattle, goats, rabbits and deer in *Melaleuca armillaris* Tall Shrubland cause losses of plant species and structural diversity and cause changes in community composition by favouring resilient species.

Weeds, in particular *Lantana camara*, detrimentally effect *Melaleuca armillaris* Tall Shrubland by competition for light, water and nutrients, and potentially increase the likelihood of more frequent fire.

- b) Observed, or inferred threatening processes that are likely to cause continuing declines in geographic distribution, environmental quality or biotic interactions within the next 20 years.

Assessment Outcome: Sub-criterion Bb is met

Justification: *Melaleuca armillaris* Tall Shrubland occurs on areas of outcropping basalt. Basalt is a valuable resource and a large proportion of the mineral in the area occurs under areas of *Melaleuca armillaris* Tall Shrubland. Clearing of *Melaleuca armillaris* Tall Shrubland for mining is likely to continue.

- c) The ecosystem occurs at 1 (CR), ≤ 5 (EN) or ≤ 10 (VU) threat-defined locations.

Assessment Outcome: Sub-criterion Bc is met.

Justification: Due to its small area and geographic range, *Melaleuca armillaris* Tall Shrubland is considered to occur at one location with regard to the threats of drought and the effect of long-term absence of fire.

Criterion C Environmental degradation

C1. Environmental degradation over the past 50 years, based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for C1.

Justification: The data required to reliably quantify the extent and severity of environmental degradation over the past 50 years are not available.

C2a. Environmental degradation over the next 50 years, based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity **OR C2b.** Any 50-year period including the past, present and future, based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for C2a and C2b.

Justification: The data required to reliably quantify the extent and severity of environmental degradation over the next 50 years, or any 50 year period, are not available.

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C3. Environmental degradation since 1750, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for C3.

Justification: The data required to reliably quantify the extent and severity of environmental degradation since 1750 is not available.

Criterion D Disruption of biotic processes or interactions

D1. Disruption of biotic processes or interactions over the past 50 years, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for D1.

Justification: The data required to reliably quantify the extent and severity of the disruption of biotic processes or interactions over the past 50 years is not available.

D2a. Disruption of biotic processes or interactions over the next 50 years, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity **OR D2b**, any 50-year period including the past, present and future, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for D2a and D2b.

Justification: The data required to reliably quantify the extent and severity of the disruption of biotic processes or interactions over the next 50 years, or any 50 year period, are not available.

D3. Disruption of biotic processes or interactions since 1750, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity.

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for D3.

Justification: The data required to reliably quantify the extent and severity of the disruption of biotic processes or interactions since 1750 are not available.

Criterion E Quantitative Analysis

Assessment Outcome: *Melaleuca armillaris* Tall Shrubland is data deficient for E.

Justification: No quantitative analysis that estimates the probability of ecosystem collapse has been completed.

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Conservation and Management Actions

There is a NSW Save our Species program for *Melaleuca armillaris* Tall Shrubland but no National Recovery Plan. The following is derived from the NSW SOS program and threat information.

Habitat loss, disturbance and modification

- Prevent further habitat loss, degradation and fragmentation by encouraging landholders to adopt long-term private land conservation agreements.
- To prevent mowing or slashing of regeneration, and degradation by vehicle access and rubbish dumping, install wildlife-friendly fencing or bollards.
- Exclude extractive mining activities.

Invasive species

- Remove invasive plant species from remnants of *Melaleuca armillaris* Tall Shrubland and adjacent vegetation using best practice bush regeneration methods.
- Control goat, rabbit and deer.
- Decrease the impacts of cattle grazing by encouraging landholders to fence (non-barbed wire) remnants.

Stakeholders

- Inform land owners and managers of sites where there are known occurrences and consult with these groups regarding options for conservation management and protection of the community.

Survey and Monitoring priorities

- Regular monitoring of the effectiveness of management and trends in the extent and condition of the community
- Investigate areas of potential regeneration

Information and Research priorities

- Determine an appropriate fire regime.
- Determine the factors affecting recruitment of the component species to prevent degradation of remnants.

References

Australian Museum (2019) Animal Factsheets – Sawflies

<https://australianmuseum.net.au/learn/animals/insects/sawflies/>

Updated 13/03/19, Accessed 1/3/20

Benson D, McDougall L (1998) Ecology of Sydney plant species: Part 6 Dicotyledon family Myrtaceae *Cunninghamia* 5(4) 808 - 987.

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- Bland LM, Keith DA, Miller RM, Murray NJ, Rodríguez JP (2017) Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. (IUCN: Gland, Switzerland)
- Bureau of Meteorology (BOM) / CSIRO (2018) State of the Climate 2018. <http://www.csiro.au/~media/OnA/Files/State-of-the-Climates-2018-CSIRO-BOM-Dec2018.pdf>
- Department of Environment, Climate Change & Water (DECCW) (2011) Strategy for the Conservation and Management of Biodiversity in the Dunmore – Shellharbour Hills Area, Sydney, NSW.
- Department of Planning, Industry & Environment (DPIE) (2014) Mineral and Extractive Resources spatial data <https://datasets.seed.nsw.gov.au/dataset/epi-mineral-and-extractive-resources>, Accessed May 2020
- Department of Planning, Industry & Environment (DPIE) (2020a) BioNet Atlas. Data accessed May 2020
- Department of Planning, Industry & Environment (DPIE) (2020b) Draft BioNet Vegetation Classification, Accessed May 2020.
- Department of Planning, Industry & Environment (DPIE) (2020c) Draft PCT map.
- Department of Regional NSW (DRNSW) (2018) NSW Seamless Geology – Rock Units – Permo-Triassic Basins <https://datasets.seed.nsw.gov.au/dataset/nsw-seamless-geology>, Accessed May 2020
- Eco Logical Australia (2007) Shellharbour Kiama Regional Hard-rock Resource Review: Flora and Fauna Assessment. A report prepared for Department of Planning by Eco Logical Australia Pty Ltd.
- Gaia Research (2009) Fauna Surveys in Remnant Forest in the Dunmore Area of the Illawarra. Report prepared for DECCW by Gaia Research.
- Grose, M. et al., 2015, Southern Slopes Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports, eds. Ekström, M. et al., CSIRO and Bureau of Meteorology, Australia https://www.climatechangeinaustralia.gov.au/media/ccia/2.1.6/cms_page_media/172/SOUTHERN_SLOPES_CLUSTER_REPORT_1.pdf
- Hadlington PW, Johnston JA (1996) Australian trees, a guide to their care and cure (New South Wales University Press: Kensington). (https://books.google.com.au/books?id=vY1iAV1-FrEC&source=gbs_navlinks_s)
- Kevin Mills & Associates (2001) The Natural Vegetation in the City of Shellharbour (prepared for Shellharbour City Council).
- Office of Environment & Heritage (OEH) (2016) Illawarra Plant Community Type map 2016, VIS_ID 4678 spatial data <https://datasets.seed.nsw.gov.au/dataset/illawarra-compiled-plant-community-type-map-2016-vis-id-4678> Accessed 01/4/20.
- Rural Fire Service (2004) Threatened Species Hazard Reduction List. NSW Rural Fire Service, Sydney. Accessed on 18 February 2011 at https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0019/24337/ThreatenedSpeciesHazardReductionList-Part3-ThreatenedEcologicalCommunities.pdf
- Shellharbour City Council (2020) <https://museum.shellharbour.nsw.gov.au/mining-basalt/> Accessed 15/3/20.
- Tozer MG, Turner K, Keith DA, Tindall D, Pennay C, Simpson C, MacKenzie B (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* **11**(3), 359-406.

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United States Geological Survey (USGS) (2000) Shuttle Radar Topography Mission
1 Arc-Second Global: SRTM1N22W016V3 - Digital Elevation Data

Expert Communications

Lemmon J (in litt. 2019) *Melaleuca armillaris* Tall shrubland – Recent observations in the Illawarra.

Appendix 1

Assessment against Biodiversity Conservation Act criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome (Clause with the highest category of threat)

Melaleuca armillaris Tall Shrubland was found to be Critically Endangered under Clause 4.10 (a)(di, ii, iii)(e)(fi)

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

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

Assessment Outcome: Critically Endangered under Clause 4.10 (a)(di, 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 (a)

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.

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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 (a)

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

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