

NSW Threatened Species Scientific Committee

Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list Eastern Suburbs Banksia Scrub 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 to Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion from Part 2 of Schedule 2 (Endangered Ecological Community) of the Act. Listing of a critically endangered ecological community 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 Eastern Suburbs Banksia Scrub 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 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 Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion (hereafter referred to as the Eastern Suburbs Banksia Scrub) is characterised by the assemblage of species listed below.

<i>Acacia longifolia</i>	<i>Acacia suaveolens</i>
<i>Actinotus helianthi</i>	<i>Actinotus minor</i>
<i>Allocasuarina distyla</i>	<i>Angophora costata</i>
<i>Aotus ericoides</i>	<i>Astroloma pinifolium</i>
<i>Austrostipa pubescens</i>	<i>Banksia aemula</i>
<i>Banksia ericifolia</i> subsp. <i>ericifolia</i>	<i>Banksia marginata</i>
<i>Banksia serrata</i>	<i>Billardiera scandens</i>
<i>Bossiaea ensata</i>	<i>Bossiaea heterophylla</i>
<i>Bossiaea scolopendria</i>	<i>Brachyloma daphnoides</i> subsp. <i>daphnoides</i>
<i>Cassytha glabella</i>	<i>Cassytha pubescens</i>
<i>Caustis pentandra</i>	<i>Chordifex fastigiatus</i>
<i>Corymbia gummifera</i>	<i>Dampiera stricta</i>
<i>Darwinia fascicularis</i> subsp. <i>fascicularis</i>	<i>Dianella revoluta</i> var. <i>revoluta</i>
<i>Dillwynia retorta</i>	<i>Elaeocarpus reticulatus</i>
<i>Entolasia stricta</i>	<i>Gompholobium glabratum</i>
<i>Gonocarpus teucroides</i>	<i>Grevillea buxifolia</i>
<i>Grevillea sphacelata</i>	<i>Haemodorum planifolium</i>
<i>Hakea laevipes</i>	<i>Hibbertia fasciculata</i>
<i>Hibbertia linearis</i>	<i>Hypolaena fastigiata</i>
<i>Isopogon anemonifolius</i>	<i>Kunzea ambigua</i>
<i>Lambertia formosa</i>	<i>Lepidosperma concavum</i>
<i>Lepidosperma laterale</i>	<i>Leptospermum laevigatum</i>
<i>Lepyrodia scariosa</i>	<i>Leucopogon ericoides</i>

NSW Threatened Species Scientific Committee

<i>Lomandra glauca</i>	<i>Lomandra longifolia</i>
<i>Melaleuca nodosa</i>	<i>Monotoca elliptica</i>
<i>Monotoca scoparia</i>	<i>Patersonia glabrata</i>
<i>Persoonia lanceolata</i>	<i>Philothea buxifolia</i>
<i>Philothea salsolifolia</i> subsp. <i>salsolifolia</i>	<i>Phyllota phyllicoides</i>
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	<i>Pittosporum undulatum</i>
<i>Platysace linearifolia</i>	<i>Pteridium esculentum</i>
<i>Ricinocarpos pinifolius</i>	<i>Schoenus ericetorum</i>
<i>Themeda triandra</i>	<i>Woollisia pungens</i>
<i>Xanthorrhoea media</i>	<i>Xanthorrhoea resinosa</i>
<i>Xanthosia pilosa</i>	

- 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.

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

- 2.1 The assemblage of species listed in Part 1.1 above which characterises the Eastern Suburbs Banksia Scrub 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>
- 2.2 It is the intent of the 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 Reasons for determining eligibility for listing

- 3.1.1 Eastern Suburbs Banksia Scrub was listed as an Endangered Ecological Community under the Threatened Species Conservation Act in 1997 (NSW Government Gazette number 62, 13th June 1997). At the time of listing the Critically Endangered category did not exist. Since this original listing, new data have become available and the Scientific Committee has undertaken a review of the conservation status of the ecological community to inform the current listing status under the Act.
- 3.1.2 Eastern Suburbs Banksia Scrub has undergone a very large reduction in distribution. Recent estimates of the current extent of the Community range from 250 ha (Tozer *et al.* 2010) to 471 ha OEH (2013b). Tozer *et al.* (2010) estimated that <10% of the original distribution of the Community remains. The distribution of Eastern Suburbs Banksia Scrub is strongly correlated with (but not restricted to) the mapped distributions of the Tuggerah, Newport, North Head and Kurnell soil landscapes of Chapman and Murphy (1989) and Hazelton and Tille (1990). Based on the extent of these soil landscapes, combined with other known occurrences of Eastern Suburbs Banksia Scrub, and including areas where the original soil types are unknown but there is evidence that they once supported the community, but excluding vegetation determined by OEH (2013b) not to comprise Eastern Suburbs Banksia Scrub, the Committee estimates that the upper bound for the extent of the Community prior to the industrial era is 9643 ha. Based on advice that the extent of habitat suitable for the occurrence of Eastern Suburbs Banksia Scrub may not have corresponded to the full extent of these soil landscapes, and excluding areas in which the original soil types are unknown, the Committee estimates that the lower bound for extent of the Community prior to the industrial era is 5355 ha. The reduction in the extent of Eastern Suburbs Banksia Scrub is therefore estimated to fall within the range 91.2% – 97.4%. OEH (2013b) estimated that between 364 and 408 ha (79–89%) of the extant area occurs within conservation reserves (Kamay Botany Bay National Park, Royal National Park and Sydney Harbour National Park). The distribution of Eastern Suburbs Banksia Scrub has been transformed from extensive areas associated with sand sheets to small fragments ranging in size from 0.02 to 69 ha (DECC 2009, Tozer *et al.* 2010).
- 3.1.3 The distribution of Eastern Suburbs Banksia Scrub is very highly restricted. The extent of occurrence of Eastern Suburbs Banksia Scrub is 156 km² based on a minimum convex polygon enclosing all occurrences of the community mapped by Tozer *et al.* (2010) and OEH (2013b), the method of assessment recommended by IUCN (Bland *et al.* 2017). Some 65 km² of this area comprises coastal open waters. The estimated area of occupancy (AOO) of Eastern Suburbs Banksia Scrub is 400 km² based on occupancy of cells in a 10 x 10 km grid, the scale recommended for assessing AOO by IUCN (Bland *et al.* 2017).
- 3.1.4 Major threats to Eastern Suburbs Banksia Scrub throughout its range include clearing and fragmentation, weed invasion, inappropriate fire regimes (both high and low fire frequency), grazing by rabbits and soil erosion (DEC 2004; DECC 2009; NSW Scientific Committee 2011; Lambert *et al.* 2015). Individual remnants may also be threatened by mowing, slashing, altered drainage/runoff, inappropriate plantings, damage caused by pedestrians, bicycles, motorcycles and horses and the dumping of construction materials and green waste (DEC 2004; NSW Scientific Committee 2011). Other potential threats, or threats of unknown extent, include infection by *Phytophthora cinnamomi*, unauthorised seed and wildflower collection, stormwater pollution and inappropriate use of herbicides (DECC 2009). Invasive weeds impacting on this community include *Chrysanthemoides monilifera* subsp. *rotundata* (Bitou Bush), *Lantana camara* (Lantana)

NSW Threatened Species Scientific Committee

and *Eragrostis curvula* (African Lovegrass) (DECC 2009). 'Clearing of native vegetation', 'Competition and grazing by the feral European rabbit *Oryctolagus cuniculus* (L.)', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Infection of native plants by *Phytophthora cinnamomi*', 'Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat)', 'Invasion of native communities by *Chrysanthemoides monilifera*' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the Act.

3.2 Criteria for listing

Eastern Suburbs Banksia Scrub 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 prescribed by the *Biodiversity Conservation Regulation 2017*:

Clause 4.9 – Reduction in geographic distribution of ecological community
(Equivalent to IUCN criterion 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 reduction in geographic distribution.

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

The ecological community's geographic distribution is:			
	(a)	for critically endangered ecological communities	very highly restricted
and the following condition applies:			
	(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.	

Dr Marco Duretto
Chairperson
NSW Threatened Species Scientific Committee

Exhibition period: 01/12/17 – 26/01/18

Proposed Listing date: 01/12/17

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, but is provided to assist in the recognition of Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion (hereafter referred to as the Eastern Suburbs Banksia Scrub) in the field. Given natural variability, along with disturbance history, Eastern Suburbs Banksia Scrub may sometimes occur outside the typical range of variation in the features described below.

4.1 Eastern Suburbs Banksia Scrub is an open to closed heath or, occasionally, a low woodland with a sparse canopy of multi-stemmed eucalypts (Adam *et al.* 1990; OEH 2013a,b). It falls within the

NSW Threatened Species Scientific Committee

Wallum Sand Heaths vegetation class of Keith (2004). Eastern Suburbs Banksia Scrub includes vegetation described under Coastal Sand Mantle Heath and Coastal Sandplain Heath (Map Units HL03 and HL04) by OEH (2013b). It has been previously defined as Map Unit HL p563 in Tozer *et al.* (2010) and as Map Unit 21b (i) in Benson and Howell (1994).

- 4.2 Eastern Suburbs Banksia Scrub occurs in the eastern suburbs of Sydney from Royal National Park to the Hawkesbury River on aeolian sands of the Tuggerah, Newport, North Head and Kurnell soil landscapes (Chapman and Murphy 1989, Hazelton and Tille 1990). These landscapes comprise gently undulating plains to rolling rises, rolling dunefields or relic dunes. Chapman and Murphy describe these sands as being of Quaternary origin (Holocene and Pleistocene), and in some cases the dunefields have been reworked such that dunes and swales may be difficult to distinguish. Eastern Suburbs Banksia Scrub occurs on the most heavily leached and nutrient-impooverished of these sands (Benson and Howell 1990, 1994). The composition and structure of Eastern Suburbs Banksia Scrub varies as a function of the degree of nutrient leaching. The most impoverished dunes generally support heath of lower stature and are dominated by *Banksia aemula* while those less leached of nutrients are more often dominated by *B. serrata* (Adam *et al.* 1990, Benson and Howell 1994, David Keith *in litt.* June 2016). Eastern Suburbs Banksia Scrub is occasionally dominated by low-growing multi-stemmed eucalypts such as *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood) (OEH 2013b). In the first few years after fire, Eastern Suburbs Banksia Scrub is an open and diverse ecological community (Lambert *et al.* 2015). Floristic diversity decreases as the canopy closes over time and the community may become dominated by a few large shrubs such as *Leptospermum laevigatum*, *Banksia ericifolia* and *Monotoca elliptica* (Benson and Howell 1994; Lambert *et al.* 2015). Eastern Suburbs Banksia Scrub may become less structurally and floristically diverse with increasing time since fire and support a greater representation of mesic species such as *Pittosporum undulatum* and *Eleocharis reticulatus* (DECC 2009). However many species not present as aboveground vegetation may still exist as seedbank propagules in the soil (Lambert *et al.* 2015).
- 4.3 The structure and composition of Eastern Suburbs Banksia Scrub varies with the degree of nutrient impoverishment and soil moisture/drainage. Dunes, their slopes and some of the more extensive sand flats tend to be freely draining with an open ground stratum (D. Keith *in litt.* June 2016). These may support a dense cover of ferns (OEH 2013b). More spatially restricted swales between, or adjacent to, steeper dunes tend to be poorly drained and may support a dense ground-layer vegetation of sedges (Cyperaceae) and cord rushes (Restionaceae). In some of the deepest depressions on the sand deposits, the water table is above the soil surface, forming permanent or semi-permanent lagoons. Vegetation associated with these lagoons does not comprise part of the Eastern Suburbs Banksia Scrub but are listed as Sydney Freshwater Wetlands in the Sydney Basin Bioregion which is listed as an Endangered Ecological Community under the Act (D. Keith *in litt.* June 2016).
- 4.4 Eastern Suburbs Banksia Scrub is one of a complex of related communities which differ in composition in response to variation in the depth of the sand mantle and exposure to maritime influences. Eastern Suburbs Banksia Scrub grades into Coastal Headland Banksia Heath (Map Unit HL06) or Coastal Headland Cliffline Scrub (Map Unit HL07) as the perched dunes become shallower and sandstone benches and outcropping become more common (OEH 2013b). Both communities share many species with Eastern Suburbs Banksia Scrub but differ in species composition in a variety of ways including the absence of the key dominant (*Banksia aemula*), the relative rarity of several key species in the Fabaceae (*Bossiaea heterophylla*, *B. scolopendria*, *Dillwynia retorta*) and in the greater abundance and diversity of restioid species. Coastal Headland Cliffline Scrub is restricted to locations where the soil is skeletal and exposure to maritime influences is high (OEH 2013b). Species richness is lower in Coastal Headland Cliffline

NSW Threatened Species Scientific Committee

Scrub relative to Eastern Suburbs Banksia Scrub and it is dominated by different shrub species including *Melaleuca armillaris*, *Baeckea imbricata* and *Westringia fruticosa* (Adam *et al.* 1990, OEH 2013b).

- 4.5 Eastern Suburbs Banksia Scrub grades into dry sclerophyll forest with increasing availability of soil nutrients. This is evident on dunes of Holocene age on the coast which support the structurally and compositionally distinct Coastal Sand-Apple Bloodwood Forest or Coastal Sand Bangalay Forest (Map Units DSF03 and DSF21) (OEH 2013b).
- 4.6 Eastern Suburbs Banksia Scrub comprises part of a class of vegetation known as the Wallum Sand Heaths (Keith 2004). Wallum Sand Heaths are associated with highly leached sands of Pleistocene origin and occur on the coast north from Sydney to South-east Queensland (Adam *et al.* 1990, Benson and Howell 1994, Keith 2004, D. Keith *in litt.* June 2016, NSW Office of Environment and Heritage *in litt.* September 2016). Wallum Sand Heaths vary in species composition across their geographic range as a consequence of the patterns in the distribution of individual species along the tropical-temperate climate continuum. For example, species such as *Allocasuarina distyla*, *Banksia ericifolia* subsp. *ericifolia*, *Bossiaea scolopendria*, *Grevillea sphacelata*, *Philotheca buxifolia* and *Xanthorrhoea resinosa*, are generally restricted to southern examples of the Wallum Sand Heaths. Eastern Suburbs Banksia Scrub is one of several types of Wallum Sand Heath occurring within the Sydney Basin which share many species but differ in their relative abundance (NSW Office of Environment and Heritage *in litt.* September 2016).
- 4.7 Eastern Suburbs Banksia Scrub is included within the Endangered Ecological Community “Eastern Suburbs Banksia Scrub of the Sydney Region” listed under the *Environment Protection and Biodiversity Conservation Act 1999*.
- 4.8 Eastern Suburbs Banksia Scrub is likely to contain a number of threatened species, listed in the table below.

Species	Common name	BC Act*	EPBC Act ⁺
Plants			
<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sunshine Wattle	Endangered	Endangered
Mammals			
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Vulnerable	
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	Vulnerable	
<i>Perameles nasuta</i>	Long-nosed Bandicoot (North Head population)	Endangered	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Vulnerable
Amphibians			
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Vulnerable	Vulnerable
<i>Litoria littlejohni</i>	Littlejohn’s Tree Frog	Vulnerable	Vulnerable
<i>Pseudophryne australis</i>	Red-crowned Toadlet	Vulnerable	

* Biodiversity Conservation Act 2016

+ Environment Protection and Biodiversity Conservation Act 1999

NSW Threatened Species Scientific Committee

References

- Adam P, Stricker P, Wiecek BM, Anderson DJ (1990) The vegetation of seacliffs and headlands in New South Wales, Australia. *Australian Journal of Ecology* **15**, 515–547.
- Benson D, Howell J (1990) 'Taken for granted'. Kangaroo Press
- Benson D, Howell J (1994) The natural vegetation of the Sydney 1:100 000 map sheet. *Cunninghamia* **3**, 677–1004.
- 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 1.1. Gland, Switzerland: IUCN.
- Chapman GA, Murphy CL (1989) 'Soil landscapes of the Sydney 1:100 000 sheet.' (Soil Conservation Service of New South Wales: Sydney)
- DEC (Department of the Environment and Conservation) (2004) Eastern Suburbs Banksia Scrub Endangered Ecological Community Recovery Plan. NSW Department of Environment and Conservation, Hurstville.
- DECC (Department of the Environment and Climate Change) (2009) Best Practice Guidelines: Eastern Suburbs Banksia Scrub. NSW Department of Environment and Climate Change, Sydney.
- Hazelton PA, Tille PJ (1990) 'Soil landscapes of the Wollongong-Port Hacking 1:100 000 Sheet.' (Soil Conservation Service of NSW, Sydney)
- Keith D (2004) 'Ocean shores to desert dunes: the native vegetation of NSW and the ACT'. (Department of Environment and Climate: Hurstville)
- Lambert J, Lambert G, Pellow B (2015) An evaluation of two management options to restore species diversity of Eastern Suburbs Banksia Scrub at North Head, Sydney. *Cunninghamia* **15**, 69–78.
- NSW Scientific Committee (2011) Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion. Determination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act 1995. NSW Scientific Committee, Sydney.
<http://www.environment.nsw.gov.au/determinations/easternsuburbsbanksia36a.htm>
(accessed 14 August 2015)
- OEH (Office of Environment and Heritage) (2013a) The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report. Version 2.0. NSW Office of Environment and Heritage, Sydney.
- OEH (Office of Environment and Heritage) (2013b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 2.0. NSW Office of Environment and Heritage, Sydney.
- 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>

NSW Threatened Species Scientific Committee

Tozer MG, Turner K, Simpson C, Keith DA, Beukers P, MacKenzie B, Tindall D, Pennay C (2010) Native Vegetation of Southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* **11**, 359–406.