NSW SCIENTIFIC COMMITTEE

Final Determination

The Scientific Committee, established by the *Threatened Species Conservation Act* 1995 (the Act), has made a Final Determination under Section 23 of the Act to list the Shale Sandstone Transition Forest in the Sydney Basin Bioregion as a Critically Endangered Ecological Community in Part 2 of Schedule 1A of the Act and as a consequence, to omit reference to Shale/Sandstone Transition Forest from the list of Endangered Ecological Communities in Part 3 of Section 1 of the Act.

This determination contains the following information:

Parts 1 & 2: Section 4 of the Act defines an ecological community as "an assemblage of species occupying a particular area". These features of Shale Sandstone Transition Forest 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 as Critically Endangered in Part 2 of Schedule 1A of the Act according to criteria as prescribed by the *Threatened Species Conservation Regulation* 2010.

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 Shale Sandstone Transition Forest in the Sydney Basin Bioregion (hereafter referred to as Shale Sandstone Transition Forest) is characterised by the assemblage of species listed below.

Acacia decurrens
Acacia falcata
Acacia implexa
Acacia parramattensis
Allocasuarina littoralis
Allocasuarina torulosa
Angophora bakeri
Aristida vagans
Arthropodium milleflorum
Astroloma humifusum
Austrodanthonia fulva
Austrostipa pubescens
Billardiera scandens
Bossiaea prostrata
Breynia oblongifolia
Brunoniella australis
Brunoniella pumilio
Bursaria spinosa
Calotis dentex
Cassytha glabella
Cheilanthes sieberi
Euchiton sphaericus
Exocarpos cupressiformis
Gahnia aspera
Glycine clandestina
Glycine microphyllus
Glycine tabacina
Gonocarpus tetragynus
Goodenia hederacea subsp. *hederacea*
Hardenbergia violacea
Hibbertia aspera subsp. *aspera*
Hibbertia diffusa
Jacksonia scoparia
Kunzea ambigua
Lagenophora gracilis
Laxmannia gracilis
Lepidosperma laterale
Leucopogon juniperinus
Lissanthe strigosa
Lomandra confertifolia subsp. *rubiginosa*
Lomandra filiformis subsp. *coriacea*
Lomandra longifolia

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Corymbia gummifera
Cymbopogon refractus
Daviesia ulicifolia
Desmodium varians
Dianella caerula
Dianella revoluta var. *revoluta*
Dichelachne micrantha
Dichondra repens
Digitaria parviflora
Digitaria ramularis
Dodonaea triquetra
Echinopogon caespitosus var. *caespitosus*
Echinopogon ovatus
Entolasia marginata
Entolasia stricta
Eragrostis brownii
Eragrostis leptostachya
Eucalyptus crebra
Eucalyptus eugenioides
Eucalyptus fibrosa
Eucalyptus globoidea
Eucalytptus punctata
Eucalyptus tereticornis
Lomandra multiflora subsp. *multiflora*
Microlaena stipoides
Notelaea longifolia f. *longifolia*
Olearia microphylla
Opercularia diphylla
Oxalis perennans
Ozothamnus diosmifolius
Panicum simile
Paspalidium distans
Persoonia linearis
Phyllanthus hirtellus
Pimelea linifolia subsp. *linifolia*
Poa labillardierei var. *labillardierei*
Pomax umbellata
Poranthera microphylla
Pratia purpurascens
Solanum prinophyllum
Solanum pungetium
Stypandra glauca
Syncarpia glomulifera
Themeda australis
Vernonia cinerea var. *cinerea*
Veronica plebeia

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 (eg fire, logging, grazing) and weather (eg 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, cryptogamic plants and vertebrate and invertebrate fauna. These components of the community are less well documented.

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Part 2. Particular area occupied by the ecological community

2.1 The assemblage of species listed in Part 1.1 above which characterises the Shale Sandstone Transition Forest 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 Shale/Sandstone Transition Forest was listed as an Endangered Ecological Community under the Act in 1998 (NSW Scientific Committee 1998). Since this time new data and analyses have become available and the Committee is of the opinion that the determination of this community should be revised.

3.1.2 The estimated current distribution of the community primarily comprises the larger remnants depicted in the maps of Tozer *et al*. (2010). The mapped area of Shale Sandstone Transition Forest is 9600 ha, representing 20-40% of its original extent (Tozer *et al*. 2010). Thus the community has undergone a very large reduction in distribution since European settlement. Approximately 260 ha is currently represented in conservation reserves, representing <2% of its original extent.

3.1.3 Shale Sandstone Transition Forest occurs or has occurred primarily on relatively accessible terrain. A large proportion of the area where Shale Sandstone Transition Forest occurred has been cleared for agriculture and urban development. Shale Sandstone Transition Forest occurs in an area where a high proportion of remnants (90%) are mostly very small (<10 ha) and scattered and often adjoin cleared and/or degraded land (Tozer 2003). Shale Sandstone Transition Forest is among the most fragmented of vegetation types occurring in the Sydney region, with an estimated 1115 km of interface with cleared or degraded land (Tozer, pers. comm. 2013). Identified threats include: clearing associated with urban development, inappropriate fire regimes, anthropogenic climate change, removal of wood, physical damage from recreational activities, rubbish dumping, grazing, mowing and weed invasion. Current rates of clearing have not been estimated for Shale Sandstone Transition Forest, however rates of clearing of adjacent Cumberland Plain Woodland remnants (5.2±0.6% between 1998 and 2007), primarily for housing and road developments, are indicative (NSW Scientific Committee and Simpson 2008). Fragmentation and urban encroachment promote changes to fire regimes. As with the neighbouring Cumberland Plain Woodland, this is likely to lead to increased shrub cover and reduced understory diversity (by fire exclusion) or elimination of some non-sprouters (increased fire frequency) (Watson 2005). Invasion by *Olea europea* subsp. *cuspidata* (African Olive) and *Asparagus asparagoides* (Bridal Creeper) affects an estimated 20% and 25% of remnants, respectively (M. Tozer, unpublished data). These weeds have the potential to cause significant structural and compositional changes in Shale Sandstone Transition Forest, resulting in ecosystem collapse. Sites surveyed by Tozer (2003)

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contained an average of 4.6 (±3) exotic species. Over a quarter of sites contained *Ligustrum sinense* (Privet). Apart from African Olive and Bridal Creeper, the most prevalent exotic species were herbs, with over half of the survey sites significantly affected by at least four species, most commonly *Paspalum dilatatum*, *Setaria gracilis*, *Cirsium vulgare*, *Plantago lanceolata*, *Bryophyllum delagoense*, *Hypochaeris radicata*, *Senecio madagascarensis* and *Axonopus affinis*. 'Clearing of native vegetation', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Removal of dead wood and dead trees', 'Invasion of native plant communities by exotic perennial grasses', 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' and 'Invasion and establishment of exotic vines and scramblers' are listed as Key Threatening Processes under the Act.

3.2 Shale Sandstone Transition Forest in the Sydney Basin Bioregion is eligible to be listed as a Critically Endangered Ecological Community in accordance with Section 12 of the Act as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with the following criteria as prescribed by the *Threatened Species Conservation Regulation* 2010:

Clause 17 Reduction in geographic distribution of the ecological community
The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:

(a) a very large reduction in geographic distribution.

Clause 19 Reduction in ecological function of the ecological community
The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:

(a) a very large reduction in ecological function,

as indicated by any of the following:

(d) change in community structure,
(e) change in species composition,
(f) disruption of ecological processes,
(g) invasion and establishment of exotic species,
(h) degradation of habitat,
(i) fragmentation of habitat.

Professor Michelle Leishman
Chairperson
NSW Scientific Committee

Exhibition period: 28/11/14 – 30/01/15 Proposed Gazettal date: 28/11/14

Part 4. Additional information about the ecological community

4.1 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 Shale Sandstone Transition Forest in the field. Given natural variability, along with disturbance

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history, Shale Sandstone Transition Forest in the Sydney Basin Bioregion may sometimes occur outside the typical range of variation in the features described below.

4.2 'Shale Sandstone Transition Forest' is listed under the Commonwealth *Environmental Protection and Biodiversity Conservation* Act 1999 as Shale/Sandstone Transition Forest. However, the Commonwealth listing advice excludes some patches, here regarded as Shale Sandstone Transitional Forest, on the basis of condition or structure thresholds.

4.3 Shale Sandstone Transition Forest corresponds to Cumberland Shale Sandstone Transition Forest (map unit p2) in Tozer *et al*. (2010), Shale Sandstone Transition Forest (Low sandstone influence) (map unit 1) and Shale Sandstone Transition Forest (High sandstone influence) (map unit 2) in Tozer (2003). Shale Sandstone Transition Forest in the Sydney Basin Bioregion also includes Cumberland Shale-Sandstone Ironbark Forest (map unit S_GW04) in DECCW (2009).

4.4 Shale Sandstone Transition Forest is recognised as a distinct assemblage with a variable species composition that occurs on soils overlying the transition between shale and sandstone lithologies. Variation in species composition depends on the composition of adjoining communities and the relative influence of the underlying sandstone and shale lithologies. Although Shale Sandstone Transition Forest is strongly ecotonal in its assemblage, it nevertheless contains species not recorded in adjoining communities, thus justifying its recognition as a distinct community (Tozer *et al*. 2010). Turpentine Ironbark Margin Forest (map unit 43 described in Tozer 2003) also occurs on soils transitional between shale and sandstone, however this community is floristically most similar to Turpentine Ironbark Forest (map unit 15 described in Tozer 2003) and together they comprise the endangered ecological community known as Sydney Turpentine Ironbark Forest (Tozer 2003).

4.5 The structure of Shale Sandstone Transition Forest varies from grassy woodland to forest. When the community occurs in areas of less sandstone influence it is dominated by *Eucalyptus tereticornis*, with *E. eugenioides*, *E. crebra*, *E. fibrosa* and *E. punctata* occurring less frequently. A small tree stratum may be present consisting of *Eucalyptus* spp., with *Allocasuarina littoralis* and *Acacia decurrens* sometimes present. A shrub layer dominated by *Bursaria spinosa* is usually present. The ground layer is diverse and is dominated by grasses and herbs including *Microlaena stipoides* var. *stipoides*, *Cheilanthes sieberi* subsp. *sieberi*, *Dichondra repens*, *Themeda australis*, *Echinopogon ovatus*, *Entolasia marginata*, *Pratia purpurascens*, *Solanum prinophyllum* and *Oxalis perennans* (Tozer 2003). When the community occurs in areas of greater sandstone influence it is dominated by *Eucalyptus punctata* and *E. crebra*, with *E. fibrosa*, *Corymbia gummifera* and *Syncarpia glomulifera* occurring less frequently. A small tree stratum may be present and is most often dominated by *Allocasuarina littoralis*, *Syncarpia glomulifera*, *Persoonia linearis* and *Acacia decurrens*. The shrub layer is well-developed and diverse, dominated by *Kunzea ambigua*, *Persoonia linearis* and *Bursaria spinosa*, while the ground layer is dominated by *Austrostipa pubescens*, *Entolasia stricta*, *Themeda australis*, *Lepidosperma laterale*, *Aristida vagans* and *Pomax umbellata* (Tozer 2003). On the margins of its distribution the community may contain, or be dominated by, tree species atypical of its broader distribution such as *Angophora floribunda*, *Corymbia gummifera*, *C. maculata*, *E. pilularis*, *E. moluccana*, *E. tereticornis* and *Syncarpia glomulifera*.

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4.6 Shale Sandstone Transition Forest occurs up to 400 m above sea level in areas receiving less than 950 mm of annual rainfall. Its distribution is strongly correlated with soils derived from Wianamatta Shale, although it is restricted to areas where the shale stratum is thin, and the soil properties are influenced by underlying sandstone. These areas include: the extensive shale/sandstone boundary located around the margins of the Cumberland Plain and disjunct shale remnants located on ridges in the lower Blue Mountains and Woronora Plateau. Shale Sandstone Transition Forest may occur on sites where Triassic sandstone or interbedded shale-sandstone (Mittagong Formation) is outcropping provided the soil retains a shale influence, either from an eroded shale cap or where there is colluvial deposition from shale upslope. In general, examples of Shale Sandstone Transition Forest on soils derived from Hawkesbury Sandstone or Mittagong Formation are rare. Soils derived from the Mittagong Formation typically support a different community (Sydney Hinterland Transition Woodland, DSFp146, of Tozer *et al.* 2010) which is not listed as endangered. Shale Sandstone Transition Forest grades gradually to either Shale Plains Woodland or Shale Hills Woodland away from the margins of the Cumberland Plain, although narrow bands of the community may form deeper incursions into the plain along deeply eroded drainage lines. Beyond the margins of the plain the community grades more abruptly to Sydney Hinterland Transition Forest, Sandstone Gully Forest (DSF142 of Tozer *et al.* 2010) or Sandstone Ridgetop Woodland (DSFp131).

4.7 The Shale Sandstone Transition Forest has been recorded from the local government areas of Bankstown, Blue Mountains, Campbelltown, Hawkesbury, Hornsby, Liverpool, Parramatta, Penrith, The Hills Shire, Wingecarribee and Wollondilly (within the Sydney Basin Bioregion) and may occur elsewhere in the Bioregion.

4.8 Small areas of Shale Sandstone Transition Forest are presently included in Bargo State Conservation Area, Blue Mountains National Park, Cattai National Park, Georges River National Park, Nattai National Park, Parramatta Regional Park, Scheyville National Park, Gulguer Nature Reserve and Upper Nepean State Conservation Area.

4.9 The Shale Sandstone Transition Forest contains a number of threatened plant and animal species, listed in the table below.

Plants	
Pimelea curviflora var. *curviflora*	Vulnerable
Birds	
Brown Treecreeper (*Climacteris picumnus victoriae*)	Vulnerable
Black-chinned Honeyeater (*Melithreptus gularis gularis*)	Vulnerable
Turquoise Parrot (*Neophema pulchella*)	Vulnerable
Mammals	
Koala (*Phascolarctos cinereus*)	Vulnerable
Eastern Freetail Bat (*Mormopterus norfolkensis*)	Vulnerable
Greater Broad-nosed Bat (*Scoteanax ruepellii*)	Vulnerable

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4.10 It is likely that some of the canopy components of Shale Sandstone Transition Forest provide a significant food source because they are winter-flowering, which is important for nectivorous migratory birds such as the Critically Endangered Regent Honeyeater (*Anthochaera phrygia*) and Endangered Swift Parrot (*Lathamus discolor*). Such trees may also provide significant food resources for the endangered Grey-headed Flying Fox (*Pteropus poliocephalus*) (S. Douglas, *in litt*. 2010).

References:

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