Australian Government

Department of Agriculture, Water and the Environment

The Threatened Species Scientific Committee provided their advice to the Minister on 27 September 2019.
The Minister approved this Conservation Advice on 26 June 2020 and agreed that a recovery plan is required is required.

Conservation Advice[1] for the Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion

This document combines the approved conservation advice and listing assessment for the threatened ecological community. It provides a foundation for conservation action and further planning.

Elderslie Banksia Scrub Forest with overstorey dominated by bangalay x Sydney blue gum hybrid, Spring Farm. © Matt White

Conservation Status

The Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion is listed in the Critically Endangered category of the threatened ecological communities list under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

At the time of this advice, the ecological community corresponds closely with the NSW listed ecological community of the same name and with NSW Plant Community Type (PCT) 774.

The ecological community was assessed by the Threatened Species Scientific Committee who recommended that the ecological community merits listing as Critically Endangered and that a recovery plan is required for the ecological community. The Committee's assessment and recommendations are at Section 5.4 and Appendix D.

The Committee's assessment of the eligibility against each of the listing criteria is:
Criterion 1: Critically Endangered
Criterion 2: Critically Endangered
Criterion 3: Insufficient data
Criterion 4: Critically Endangered
Criterion 5: Insufficient data
Criterion 6: Insufficient data

The decline in geographic distribution since 1750 assessed under criterion 1, and the restricted geographic distribution plus the action of threatening processes assessed under criterion 2 would also represent a Critically Endangered status under Criteria A3 and B of the IUCN Red List of Ecosystems (Bland et al 2017) and under the *NSW Biodiversity Conservation Act 2016*.

[1] The Conservation Advice is a statutory document as per section 266B of the *Environment Protection and Biodiversity Conservation Act 1999*.

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2 CONSERVATION OBJECTIVE

To mitigate the risk of extinction of the Elderslie Banksia scrub forest in the Sydney Basin Bioregion and help recover its biodiversity and function, through protections provided under the *Environment Protection and Biodiversity Conservation Act 1999* and through the implementation of the priority conservation actions set out in Section 5.

This conservation advice contains information relevant to the conservation objective by:

- describing what the ecological community is, where it can be found and what vegetation classifications correspond to it (see Section 2; Appendices A and B);
- providing guidance on when the EPBC Act is likely to apply to the ecological community, through key diagnostic features, condition thresholds and supplementary information (see Section 2.5);
- identifying what other existing protection measures apply (see Section 2.7);
- identifying the key threats to the ecological community (see Section 3; Appendix C);
- presenting evidence (listing advice) for why the ecological community merits listing as nationally threatened under the EPBC Act (see Section 4; Appendix D); and
- outlining the priority conservation and research actions that could appropriately be done to stop decline and support recovery of the ecological community (see Section 5).

3 DESCRIPTION

The ecological community described here is a type of scrubby forest or woodland limited to sandy substrates associated with deep Tertiary sand deposits above the present day Nepean River floodplain, primarily in the Camden area within the Macarthur District of south-western Sydney, New South Wales (NSW). Key elements of the canopy include *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus botryoides* x *E. saligna* (a natural hybrid of Bangalay and Sydney Blue Gum) and various other species of *Eucalyptus* over a mostly shrubby understorey.

3.1 Name of the ecological community

This advice follows the assessment of a public nomination to list a broader ecological community, the 'Hinterland Sand Flats Forest and Woodland of the Sydney Basin Bioregion', that was placed on the 2011 Finalised Priority Assessment list. The 'Elderslie Banksia Scrub Forest' was a component of this nomination but was excluded from the final listing. It was assessed separately due to its unique nature and recognition that an equivalent ecological community was listed in NSW (initially as Endangered in 1999, then re-listed as Critically Endangered in 2015) under the *Threatened Species Conservation Act 1995* (TSC Act) (NSW Scientific Committee, 1999; 2015). The TSC Act has since been superseded by the *Biodiversity Conservation Act 2016* (BC Act), with the listing continued under the new legislation. The national ecological community encompasses all of the Elderslie Banksia Scrub Forest listed under the NSW BC Act plus areas that intergrade with or are transitional to some surrounding forest described in NSW as either River Flat Eucalypt Forest, Moist Shale Woodland or Cumberland Plain Woodland provided that the key diagnostic characteristics are met (as set out in section 2.5).

It is recommended that the ecological community be named **Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion**. The name of the ecological community acknowledges a well-recognised name that is based on the original vegetation map unit (Benson, 1977), state-listed entity and the location where it was first described. It also recognises that Coast Banksia is a feature of the ecological community. Throughout this document the full name of the ecological community may be abbreviated to 'Elderslie Banksia Scrub Forest' or 'the ecological community'.

3.2 Location and physical environment

The Elderslie Banksia Scrub Forest is restricted to the Cumberland subregion of the Sydney Basin IBRA bioregion[2]. It is only known from the Camden local government area (LGA) in proximity to the Nepean River (*sensu* Tozer et al., 2010; Douglas, 2015). The area is within the jurisdiction of Greater Sydney Local Land Services.

Known patches occur on an extensively cleared and largely mined Tertiary sand deposit located at the once-rural locality of Spring Farm, which is a rapidly urbanising area adjacent to the established suburb of Elderslie. Additional very small patches may have been present on Tertiary sands upstream of the Warragamba River confluence with the Nepean River, but these either no longer remain or have not been confirmed due to a very small patch size.

The ecological community occurs at low elevations, of around 60 to 100 m above sea level. It is normally above the 100 year flood level, though it is possible that some regrowth on mined sand deposits is now artificially within the present floodplain. It is found in an area that receives around 750 mm rainfall annually (Tozer et al., 2010).

The ecological community occurs on deep sandy substrates on high-level Tertiary alluvium (NSW Scientific Committee, 1999; Tozer et al., 2010). The deposits were first described by Willan (1925), who deemed them to be of Tertiary origin and associated with the ancestral Nepean River. The Geological Survey of New South Wales in 1971 identified what it termed the Camden high level sand deposit. Mapping of the sand deposits was first undertaken at a 1:4,000 scale by Gobert (1977), who identified the presence of a shallow perched water table (aquifer). Later mapping was undertaken at a 1:11,000 scale by Longworth and McKenzie (1981), and broad-scale geological mapping encompassing those deposits at 1:100,000 by Stroud et al. (1985) and Wallace (1983).

Hazelton, in Clements et al. (2002), identified discrepancies in the mapping and description of the sandmass, and "a lack of detail of specific areas of (ecological) interest" and subsequently undertook new research, using in part data from SMEC (2002). This review of earlier literature indicated that the sandmass had a complex and significantly variable composition ranging from white sands, including secondary aeolian deposits, through to heavy clayey sands, laterised bands, and clayey colluvium to 3 m depth and derived from surrounding Wianamatta Shale that covered parts of the sandmass (Hazelton in Clements et al., 2002).

Clay-rich layers within the sandmass allowed the development of an aquifer, with a "substantial aquifer" noted as being close to the then present ground surface by Longworth and McKenzie (1981). Wallace (1983) also described "a perched water table and abundant underground water, commonly at shallow depth (<3 m)" in the eastern part of the deposit. The aquifer may have discharged in various locations, including where the sandmass was incised by watercourses such as Spring Creek, and likely gave rise to the name of that watercourse and to the locality of Spring Farm. Similar phenomena are documented for other sandmasses in the Sydney Basin region, and are associated with other highly endemic and threatened ecological communities such as Eastern Suburbs Banksia Scrub (listed in NSW and nationally) and Maroota Sands Swamp Forest (listed in NSW).

The soil is likely to be low in nutrients, unlike more recent alluvial deposits (Keith, 2004), and may be well- or poorly- drained (NSW Scientific Committee, 1999). The aquifer may still be intact on the edges of the sandmass, and groundwater discharge may explain some of the wetter areas within the ecological community. Such areas may be indicated by an understorey of ferns and/or sedges, and (sub)canopy of *Melaleuca* species. The sandy substrate influences the types

[2] IBRA refers to the Interim Biogeographical Regionalisation of Australia. IBRA regions are large geographically distinct areas of similar climate, geology and landform with corresponding similarities in their vegetation and animal communities. The version current at the time of this advice is IBRA v7 (DoE, 2013), which divides Australia into 89 bioregions and 419 subregions, including offshore islands.

of plant species that occur in the ecological community, many of which align to coastal dune flora (Keith, 2004) and the flora of the elevated sandstone plateaux to the south (Steenbeeke, pers. comm., 2015; Douglas, 2015).

3.3 Vegetation

3.3.1 Canopy layer

The canopy may be dominated by *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia) on the most sandy soils, especially on elevated and exposed sites. *Angophora subvelutina* (Broad-leaved Apple) may be prominent on less sandy sites, areas with impeded drainage/higher groundwater, and areas transitional with other forest assemblages. In other taller forest areas, the canopy can be dominated by the natural hybrid *Eucalyptus botryoides* (Bangalay) x *E. saligna* (Sydney Blue Gum), but can also include *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus baueriana* (Blue Box), *E. amplifolia* (Cabbage Gum), and *E. tereticornis* (Forest Red Gum). A subcanopy of Coast Banksia may be present or a subcanopy of *Melaleuca decora* (Paper Bark, White Feather Honey Myrtle) and *M. linariifolia* (Snow in Summer) may be prominent in wetter sites or sites such as along/near watercourses; in areas with impeded drainage or high groundwater; and in areas transitional with River-Flat Eucalypt Forest (*sensu* Tozer et al., 2010; Douglas, 2015; NSW Scientific Committee, 2015).

3.3.2 Understorey – shrub or mid layer (low to medium shrubs)

The shrub or mid layer is typically 'scrubby' – mostly sclerophyllous vegetation, including flora typically associated with coastal sand and sandstone plateau areas of NSW, though also with some mesophyllous species. Characteristic mid layer species include: *Acacia decurrens* (Black Wattle), *A. implexa* (Hickory Wattle), *A. ulicifolia* (Prickly Moses), *Aotus ericoides* (Common Aotus), *Brachyloma daphnoides* (Daphne Heath), *Breynia oblongifolia* (Coffee Bush), *Dillwynia glaberrima* (Smooth-leaved Dillwynia), *Persoonia linearis* (Narrow-leaved Geebung), *Pimelea linifolia* subsp. *linifolia* (Slender Rice-flower), and *Ricinocarpos pinifolius* (Wedding Bush) (NSW Scientific Committee, 1999, 2015; Tozer et al., 2010).

In some areas the ecological community has more elements associated with dry rainforest and riverflat forest. Species include *Clerodendrum tomentosum* (Hairy Clerodendrum), *Duboisia myoporoides* (Corkwood), *Kunzea ambigua* (Tick Bush), *Ozothamnus diosmifolius* (White Dogwood), *Platysace lanceolata* (Shrubby Platysace), *Clematis* spp., *Cayratia clematidea* (Native Grape), *Parsonsia straminea* (Hairy Silkpod), and *Denhamia silvestris* (syn. *Maytenus silvestris*) (Narrow-leaved Orangebark).

3.3.3 Understorey – ground layer (ferns, graminoids and forbs)

Many of the understorey species that are known to be present are common, widespread, hardy and/or pioneering plants that are not specific to the ecological community.

The ground layer often includes *Dianella caerulea* and *D. revoluta* (Flax-lilies), *Gahnia clarkei* (Tall Saw-sedge), *Gleichenia dicarpa* (Pouched Coral Fern), *Hibbertia diffusa* (Wedge Guinea Flower), *Lomandra* spp. and *Pteridium esculentum* (Common Bracken) (NSW Scientific Committee, 1999, 2015; Tozer et al., 2010).

Sites with taller forest tend to include understorey species that prefer wetter areas, such as *Viola* spp. (Violets), *Centella asiatica* (Indian Pennywort), *Dichondra repens* (Kidney Weed), and *Pteris tremula* (Tender Brake). In some sites such as those intergrading with River-Flat Eucalypt Forest, a grassy understorey may be apparent, e.g. *Microlaena stipoides* (Weeping Grass) and *Austrostipa ramosissima* (Stout Bamboo Grass) with sedges such as *Gahnia* and *Carex* species.

Further flora species that are known or likely to be part of the ecological community can be found in Table A1 at Appendix A.

3.4 Fauna

Yellow-tailed Black Cockatoo in Elderslie Banksia Scrub Forest, Spring Farm. (Shortly before this photo was taken, it had been seen browsing on Coast Banksia below.) *Photo credit: Matt White*

Many remnants of the ecological community are now unlikely to support a natural and complete faunal assemblage due to a loss of large, old, hollow-bearing trees; modifications to the understorey; and isolation and fragmentation (Lindenmayer et al., 2006). As a result of clearing, fragmentation, invasive species and inappropriate fire regimes, the structure of vegetation and habitat elements across the ecological community has been, and continues to be, modified. However, remnants are still of value to disturbance-tolerant or highly mobile species, particularly as stepping-stone habitat in otherwise cleared or developed landscape (Doerr et al., 2010).

The vertebrate fauna of this ecological community includes the following species that have been recorded either within the ecological community or similar native vegetation in the Camden LGA (Jones et al., 1997):

Amphibians: *Limnodynastes dumerilii* (Eastern Banjo Frog), *L. peronii* (Brown-striped Frog), *L. tasmaniensis* (Spotted Marsh Frog), *Litoria Verreauxii* (Verreaux's Tree Frog) and *Crinia signifera* (Common Eastern Froglet).

Reptiles: *Ctenotus robustus* (Striped Skink), *Lampropholis guichenoti* (Garden Skink), *Pygopus lepidopodus* (Common Scaly-foot), *Pogona barbata* (Bearded Dragon), and *Pseudechis porphyriacus* (Red-bellied Black Snake).

Birds: Common birds are likely to include: *Anthochaera carunculata* (Red Wattlebird), *Cacatua galerita* (Sulphur-crested Cockatoo), *Cacatua sanguinea* (Little Corella), *Cracticus tibicen* (Australian Magpie), *Corvus coronoides* (Australian Raven), *Eolophus roseicapillus* (Galah), *Eopsaltria australis* (Eastern Yellow Robin), *Dacelo novaeguineae* (Laughing Kookaburra), *Malurus cyaneus* (Superb Fairy-wren), *Manorina melanocephala* (Noisy Miner), *Platycercus elegans* (Crimson Rosella), *Platycercus eximius* (Eastern Rosella), *Podargus strigoides* (Tawny Frogmouth), *Rhipidura leucophrys* (Willie Wagtail), *Strepera graculina* (Pied Currawong). Less common birds are likely to include: *Acanthiza pusilla* (Brown Thornbill), *Anthochaera phrygia* (Regent Honeyeater), *Artamus cyanopterus* (Dusky Woodswallow), *Botaurus poiciloptilus* (Australasian Bittern), *Colluricincla harmonica* (Grey Shrike-thrush), *Caligavis chrysops* (Yellow-faced Honeyeater), *Malurus lamberti* (Variegated Fairy-wren), *Melanodryas cucullata* (Hooded Robin), *Ninox novaeseelandiae* (Southern Boobook Owl), *Pachycephala pectoralis* (Golden Whistler), *Pardalotus striatus* and *P. punctatus* (Striated and Spotted Pardalotes), *Petroica rosea* (Rose Robin), *Rhipidura albiscapa* (Grey Fantail) and *Sericornis frontalis* (White-browed Scrubwren). In addition, *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo) have been observed feeding on banksias in the ecological community at Spring Farm (pers. obs. J. Billing, A. Chalklen & M. White, 2014) and the nationally threatened *Lathamus discolor* (Swift Parrot) is a migratory species that could utilise the ecological community over winter (Jones et al., 1997).

Mammals: *Tachyglossus aculeatus* (Short-beaked Echidna), *Petaurus breviceps* (Sugar Glider), *Trichosurus vulpecula* (Common Brushtail Possum), *Pseudocheirus peregrinus* (Common Ringtail Possum) and *Pteropus poliocephalus* (Grey-headed Flying-fox).

Further details on fauna species that are known to, or may, be part of the ecological community can be found in Table A2 at Appendix A.

3.5 Key diagnostic characteristics and condition thresholds

National listing typically focuses legal protection on the remaining patches of the ecological community that are most functional, relatively natural and in relatively good condition. Key diagnostic characteristics and condition thresholds help to:

a) identify when a patch of the threatened ecological community is present;

b) determine when the EPBC Act is likely to apply to the ecological community; and

c) distinguish between patches of different quality.

However, because of the very small size of patches and extent remaining and the nature of the threats, **condition thresholds have not been applied** to the Elderslie Banksia Scrub Forest ecological community. All remaining patches are considered critical to the survival of this ecological community. Even degraded patches that retain the characteristics of the ecological community need protecting.

3.5.1 Key diagnostic characteristics

The key diagnostic characteristics presented here summarise the main features of the ecological community. These are intended to aid the identification of the ecological community, noting that a broader description is given in other sections of this document, above.

- The Elderslie Banksia Scrub Forest ecological community is limited to the Cumberland IBRA Subregion of the Sydney Basin Bioregion:
  - it occurs near the Nepean River typically in association with deep (≥1 m) sand deposition areas from past river flows; typically where Tertiary alluvium overlies another substrate, usually Triassic age sedimentary strata of the Wianamatta Group;
  - it currently occurs upstream of the confluence of the Nepean River with the Warragamba River, particularly around the location of Spring Farm.
- The ecological community occurs at moderately low altitude, around 60 to 100 m ASL. It typically lies above the 1 in 100 year flood level, with possible exceptions including regrowth on mined sand deposits that are now artificially within the current floodplain.
- The canopy is or was dominated by *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), but can also be dominated by *Eucalyptus botryoides* (Bangalay) x *E. saligna* (Sydney Blue Gum) and may contain other tall canopy species such as *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus baueriana* (Blue Box), *Eucalyptus amplifolia* (Cabbage Gum), and *Eucalyptus tereticornis* (Forest Red Gum).

3.5.2 Further information to assist in determining the presence of the ecological community and significant impacts

The landscape position of the patch, including its position relative to surrounding vegetation, influences how important it is in the broader landscape; for example, whether it enables movement of native fauna or plant material or supports other ecological processes. The frequency and intensity of fire may influence the level of shrubbiness, or floristic elements such as the abundance of mesic species. The following information should be considered when evaluating the key diagnostic characteristics to assess a site that may include the ecological community and determine the potential impacts on a patch.

Defining a patch

A patch is a discrete and mostly continuous area of the ecological community. A patch may include small-scale (<30 m) variations, gaps and disturbances, such as tracks, paths or breaks (including exposed soil, leaf litter, cryptogams and watercourses/drainage lines), or localised variations in vegetation that do not significantly alter the overall functionality of the ecological community. Such breaks are generally included in patch size calculations. Where there is a break in native vegetation cover, from the edge of the tree canopy of 30 m or more (e.g. due to permanent artificial structures, wide roads or other barriers; or due to water bodies typically more than 30 m wide) then the gap typically indicates that separate patches are present.

Sampling protocol

Thorough and representative on-ground surveys are essential to accurately assess the extent of the ecological community. Because of the small patch size, small number of patches, and modified state of all remnants of the ecological community, entire patches should be sampled. Standard sampling methods that are often applied to the Sydney region and other parts of NSW (e.g. 20 x 20 m or equivalent 400 m^2 quadrats) may not be feasible or useful.

Timing of surveys

The timing of surveys is important with respect to disturbance history because the ecological community can vary markedly in appearance depending on the time since last disturbance, and the nature of that disturbance. For instance, many plant species may only be evident several months to a year or more after fire. Others are only readily detected or identifiable during their flowering season. Ideally, surveys should be repeated in more than one season and more than one year to ensure that the flora of a patch is fully and adequately sampled. It is important to note what kind of disturbance may have happened within a patch, and where possible, when that disturbance occurred.

Because most, if not all, remnants of this ecological community are subject to weed invasion, sometimes severely, sampling at a suitable interval after primary weeding and potentially after the use of fire to stimulate the seedbank may be important when assessing ecological resilience. Sites with a high weed load should not be dismissed as of 'low significance' solely on that basis. The appropriate removal of weeds and the use of seedbank stimulation in some form may dramatically alter the appearance, structure and floristics of a patch.

Buffer zone

A buffer zone is a contiguous area adjacent to a patch that is important for protecting the integrity of the ecological community. As the risk of damage to an ecological community is usually greater where actions occur close to a patch, the purpose of the buffer zone is to help protect and manage the integrity of the ecological community. As the buffer zone lies to the outside of the patch, it is not part of the ecological community itself; consideration of the buffer zone is strongly recommended, however.

For EPBC Act approval, changes in use of the land that falls within the buffer zone must not have a significant impact on the ecological community, although there are exemptions for continuing use. Where the buffer is subject to existing land uses, such as grazing, infrastructure access or fire breaks, these can continue. However, practical application of a buffer zone is strongly recommended to avoid adverse impacts to the patch. It may also be a focus of revegetation initiatives, where practical.

The recommended minimum buffer zone is 30 m from the outer edge of the patch. A larger buffer zone should be applied, where practical, if patches are down slope of drainage lines or a source of eutrophication.

Area critical to the survival of the ecological community

Given the very restricted geographic extent, including very limited number of patches remaining, all patches of the Elderslie Banksia Scrub Forest ecological community, plus buffer zones surrounding each patch, irrespective of condition, are considered critical to the survival of the ecological community. Areas that formerly contained the ecological community, and are not built upon, particularly derived native grasslands and shrublands and areas of native vegetation adjacent or near to patches with intact canopies, can be important to the survival of the ecological community in a fragmented, modified landscape. These areas should be considered a priority for management and funding to restore or support (buffer) the ecological community, but should not be used as an offset for patches with intact canopies.

Revegetated areas and areas of regrowth

Revegetated or replanted sites (or areas of regrowth) are not excluded from the national ecological community, provided that the patch meets the key diagnostic characteristics, above. It is recognised that reconstruction/revegetation often requires long term effort and commitment and results are uncertain. Reconstructing a woodland or forest ecological community to a state that resembles appropriate reference sites can, at best, be extremely slow and ultimately prove unsuccessful (Wilkins et al, 2003).

Other considerations related to significance

Actions that may have 'significant impacts' on any patches of the ecological community require consideration under the EPBC Act. The ecological importance of a patch is also influenced by its surrounding landscape. For example, if connected to, or near, other native vegetation, the ecological community may contribute substantially to landscape connectivity and function. Similarly, actions beyond the boundary of any patch of the ecological community may have a significant impact on the patch. For this reason, when considering actions likely to have impacts on this ecological community, it is important also to consider the environment that surrounds any patches.

In this ecological community, most patches are very small and more exposed to edge effects, particularly if buffer zones are not applied. Furthermore, as well as requiring legislative protection, some patches of the ecological community occur in isolation, thereby benefiting from management of the surrounding area and by linking these patches with other native vegetation. This is partially addressed in the Camden Contributions Plan (Camden Council, 2011) and earlier associated work by Clements (2002). Connectivity to other native vegetation remnants or restoration works (e.g. native plantings) in particular patches in an important position (or linking) between other patches in the landscape, can contribute to movement of fauna and the transfer of pollen and seeds.

3.6 Geographic extent

The Elderslie Banksia Scrub Forest has been subject to extensive clearing, fragmentation and degradation across a naturally very limited range. Much of the substrate that underpins the ecological community has been mined such that most of the habitat for the ecological community no longer exists. Since European settlement, it is estimated that the ecological community has undergone a reduction in extent of at least 90% (Douglas, 2015).

Estimates for the current extent of the ecological community were calculated from the mapping of Tozer et al. (2003, 2010), the mapping of Eco Logical Australia as used in the Camden Local Biodiversity Strategy (2013), a subset of data in Clements et al. (2002) and Clements (2002), aerial photography and OEH vegetation maps in the on-line SIX Maps package (accessed May, 2015), and ground-truthing by Douglas (2015). The total remaining extent is calculated at ~5 ha in five known patches, all but one of which are very small.

A site at Camden Aerodrome is appropriately considered potential former habitat of the ecological community (noting, its original flora is unknown) (Steenbeeke, pers. comm., 2014, 2015; Ridgeway, pers. comm., 2014, 2015; Corby, pers. comm., 2015b). The geology of that site seems to be consistent with that of the ecological community, but the vegetation has been mapped as a mix of Alluvial Woodland, River-Flat Eucalypt Forest, and cleared exotic vegetation (Tozer, 2003; Tozer et al., 2010; Eco Logical Australia, 2013). Any reconstruction of the ecological community at that site should not be used as an offset for the destruction of other more intact patches elsewhere.

Both the average patch size (<1 ha) and the total area of the ecological community are less than the estimates by the NSW Scientific Committee and Simpson (2008), Tozer et al. (2003), Tozer et al. (2010), and Clements (2002), indicating clearing of the ecological community has occurred since those papers were published. Estimates of the extant area of the ecological community range from about 13 ha (NSW NPWS, 2002a; Tozer et al. 2003, based on modelling and minor ground-truthing) to less than 15 ha (Tozer et al. 2010, based on some ground-truthing) to about 17 ha (Clements, 2002, based on extensive ground-truthing). The latest estimate is about 5 ha with approximate patch sizes of: 3.2, 0.94, 0.41, 0.36 and 0.20 hectares, respectively (Douglas, 2015). One site, known as the Integral Energy Offset Site, that may have been mapped as the ecological community by some authors, is known to be a

reconstruction of the ecological community on a cleared and re-contoured sand mound remaining after mining ('Stand REB' in Clements et al., 2002).

3.7 Other protection

The ecological community is listed as Critically Endangered under the NSW *Biodiversity Conservation Act 1995* (BC Act).

Additionally, the ecological community provides habitat or is in close proximity to known occurrences of three threatened plant species and 13 threatened animal species that are protected under state and national law (Table 1).

Table 1. Threatened flora and fauna species known or potentially occurring within or near to the Elderslie Banksia Scrub Forest ecological community.

Scientific name	Common name	EPBC Act^	BC Act^
Flora			
Cynanchum elegans	White-flowered Wax Plant	E	E
Eucalyptus benthamii	Camden White Gum, Nepean River Gum	V	V
Pomaderris brunnea	Rufous Pomaderris	V	E
Fauna			
Anthochaera phrygia	Regent Honeyeater	CE	CE
Botaurus poiciloptilus	Australasian Bittern	E	E
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll, Bindjulang	E	V
Heleioporus australiacus	Giant Burrowing Frog	V	V
Lathamus discolor	Swift Parrot	CE	E
Meridolum corneovirens	Cumberland Land Snail	–	E
Miniopterus orianae oceanensis	Eastern Bent-wing Bat	–	V
Micronomus norfolkensis	Eastern Coastal Free-tail Bat	–	V
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	V	V
Pseudomys novaehollandiae	New Holland Mouse, Pookila	V	–
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	–	V

Sources: Department of the Environment, 2014a; NSW Scientific Committee, 2015. This list is current as at August 2016.

^ V = Vulnerable, E = Endangered, CE = Critically Endangered, – = not listed under an Act

Further details on non-threatened flora and fauna species that are known or likely to be part of the ecological community can be found at Appendix A.

None of the known patches of the ecological community currently occurs in formal State or Commonwealth conservation reserves (Tozer et al., 2010; NSW Scientific Committee, 2015).

Some sites are within Council-owned reserves, and others are planned for inclusion in Council reserves as part of the Spring Farm conservation strategy within the Camden Contributions Plan (Camden Council, 2011). On-going conservation works will also be required to prevent their degradation and ultimate loss through major threats such as weeds, eutrophication and recreational pressures. However, inspections in May 2015 indicated that these areas are not

being effectively managed for conservation (Douglas, 2015), and all have significant weed problems. The Plan includes designation of some areas to be subject to reconstruction through planting. Inspections by Douglas (2015) revealed that the largest remnant, now Council-owned, has been subject to inappropriate and substantially failed plantings by a contractor. The plantings include species not native to the Camden area or to the ecological community.

One site beside an electricity substation (the Integral Energy Offset site) is being protected as an offset for earlier clearing by Landcom. Clements et al. (2002) indicate that it is not a remnant but a planted reconstruction.

To date, the evidence suggests that even when remnants are protected through Council reservation or formal offsetting mechanism, the outcomes have been mixed. There remains considerable potential to rectify this subject to availability of sufficient funds, expertise, and commitment to continual follow-up work, which is the intent of the conservation strategy within the Camden Contributions Plan (Camden Council, 2011).

4 SUMMARY OF THREATS

New residential development adjacent Elderslie Banksia Scrub Forest, Spring Farm. Note the depth to which the sand has been cut for the housing block. *Photo credit: Andrew Chalklen*

Area cleared for residential development adjacent to Elderslie Banksia Scrub Forest with overstorey dominated by Bangalay x Sydney Blue Gum hybrid, Spring Farm. Note the minimal buffer zone.
Photo credit: Matt White

Vegetation clearance was, and continues to be, a major contributor to the decline of native vegetation across the Cumberland IBRA subregion due to the increasing urbanisation of western Sydney and the resultant loss of native biodiversity and fragmentation of ecological communities. The main historical threats to the ecological community were from clearing for agriculture, most of which occurred before 1947 (Clements et al., 2002), as well as sand

mining, rural-residential and peri-urban development. Urbanisation is now the main threat in terms of direct habitat loss, though some of this has been contained through the conservation strategy for the Spring Farm urban release area (Clements, 2002) and associated Camden Contributions Plan (Camden Council, 2011). Current and future threats relate to the subsequent impacts of fragmentation, loss of native biodiversity and edge effects due to clearance (NSW OEH, 2012).

Key threats to the ecological community occurring as a result of increasing urbanisation include:

- inappropriate fire regimes, particularly altered fire frequency and intensity e.g. due to arson or hazard reduction burning, or some patches may have been impacted by a lack of fire because of the close proximity of relatively high density housing and roads;
- weed invasion from escaped garden and agricultural plants and contaminated mulch, sometimes facilitated by nutrient enrichment from increased run-off and/or absence of fire (see list of weeds in Table A3 at Appendix A);
- predation and displacement of native fauna by domestic pets, feral introduced species and aggressive native species adapted to an urban setting;
- 'tidying-up' of remnant bushland due to residents' fears about bushfire and snakes;
- hydrological changes and increased nutrient loads from urban run-off, rubbish and garden waste dumping and domestic pets; and
- recreational activities (e.g. mountain bike, trail bike and 4WD use).

Other threats include:

- ongoing impacts from fragmentation and loss of diversity, including loss of key flora, particularly many Coast Banksia trees;
- changes in faunal components and associated ecological function; and
- diseases, such as *Phytophthora cinnamomi* and myrtle rust (*Puccinia psidii* s.l.).

Further details about the threats to the ecological community can be found at Appendix C.

5 SUMMARY OF ELIGIBILITY FOR LISTING AGAINST EPBC ACT CRITERIA

Criterion 1 – Decline in geographic distribution

The Elderslie Banksia Scrub Forest ecological community has undergone a reduction in extent of at least 90% of its original pre-European extent. The ecological community has undergone a 'very severe' decline in its geographic extent, and is therefore **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 2 – Limited geographic distribution coupled with demonstrable threat

The known patches of Elderslie Banksia Scrub Forest are naturally restricted to a small number of highly localised deep and perched sand deposits near the Nepean River. Its current extent is estimated to be five hectares only, with a median patch size of 0.41 hectare, and remaining patches are isolated. The geographic distribution of the ecological community is very restricted. As detailed in the *Description of Threats* (Appendix C), the Elderslie Banksia Scrub Forest is subject to a range of ongoing demonstrable threats, mostly due to the impacts of previous clearance and ongoing urbanisation. The combination of a very restricted geographic distribution and ongoing threats means the ecological community could be lost in the 'immediate future'. Therefore, the ecological community is **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 3 – Loss or decline of functionally important species

Although there is likely to have been a very severe decline in certain species within the ecological community, notably Coast Banksia, specific data related to the decline of functionally important species and subsequent impacts to the ecological community are not available. As such there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

Criterion 4 – Reduction in community integrity

The modifications to the ecological community and the surrounding landscape in general are such that the reduction in integrity across its geographic distribution is **very severe**, and the potential for successful restoration in the immediate future is low for the Elderslie Banksia Scrub Forest. Therefore, the ecological community is **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 5 – Rate of continuing detrimental change

Approximately one third of the estimated extant area of the ecological community has been cleared or degraded to the point where it is no longer recognisable as the ecological community in the fourteen years since the mapping of Clements (2002) and Tozer et al. (2003) (also cited as NSW NPWS, 2002a). The Camden Contributions Plan (2011) identifies at least the majority of accepted remaining sites of the ecological community at Spring Farm within existing or proposed Council reserves to be set aside as part of the urbanisation process. It is unclear to what extent this plan will prevent further losses to clearing or to degradation of the ecological community (i.e. loss of condition). However, the available data either fall below prescribed listing thresholds or provide no clear information. Consequently, there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

Criterion 6 – Quantitative analysis showing probability of extinction

There are no quantitative data available to assess this ecological community under this criterion. As such, there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

A detailed assessment of eligibility against each of the EPBC Act criteria is provided at Appendix E.

6 PRIORITY RESEARCH AND CONSERVATION ACTIONS

The **Conservation Objective** (see section 1 above) provides the goal and rationale for the priority actions identified here. The objective is:

> To mitigate the risk of extinction of the Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion ecological community and help recover its biodiversity and function, through protections provided under the *Environment Protection and Biodiversity Conservation Act 1999* and implementing the following priority conservation actions.

6.1 Priority protection and restoration actions

It is more practical and cost-effective to maintain existing remnants than to allow their degradation and then attempt rehabilitation of these or other areas. The more disturbed and modified a patch of the ecological community, the greater is the recovery effort required. To gain the most cost-effective outcomes of investments in management it is important to consider the likely interaction of management actions at any one site, as these may be synergistic or antagonistic. There are also likely to be interactions between sites. Additionally, when allocating resources it is important to consider the minimum investment required for success and the follow-up required to secure long term recovery.

The three key approaches to achieve the conservation objective are:

PROTECT the ecological community to prevent further loss of extent and condition;

RESTORE the ecological community within its original range by active abatement of threats, re-vegetation and other conservation initiatives;

COMMUNICATE WITH AND SUPPORT researchers, land use planners, landholders, land managers, community members, including the Indigenous community, and others to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery.

These approaches are overlapping in practice and form part of an iterative approach to management that should include research, planning, management, monitoring and review.

Priority actions are recommended for the abatement of threats and supporting recovery of the ecological community. Actions inconsistent with these recommendations that are likely to significantly affect the ecological community should not be undertaken.

In assessment of activities that may have a significant impact on the ecological community, incorporate relevant actions listed below when determining recommendations including conditions of approval. Applications to Australian Government funding programmes should also consider prioritising these restoration activities. Also take into consideration the information outlined above under ‘Further information to assist in determining the presence of the ecological community and significant impacts’ (section 2.5.2).

PROTECT

Highest priorities:

- Conserve patches of this ecological community, and adjacent native vegetation, to help avoid further clearance and fragmentation of remnants. Given that this ecological community is highly restricted in spatial extent, with very few patches remaining, avoid any further losses to any patches of the ecological community. In particular, any further clearance of the ecological community and adjacent vegetation, including offsetting arrangements that permit damage to it, would be unacceptable in order to stop extinction and support recovery. Implement conservation management, including formal reserve and off-reserve protection though conservation arrangements, management agreements and covenants/reserve tenure on private and public lands.

- Avoid inappropriate disturbances to native vegetation (e.g. native shrub removal or other damage to the native understorey for 'tidying up' purposes, informal track formation, or ecologically inappropriate burning) to maintain the integrity of the patch, particularly during peak flowering and fruiting seasons of the ecological community.
- Establish buffer zones with appropriate native species to minimise 'edge effects' from increased run-off, weed invasion, rubbish dumping and other disturbances. Buffers should be as large as possible, at a minimum 30 m from the outer edge of the patch.
- Limit weed infestation and spread, including:
    - restrict or prevent plantings of potential or known environmental weeds in nearby gardens, from which they may spread into the remnant;
    - prevent the dumping of garden waste beyond the confines of the garden, on private or public land; and
    - avoid planting known or potential weeds in roadworks, landscaping and other development near the ecological community (plant appropriate local species). Ensure development and production activities implement appropriate measures to prevent the introduction and spread of weeds (e.g. during mowing, roadworks, or adjacent development).

Other priorities:

- Prevent the introduction of *Phytophthora cinnamomi* and myrtle rust (*Puccinia psidii* s.l.) to the ecological community. Steps to avoid introduction of Phytophthora should be undertaken in line with the national 'Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*' (Department of the Environment, 2014a), available at: http://www.environment.gov.au/biodiversity/invasive-species/diseases-fungi-and-parasites/phytophthora-cinnamomi-disease. Further guidance in relation to preventing the spread of both *Phytophthora* and myrtle rust (as well as weeds) is contained in the "Arrive Clean, Leave Clean" guidelines (Department of the Environment, 2015b), available at http://www.environment.gov.au/biodiversity/invasive-species/publications/arrive-clean-leave-clean.
- Install adequate fencing and signage for all remaining patches to restrict access, especially by vehicles.
- Given the small number and area of remnants, burning should be avoided (particularly canopy fires in areas where Coast Banksia is present), unless no other options exist for weed control and restoration. Prior to burning, seed of Coast Banksia should be collected in case they are required for re-introduction, as the persistence of this species in small fragmented remnants is important yet highly uncertain.
- If hazard reduction burns or other fire plans are deemed necessary, they should not be implemented without taking into account recent/unplanned burns, including as a result of arson (NSW DEC, 2005). Fires should be managed to ensure that prevailing fire regimes do not disrupt active components of the life cycle of any component species of the Ecological Community, degrade its habitat, promote invasion of exotic species or increase impacts of grazing/predation. Some practices that may be followed include:
    - ensuring that fires do not occur between mid autumn and late spring, and following up planned and unplanned fires with appropriate weed control;
    - ensuring that fires do not occur before an accumulation of a seedbank for obligate seeding plants, large enough to replace the number of fire-killed standing plants;

- ensuring that intervals between successive fires take into account the longevity of the standing population of key obligate seeding plant species and are shorter than the period required to maintain recovery capacity of resprouting individuals; and
- reducing fire intensity where important fauna habitat features are evident (e.g. nest sites, hollow logs).

- Control stormwater and other urban run-off, particularly from nearby developments, to prevent:
  - the further alteration of hydrological regimes in the ecological community;
  - the infiltration of litter;
  - the dispersal of weeds; and
  - the introduction of unnaturally high nutrient levels and pollutants to the ecological community.
- Manage and protect existing offset areas (e.g. near the electricity substation) in perpetuity in areas dedicated for conservation purposes, and avoid any further reductions of the size, condition and ecological function of these areas.

RESTORE

Other high priority measures should be undertaken consistent with *Recovering Bushland on the Cumberland Plain: best practice guidelines on the management and restoration of bushland* (NSW DEC, 2005) and any national recovery plan relevant to this ecological community[3], including:

- Conserve the soil seedbank and support the regeneration of the ecological community through:
  - the appropriate use of fire and weed management, including the establishment of a fire history, the use of monitoring plots to assist in tracking fire responses, and avoiding use of prescribed fire between mid autumn and late spring;
  - revegetation using seedlings grown from locally endemic seeds collected in the area, if natural regeneration is not possible – this is a priority for some species in this ecological community, e.g. *Ricinocarpos pinifolius* and *Brachyloma daphnoides*. Seed may need to be obtained from outside the normal range of the ecological community if there is insufficient local material and/or a) if failure rates suggest consistently low levels of seed viability (e.g. due to inbreeding depression), or b) if climate change and predicted change warrants using plant material from a provenance better suited to current and future climatic conditions.
- Undertake weed control and restoration activities, including:
  - identifying and managing weeds that are emerging threats;
  - managing and reducing weed infestations using best practice guidelines, with a focus on the species that pose the most threat to the ecological community. In particular, note that:
    - broad-scale, non-selective herbicide use is inappropriate and particular attention should be paid to avoiding areas that contain threatened flora or areas near waterways (NSW DECC, 2005); and

[3] At the time this conservation advice was approved, a national recovery plan was in preparation for multiple ecological communities of the Cumberland Plain and surrounds.

    - sediment fences and the use of shade cloth on fences can be utilised to prevent some weeds from invading a remnant, particularly when undertaking housing and other infrastructure development in adjacent areas.
    - keeping vehicles and machinery out of remnants. If vehicles must be taken into remnants, ensure they are washed to remove soil and weed seeds and treated to sterilise *Phytophthora* spores; and
    - discouraging access to the ecological community by people and pets, particularly dogs and cats (in this case, remnants may need to be fenced to limit access other than to managers, researchers, and emergency services).
- Control introduced pest animals in the local region.
- Avoid the spread of *Phytophthora* and myrtle rust. Steps to avoid spread of *Phytophthora* should be undertaken in line with information in the national threat abatement plan (Department of the Environment, 2014a), available at: http://www.environment.gov.au/biodiversity/invasive-species/diseases-fungi-and-parasites/phytophthora-cinnamomi-disease.
- Enhance connectivity through revegetation between patches to reduce isolation effects. Ensure that all management and regeneration activities are undertaken in a manner based on best practice guidelines that provide for the retention of a functional ecosystem.

COMMUNICATION AND SUPPORT

- Develop and promote educational materials for the community, organisations and agencies, which develop their understanding and appreciation of the value of the ecological community to ensure conservation of the ecological community is taken into account in activities such as infrastructure development and maintenance, and regional planning.
- Support and encourage land managers to implement monitoring of management actions.
- Engage with school and volunteer groups (e.g. relevant 'Friends' groups) to assist with on-ground monitoring, management and promotion of the ecological community and the sites where it occurs. The vegetation is highly localised and has the potential to generate support among residents.
- Promote awareness in the community about local weeds and plants escaping from gardens, their prevention and management, including dumping of garden refuse and green waste.
- Support opportunities for Traditional Owners to manage or be involved in the management of the ecological community.

6.2 Research, monitoring and other priorities

- Undertake extensive on-ground surveys and mapping of all potential sites upstream of the confluence of the Nepean River with the Warragamba River.
- Adapt previous management and research outcomes and provide feedback into future planning and management for the conservation of the ecological community.
- Experiment with restoration methods, for example trial 'trigger' practices such as brush matting and strategic soil disturbance in an experimental framework ex-situ to support adaptive management.

6.3 Existing management and recovery plans

A number of existing plans relate to management and/or recovery of the ecological community or its component species. These prescriptions were current at the time of publishing. Please refer to the relevant agency's website for any updated versions or new information that has been published. Plans prepared for the management and/or recovery of the ecological community (or its component vegetation units) include:

- NSW Department of Environment and Conservation (2005). *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland*. Sydney. Accessed 14 October 2016. Available on the internet at: http://www.environment.nsw.gov.au/threatenedspecies/CumberlandPlainManagementGuidelines.htm
- NSW Department of Environment, Climate Change and Water (2010). *Cumberland Plain Recovery Plan*. Sydney, NSW. Accessed 14 October 2016. Available on the internet at: http://www.environment.nsw.gov.au/threatenedspecies/CumberlandPlainRecoveryPlan.htm

Recovery plans prepared for species occurring in the ecological community include:

- Department of the Environment (2016). *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)*. Commonwealth of Australia, Canberra. Accessed 14 October 2016. Available on the internet at: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-regent-honeyeater-anthochaera-phrygia-2016
- Queensland Department of Environment and Resource Management (2011). *National recovery plan for the large-eared pied bat Chalinolobus dwyeri*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Accessed 14 October 2016. Available on the internet at: http://www.environment.gov.au/resource/national-recovery-plan-large-eared-pied-bat-chalinolobus-dwyeri
- Victorian Department of Environment, Land, Water and Planning (2016). *National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus*. Accessed 14 October 2016. Available on the internet at: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/spotted-tailed-quoll
- Saunders, D.L. and Tzaros, C.L. (2011). *National Recovery Plan for the Swift Parrot Lathamus discolor*. Birds Australia, Melbourne. Accessed 14 October 2016. Available on the internet at: http://www.environment.gov.au/resource/national-recovery-plan-swift-parrot-lathamus-discolor

6.4 Recovery plan recommendation

The Threatened Species Scientific Committee recommends that a recovery plan is developed for the Elderslie Banksia Scrub Forest ecological community. The actions required to avoid extinction and promote recovery of the ecological community include short and long term activities that need to be co-ordinated and involve a range of stakeholder groups to be effective. A recovery plan would provide further guidance to land managers and raise public awareness of conservation actions.

It is suggested that the recovery plan for the ecological community should be part of a multi-ecological community recovery plan for all relevant nationally threatened ecological communities that occur on or near the Cumberland IBRA subregion. This is because these ecological communities tend to have similar threats acting upon them and a coordinated, strategic and regional approach is likely to provide efficiencies and improve overall conservation outcomes.

APPENDICES

APPENDIX A – SPECIES LISTS

All species lists presented in this appendix are indicative rather than comprehensive lists of relevant species that comprise the ecological community. A particular patch may not include all species on the list or may include other species not listed. Scientific names are valid as at October 2016.

Table A1. Native plant species of the ecological community. Scientific names are current as at October 2016. Some local Indigenous names have also been provided. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers.

Scientific name	Common name
Trees and tall shrubs	
Angophora subvelutina #	Broad-leaved Apple
Banksia integrifolia subsp. *integrifolia #*	Coast Banksia, White Banksia, Honeysuckle
Eucalyptus amplifolia	Cabbage Gum
Eucalyptus baueriana	Blue Box
Eucalyptus benthamii	Camden White Gum
Eucalyptus botryoides x Eucalyptus saligna #	Hybrid Bangalay, Southern Mahogany x Sydney Blue Gum Kai'yeroo (D'harawal)
Exocarpos cupressiformis	Native Cherry, Cherry Ballart, Goo'weregan (D'harawal)
Melaleuca decora	Paper Bark, White Feather Honey-Myrtle, Bujor (D'harawal)
Melaleuca linariifolia	Snow in Summer, Gurren'durren (D'harawal)
Eucalyptus tereticornis	Forest Red Gum
Low to medium shrubs	
Aotus ericoides	Common Aotus, Golden Pea
Acacia decurrens	Boo'kerrinkin (D'harawal), Black Wattle, Green Wattle, Sydney Green Wattle
Acacia implexa	Hickory Wattle, Weetjellan (D'harawal)
Acacia parramattensis	Parramatta Wattle, Sydney Green Wattle
Acacia ulicifolia	Prickly Moses, Juniper Wattle
Brachyloma daphnoides	Daphne Heath
Breynia oblongifolia	Coffee Bush
Bursaria spinosa	Blackthorn, Kurwan (D'harawal)
Clerodendrum tomentosum	Hairy Clerodendrum, Downy Chance Tree, Hairy Lolly Bush
Dillwynia glaberrima	Smooth-leaved Dillwynia
Duboisia myoporoides	Corkwood, Poison Corkwood, Eye Opening Tree, Yellow Basswood
Kunzea ambigua	Tick Bush
Leptospermum polygalifolium subsp. polygalifolium	Tantoon, Ti-tree
Ozothamnus diosmifolius	White Dogwood, Rice Flower, Sago Bush, Pill Flower
Persoonia linearis	Narrow-leaved Geebung
Pimelea linifolia	Slender Rice Flower, Granny's Bonnet, Queen-of-the-Bush
Platysace lanceolata	Shrubby Platysace
Ricinocarpos pinifolius	Wedding Bush
Ferns, forbs and graminoids	
Aristida ramosa	Purple Wiregrass
Austrostipa ramosissima	Stout Bamboo Grass
Centella asiatica	Indian Pennywort, Gotu Cola
Dianella caerulea	Blue Flax-lily, Blueberry Lily
Dianella revoluta	Black-anther Flax-lily, Pokulbi (D'harawal)

Scientific name	Common name
Dichondra repens	Yilibili (D'harawal), Kidney Weed
Eragrostis brownii	Brown's Lovegrass, Brown Love Grass, Common Love Grass, Bentham's Love-grass
Gahnia clarkei	Tall Saw-sedge
Gleichenia dicarpa	Pouched Coral-fern, Tangle Fern, Wiry Coral Fern
Glycine clandestina	Twining Glycine
Gompholobium minus	Dwarf Wedge Pea
Hibbertia diffusa	Wedge Guinea Flower
Imperata cylindrica	Blady Grass
Kennedia rubicunda	Dusky Coral-pea, Red Kennedy Pea
Lomandra filiformis	Wattle Mat-rush
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Phyllanthus gunnii	Shrubby Spurge, Scrubby Spurge
Pteridium esculentum	Gurgi (Cadigal), Bracken
Pteris tremula	Tender Brake, Tender Brakefern
Ranunculus inundatus	River Buttercup
Veronica plebeia	Creeping Speedwell, Trailing Speedwell
Viola spp.	Violet

Sources: NSW Scientific Committee (1999, 2015); Tozer et al. (2010); NSW OEH (2012); Department of the Environment (2014a); Douglas (2015).

– Dominant canopy species

Table A2. Native fauna species that are known to occur or may occur in the ecological community. Scientific names are current as at October 2016.

Scientific name	Common name	EPBC Act*	BC Act*
Birds			
Acanthiza pusilla	Brown Thornbill		
Anthochaera carunculata	Red Wattlebird		
Anthochaera phrygia	Regent Honeyeater	CE	CE
Artamus cyanopterus	Dusky Woodswallow		
Botaurus poiciloptilus	Australasian Bittern	E	E
Cacatua galerita	Sulphur-crested Cockatoo		
Cacatua sanguinea	Little Corella		
Calyptorhynchus funereus	Yellow-tailed Black Cockatoo		
Colluricincla harmonica	Grey Shrike-thrush		
Corvus coronoides	Australian Raven		
Cracticus tibicen	Australian Magpie		
Dacelo novaeguineae	Laughing Kookaburra		
Eolophus roseicapillus	Galah		
Eopsaltria australis	Eastern Yellow Robin		
Caligavis chrysops	Yellow-faced Honeyeater		
Lathamus discolor	Swift Parrot	CE	E
Malurus cyaneus	Superb Fairy-wren		
Malurus lamberti	Variegated Fairy-wren		
Manorina melanocephala	Noisy Miner		
Melanodryas cucullata	Hooded Robin		
Ninox novaeseelandiae	Southern Boobook Owl		
Pachycephala pectoralis	Golden Whistler		
Pardalotus punctatus	Spotted Pardalote		
Pardalotus striatus	Striated Pardalote		
Platycercus elegans	Crimson Rosella		
Platycercus eximius	Eastern Rosella		
Podargus strigoides	Tawny Frogmouth		
Rhipidura leucophrys	Willie Wagtail		
Rhipidura albiscapa	Grey Fantail		
Sericornis frontalis	White-browed Scrubwren		
Strepera graculina	Pied Currawong		
Mammals			
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll, Bindjulang	E	V
Miniopterus orianae oceanensis	Eastern Bent-wing Bat	-	V
Micronormus norfolkensis	Eastern Coastal Free-tail Bat	–	V
Petaurus breviceps	Sugar Glider		
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	V	V
Pseudocheirus peregrinus	Common Ringtail Possum		
Pseudomys novaehollandiae	New Holland Mouse, Pookila	V	–
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	-	V
Tachyglossus aculeatus	Short-beaked Echidna		
Trichosurus vulpecula	Common Brush-tailed Possum		

Scientific name	Common name	EPBC Act*	BC Act*
Reptiles and Amphibians			
Ctenotus robustus	Striped Skink		
Eulamprus heatwolei			
Heleioporus australiacus	Giant Burrowing Frog	V	V
Lampropholis guichenoti	Garden Skink		
Limnodynastes dumerilii	Eastern Banjo Frog		
Limnodynastes peroni	Striped Marsh Frog, Brown-Striped Frog		
Limnodynastes tasmaniensis	Spotted Marsh Frog, Spotted Grass Frog		
Litoria verreauxii	Verreaux's Tree Frog, Whistling Tree Frog		
Pogona barbata	Bearded Dragon		
Pseudechis porphyriacus	Red-bellied Black Snake		
Pygopus lepidopodus	Common Scaly-foot		
Invertebrates			
Meridolum corneovirens	Cumberland Land Snail	-	E

Sources: Jones et al., 1997; NSW Scientific Committee (2015); Douglas (2015); Department of the Environment (2014a)

* CE – Critically Endangered, E – Endangered, V – Vulnerable

Table A3. Weed species that may occur in the ecological community. Scientific names are current as at October 2016.

Scientific name	Common name
Acetosella vulgaris	sheep sorrel
Alternanthera philoxeroides #	alligator weed
Anredera cordifolia #	Madeira vine, jalap, lamb's-tail, mignonette vine, anredera, gulf madeiravine, heartleaf madeiravine, potato vine
Arctotheca calendula	capeweed
Asparagus aethiopicus #	asparagus fern, ground asparagus, basket fern, sprengi's fern, bushy asparagus, emerald asparagus
Asparagus asparagoides #	bridal creeper, bridal veil creeper, smilax, florist's smilax, smilax asparagus
Asparagus scandens #	asparagus fern, climbing asparagus fern
Briza subaristata	briza
Bromus spp.	brome grasses
Cabomba caroliniana	cabomba, common cabomba, fanwort, Carolina fanwort, watershield, Carolina watershield, fish grass, Washington grass
Carduus spp.	thistles
Chloris gayana	Rhodes grass
Chrysanthemoides monilifera subsp. *monilifera* #	boneseed
Chrysanthemoides monilifera subsp. *rotundata* #	bitou bush
Cinnamomum camphora	camphor laurel
Cotoneaster pannosus	cotoneaster
Cytisus scoparius #	broom, English broom, Scotch broom, common broom, Scottish broom, Spanish broom
Delairea odorata (syn. *Senecio mikanioides*)	Cape ivy, German ivy
Echium plantagineum	Paterson's curse
Echium vulgare	Viper's bugloss
Ehrharta erecta	African veldt grass
Eragrostis curvula	African lovegrass
Gleditsia triacanthos #	honey locust
Genista monspessulana #	Montpellier broom, cape broom, canary broom, common broom, French broom, soft broom
Hypochaeris radicata	catsear, flatweed
Lantana camara #	lantana, common lantana, kamara lantana, large-leaf lantana, pink flowered lantana, red flowered lantana, red-flowered sage, white sage, wild sage
Ligustrum spp.	privets
Lycium ferocissimum #	African boxthorn, boxthorn
Melinis repens	red Natal grass, Natal grass, Natal redtop
Nassella trichotoma #	serrated tussock, Yass River tussock, Yass tussock, nassella tussock
Nassella neesiana #	Chilean needlegrass
Oenothera sp.	evening primrose
Olea europaea subsp. *cuspidata*	African olive
Opuntia spp. #	prickly pears
Paspalum dilatatum	paspalum
Cenchrus clandestinus	kikuyu
Pittosporum undulatum	sweet pittosporum
Plantago lanceolata	plantain
Pyracantha spp.	firethorns
Rhaphiolepis indica	Indian hawthorn
Rubus fruticosus aggregate #	blackberry, European blackberry
Senecio madagascariensis #	fireweed, Madagascar ragwort, Madagascar groundsel
Solanum spp.	nightshades
Tradescantia fluminensis	trad, wandering Jew
Trifolium repens	white clover
Ulex europaeus #	gorse, furze

Sources: Corby, pers. comm. (2014); Department of the Environment (2014a); Steenbeeke, pers. comm. (2014); NSW Scientific Committee (2015); Douglas (2015)

– Weeds of National Significance (WoNS), as identified at http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html, October 2016

APPENDIX B – VEGETATION CLASSIFICATION AND DIFFERENCES WITH OTHER SIMILAR ECOLOGICAL COMMUNITIES

Distribution

The Elderslie Banksia Scrub Forest occurs in small patches on deep Tertiary sand deposits near the Nepean River in the Macarthur District of south-western Sydney. All known remnants are in the extensively cleared and rapidly urbanising locality of Spring Farm. Other very small patches may occur on similar sediments upstream of the confluence of the Nepean River and the Warragamba River, but have yet to be identified.

The ecological community occurs only in the Cumberland (SYB08) subregion within the Sydney Basin Bioregion (IBRA7). It occurs primarily in the Camden Local Government Area, but may occur elsewhere in the subregion provided that other characteristics are met.

Relationships to other vegetation classifications

The ecological community corresponds, entirely or in part, to the following vegetation classifications:

- Tozer et al. (2010) - DSF p463 Elderslie Banksia Scrub Forest
- Keith (2004) – Sydney Sand Flats Dry Sclerophyll Forest (in part, only)

If a patch is mapped as meeting the BC Act description of the Elderslie Banksia Scrub Forest (DSF p463 in Tozer et al., 2010), it is regarded as part of the national ecological community.

Differences from similar or intergrading ecological communities

The ecological community is adjacent to, and intergrades with, the nationally listed 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' and the 'Western Sydney Dry Rainforest and Moist Shale Woodland' ecological communities (Douglas, 2015). It also occurs adjacent to and intergrades with the NSW-listed 'River-Flat Eucalypt Forest' (NSW Scientific Committee, 2015). Areas of vegetation considered by some classifications to be transitional between the Elderslie Banksia Scrub Forest and the aforementioned adjacent communities should be regarded as part of the Elderslie Banksia Scrub Forest ecological community for the purposes of EPBC Act listing.

The following vegetation types occur in western Sydney on sandy substrates. They can generally be differentiated from Elderslie Banksia Scrub Forest by their location in the landscape, geology, and/or floristic composition.

Agnes Banks Woodland (DSF p239, Tozer et al., 2010)

Agnes Banks Woodland (part of the nationally listed Castlereagh Scribbly Gum and Agnes Banks Woodlands) occurs on a similar substrate to Elderslie Banksia Scrub Forest and has some allied coastal floral characteristics. It primarily occurs on deep aeolian (wind-blown) sands, overlying Tertiary alluvium, whereas the Elderslie Banksia Scrub Forest occurs on fluvial deposits, part of which includes secondary aeolian material (Hazelton in Clements et al., 2002). It occurs around the Agnes Banks township at least 20 km further north than Elderslie Banksia Scrub Forest and at a much lower elevation of around 30 m ASL. Both ecological communities may include *Melaleuca decora*, but they differ in many of the other characteristic canopy and understorey flora. The Elderslie Banksia Scrub Forest is more likely to include occasional mesophyllous 'rainforest' species such as *Breynia oblongifolia* (Coffee Bush) and *Clerodendrum tomentosum* (Hairy Clerodendrum). Agnes Banks Woodland has a prominent component of Proteaceae and Fabaceae species and a canopy of 10-12 m dominated by *Eucalyptus sclerophylla* (Scribbly Gum) and *E. parramattensis* (Parramatta Red Gum).

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (FoW p33, Tozer et al., 2010)

River-Flat Eucalypt Forest is a woodland or open forest occurring on alluvial flats and stream-banks. It differs from the Banksia scrub component of the Elderslie Banksia Scrub Forest by its typically open shrub layer with almost continuous ground cover of grasses and forbs (Tozer et al., 2010). Some remnants of Elderslie Banksia Scrub Forest intergrade with the River-Flat Eucalypt Forest. They differ from River-Flat Eucalypt Forest in that they occur on older, generally sandier geology (Tertiary, not Quaternary) above the current 1 in 100 year flood height, and typically include understorey species more commonly associated with sandstone terrain and coastal dunes.

Eastern Suburbs Banksia Scrub

Eastern Suburbs Banksia Scrub of the Sydney Region is listed as endangered under both the EPBC Act and the NSW BC Act. It occurs in Sydney's eastern and south-eastern suburbs, on a sandy (aeolian), nutrient poor substrate (NSW NPWS, 2002a). Eastern Suburbs Banksia Scrub has a low scrub or heath structure, with small areas of woodland and wet areas (NSW NPWS, 2002a). It is distinguished from the Elderslie Banksia Scrub Forest by its more coastal location on aeolian sands; a heathy understorey typically lacking in mesophyllous flora; and generally shorter overstorey.

APPENDIX C – DESCRIPTION OF THREATS

The ecological community has been reduced to very small remnants by clearing for various purposes (NSW Scientific Committee, 1999). It is under ongoing pressure, like many threatened ecological communities on the Cumberland Plain, due to the effects of past disturbance and new land-use demands (NSW DECCW, 2010; Tozer et al., 2010) and was uplisted in March 2015 to Critically Endangered status under the NSW TSC Act (NSW Scientific Committee, 2015). This listing has continued under the New South Wales *Biodiversity Conservation Act 2016*, which superseded the TSC Act in August 2017. There is a high edge to area ratio of the remaining few remnants, all of which are disconnected from each other by earlier clearing. The various threats are likely to interact in complex ways to continue to reduce the integrity, function and resilience of the Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion ecological community.

Clearing and fragmentation

Vegetation clearance was, and continues to be, a major contributor to the decline of native vegetation across the Cumberland Plain, including this ecological community. It has been cleared initially for cropping and grazing, later followed by orchards, poultry farms, sand extraction, energy infrastructure and residential development from the 1960s (Clements et al., 2002; NSW Scientific Committee, 2015). Urbanisation is now the primary land use pressure.

The ecological community has a naturally restricted distribution (Tozer et al., 2010). In addition, as with other local vegetation types, it has been extensively cleared (Keith, 2004; NSW NPWS, 2004; Tozer et al. 2010). In 2010, it was estimated that less than 15% of the pre-1750 extent remains and much of this is now more fragmented (Tozer et al., 2010), with a recent survey indicating there may be less than 10% of the original extent (Douglas, 2015).

The ecological community was listed for protection under the then NSW TSC Act in 1999. Despite this, further clearing and degradation has occurred in and around the ecological community, even on public tenure. Sometimes clearing has been permitted subject to offsetting.

With clearance of the ecological community, and other surrounding vegetation, the patches of this ecological community are now very small and isolated. Such patches are less buffered against disturbances, such as invasion by weeds (Tozer, 2003; Cuneo et al., 2009), or other impacts from surrounding activities. Loss of connectivity through increased fragmentation is also likely to result in a decrease in biological and genetic diversity, and an increase in predator pressure on native fauna (Anderson & Burgin, 2002).

Inappropriate fire regimes

The vegetation composition of the ecological community is influenced by a range of factors including its recent disturbance history and patch size (NSW Scientific Committee, 1999; 2015). Due to its proximity to urban areas, frequent fire from arson is a potentially significant threat to the ecological community (NSW DECCW, 2010). Frequent fire can also be caused by inappropriate hazard reduction burning (NSW Scientific Committee, 2010).

Burning the ecological community too often may result in the loss of species diversity if native species do not have enough time to mature and set seed. The NSW Scientific Committee (2010) noted that low seedling recruitment observed in the ecological community is thought to be associated with too frequent fire and extended dry periods.

Regeneration of Coast Banksia may be a particular concern, even after a single fire. Standing plants of this species are generally killed by fire when the canopy is scorched. Its fruits are not serotinous (i.e. they are released immediately at maturity), unlike most other banksias, and do not persist in the soil. The species may rely on seed dispersal for post-fire regeneration. Thus, in highly fragmented, weedy remnants, there is likely to be a high risk of regeneration failure.

Conversely, the exclusion of fire for greater than 30 years may have a detrimental impact on the ecological community, particularly through loss of understorey plant diversity (NSW DEC, 2005), especially those species that require fire to regenerate. This can be caused by measures to avoid fires as residential areas are expanding near the ecological community.

Invasion by weeds

Weed incursion in the Cumberland IBRA subregion region has been facilitated by soil disturbance through earth moving, land clearing and track encroachment; through livestock grazing and movement; through the introduction of invasive plants in horticulture; through grazing and soil disturbance due to pest fauna such as rabbits; and by increased water and nutrients from subsequent changes in soil properties within urbanised areas (*sensu* NSW DEC, 2005). Many weeds are known to occur in the Cumberland IBRA subregion (including within and surrounding the ecological community) in densities that displace native plants and lead to a decline in native species diversity and regenerative capacity (Benson, 1992).

Weed incursion into the Elderslie Banksia Scrub Forest is an ongoing problem, in part facilitated by enrichment of the sandy soils with nutrients from surrounding rural and now urban development (NSW Scientific Committee, 2015). All remnants of the ecological community are impacted by weeds, sometimes to a significant extent. African lovegrass (*Eragrostis curvula*) has been identified as an invasive weed of particular concern in the ecological community (NSW NPWS, 2004; NSW OEH, 2012). Other aggressive weeds of particular concern that have been observed in remnants include: Indian hawthorn (*Rhaphiolepis indica*), boxthorn (*Lycium ferocissimum*), firethorn (*Pyracantha angustifolia*), blackberries (*Rubus* spp.), African olive (*Olea europaea* subsp. *cuspidata*) and lantana (*Lantana camara*) (NSW Scientific Committee, 2015). In addition, potentially more recent weed arrivals, or those that have previously occurred at low levels but have since expanded, include: Madeira vine (*Anredera cordifolia*), moth vine (*Araujia sericifera*), asparagus fern, bridal creeper, climbing asparagus fern (*Asparagus aethiopicus*, *A. asparagoides*, *A. scandens*), boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*), camphor laurel (*Cinnamomum camphora*), Cape ivy (*Delairea odorata*), privets (*Ligustrum lucidum*, *L. sinense*), and Japanese honeysuckle (*Lonicera japonica*). A list of weeds that are known to, or may, be present within the ecological community is at Table A3 of Attachment A.

Changes in composition and associated ecological functions

A 1997 survey by NSW National Parks and Wildlife Service (NPWS) found that of the 62 mammal species known from the western Sydney region at the time of European settlement only 15 of these species had stable populations in the region at the time of the survey. Ten years later, further intensive surveys across the Cumberland IBRA subregion found that many species had been lost or were in decline (Leary, 2007).

The 2007 NPWS survey found there had been a severe depletion of habitat features needed to support fauna of the region. For example, large hollow-bearing trees were largely absent, while the additional ground habitat provided by these trees as fallen timber had also been reduced. Across the Cumberland IBRA subregion survey sites the diameter of trees measured was small (mean 22 cm), while fewer than 3% contained hollows or fissures, indicating limited current value in providing nesting habitat for hollow-dependent fauna (such as some bird species, bats and some other arboreal mammals) (Leary, 2007). While specific information on hollow development is limited, modelling of eucalypt woodland in south-west NSW indicates that the lag time for development is likely to have severe implications for species such as parrots and arboreal mammals, in the absence of immediate intervention (Manning et al., 2013).

Due to the fragmented nature of the ecological community, its disturbance history and the fact that it is surrounded by cleared or significantly modified land, the ecological community would no longer support some native fauna species. The fragmentation of the ecological community

and the loss of habitat for local flora and fauna continue to compromise the ecological processes and species composition of the ecological community.

Some remnants no longer support a diverse range of native fauna due to a loss of hollow bearing trees, modifications to the understorey, and isolation and fragmentation of remaining stands (Lindenmayer & Fischer, 2006; Leary, 2007).

Leary (2007) also comments on the substantial reduction and modification of ground cover, due to the alteration of fire regimes. Implications of this include the reduction of habitat for small reptiles, invertebrates and mammals.

Loss of fauna and ecosystem function can also be caused to the ecological community by a range of feral and domestic introduced species including dogs, cats, foxes, black rat, house mouse, numerous introduced birds and the European wasp and honeybee. These are present in large numbers in the remnant bushland of the region, and harm native wildlife through predation and competition for resources (Jones et al., 1997).

Fauna species that are native to Australia but that previously occurred less frequently in western Sydney are also associated with loss of native fauna and ecosystem function. Sulphur-crested Cockatoos have significantly increased in numbers following urban development and displaced rarer local species by aggressively competing for nesting hollows (Jones et al., 1997). One of the most common birds in the Narellan area is *Cacatua sanguinea* (Little Corella) (Steenbeeke, pers. comm., 2015). This species is primarily from west of the Great Dividing Range in NSW, but has established locally in large flocks, probably as a result of the increased grassland and open woodland habitats the region provides. It too is a serious competitor for nesting resources.

Rabbits, deer, and escaped domestic goats are present in or near known remnants of the ecological community (Ridgeway, pers. comm., 2015; Douglas, 2015). These are a threat through herbivory, other physical damage to plants, and disturbance that can promote weed invasion. Rabbit burrows and diggings can also accelerate soil erosion.

Other threats

Urbanisation of the landscapes that adjoin and/or support the ecological community can have significant hydrological effects given how small and isolated remaining patches are. Road building and urban development surrounding the ecological community reduces surface permeability and results in increased runoff. Many new roads have been built adjacent to and in the catchment for the ecological community at Spring Farm and more are planned. This can change stream flow patterns, causing erosion in some areas, and deposition of high nutrient and sediment loads elsewhere, which encourages weed invasion and compromises habitat for fauna such as frogs (NSW DEC, 2005; NSW DECCW, 2010). Urbanisation also brings increased water pollution risks from agrichemicals used to establish and maintain lawns, gardens, and formal parks, along with nutrient and bacterial loads from domestic animal waste, and hydrocarbons and detergents washed into stormwater systems from washing of cars on hard surfaces. The ecological community includes remnants along Spring Creek, and further pollution of this waterway risks additional contamination of its riparian soils, in addition to more direct harm to its flora and fauna.

Predation and stressing of native fauna by domestic pets; rubbish dumping; and damaging recreational activities are additional threats associated with urban development.

Whilst a lot of the ecological community was cleared first in association with agricultural development, sand mining became one of the primary causes of further clearance of the ecological community. Extraction usually completely removes the vegetation from the extraction zone, and post extraction revegetation is not able to replace those ecological communities in their original form (NSW NPWS, 1997). Whilst modern mining operations in

the area were generally required to provide some post-extraction revegetation, Clements et al. (2002) and Clements (2002) found that where revegetation had been attempted, outcomes were poor in terms of survival, species mix, and patch viability. Mining has apparently occurred such that many areas were subject to multiple excavation stages, meaning that revegetation was often impractical as there was an intention to leave the site open for future extraction. Existing use rights held by long-established operations allowed mining to continue under circumstances where modern law and policy would otherwise have prevented or heavily constrained operations, at least in terms of further vegetation clearing and the need for effective revegetation works (Douglas, 2015).

Sand and gravel extraction represents a current and ongoing threat to the ecological community. Whilst the resource is nearly commercially exhausted, some mining is still occurring and has cleared more of the remaining or regenerated native vegetation that might otherwise have constrained subsequent urbanisation. This occurs in part within former quarries that have excavated down to non-commercial clays that would not be able to support the ecological community because the associated sandy soil has been removed. After quarrying, the clay wastes that have been washed out of the commercially valuable sandmass are left in the former pit.

Transmission of plant pathogens occurs through various vectors such as humans and invasive fauna, and on larger scales, through contaminated vehicles and machinery. Effective hygiene practices can help to manage human and mechanical transmission. The ecological community is at risk of infection by *Phythophthora cinnamomi* and myrtle rust (*Puccinia psidii* s.l.). *Phytophthora* is a plant pathogen that can survive for long periods in soil and is a Key Threatening Process in NSW and under the EPBC Act. Myrtle rust is a serious fungal pathogen that affects plants belonging to the Myrtaceae family. Myrtle rust is now widely distributed in coastal areas across NSW, including the Sydney region (NSW DPI, 2012).

Rural tree dieback caused by excessive feeding from outbreaks of *Cardiaspina* psyllid insects, has recently caused substantial impacts, including tree mortality, to vegetation in the Cumberland IBRA subregion (Steenbeeke, pers. comm., 2014). Insect outbreaks are made worse by the loss of some woodland bird species, especially from small patches such as for this ecological community.

Key threatening processes

Key threatening processes identified under the NSW BC Act and EPBC Act that are known to, or likely to, affect the Elderslie Banksia Scrub Forest are listed in Table C1:

Table C1 Potentially relevant key threatening processes identified in the EPBC Act and the NSW BC Act.

EPBC Act	NSW BC Act
Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (*Manorina melanocephala*)	Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala*
Competition and land degradation by rabbits	Competition and grazing by the feral European rabbit
Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)	Infection of native plants by *Phytophthora cinnamomi*
Land clearance	Clearing of native vegetation

EPBC Act	NSW BC Act
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
Novel biota and their impact on biodiversity	
Predation by European red fox	Predation by the European red fox (*Vulpes vulpes*)
Predation by feral cats	Predation by the feral cat (*Felis catus*)
	Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
	Competition from feral honeybees
	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners
	High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
	Invasion and establishment of exotic vines and scramblers
	Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*
	Invasion of native plant communities by exotic perennial grasses
	Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
	Loss of hollow-bearing trees
	Removal of dead wood and dead trees

Sources: NSW OEH (2015); Department of the Environment (2015a).

APPENDIX D – ELIGIBILITY FOR LISTING AGAINST THE EPBC ACT CRITERIA

This appendix presents a detailed assessment of how the Elderslie Banksia Scrub Forest ecological community meets each of the six listing criteria. It forms the listing advice from the Threatened Species Scientific Committee to the Minister.

Criterion 1 – Decline in geographic distribution

Criterion 1. Decline in geographic distribution			
Category	**Critically Endangered**	**Endangered**	**Vulnerable**
Its decline in geographic distribution is **either**:	**very severe**	severe	substantial
a) Decline relative to the longer-term (beyond 50 years ago e.g. since 1750); **or**,	**≥90%**	≥70%	≥50%
b) Decline relative to the shorter-term (past 50 years).	≥80%	≥50%	≥30%

Eligible under Criterion 1(a) for listing as Critically Endangered

Evidence:

The Elderslie Banksia Scrub Forest has undergone a significant reduction in extent since European settlement (NSW NPWS, 2014; Tozer et al., 2010). While no reliable estimate of the pre-European extent is available (NSW Scientific Committee, 2015), Tozer et al. (2010) indicated that the ecological community is likely to have been reduced by at least 85% of its original pre-European extent. Following review of available data in conjunction with ground-truthing, Douglas (2015) indicated that the reduction in extent was at least 90%. Estimates of decline and extent for the ecological community are shown in Table E1.

The decline in the area of occupancy is due largely to clearing and degradation of remaining patches (driven by a range of threats as described in section 2 *Summary of Threats* and Appendix C).

Table E1. Estimates of decline and extent for Elderslie Banksia Scrub Forest.

Estimated area pre-1750 (ha)	Estimated area extant (ha)	Estimated % original extent remaining	Estimated area reserved (ha)	% of current extent reserved
Unknown	16* 5***	<15** <10***	0	0

Sources: NSW Scientific Committee (2015), plus * - mapping data of unit DSF p463 coupled with site visit in December 2014; ** - Tozer et al. (2010) for vegetation unit DSF p463; and *** - Douglas (2015).

The Committee considers that the ecological community has undergone a 'very severe' decline of >90% in its geographic extent and is therefore **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 2 – Limited geographic distribution coupled with demonstrable threat

Criterion 2 - Limited geographic distribution coupled with demonstrable threat			
Its geographic distribution is:	**Very restricted**	**Restricted**	**Limited**
2.1. Extent of occurrence (EOO)	**< 100 km^2 = <10,000 ha**	<1,000 km^2 = <100,000 ha	<10,000 km^2 = <1,000,000 ha
2.2. Area of occupancy (AOO)	**< 10 km^2 = <1,000 ha**	<100 km^2 = <10,000 ha	<1,000 km^2 = <100,000 ha
2.3. Patch size [#]	**< 0.1 km^2 = <10 ha**	< 1 km^2 = <100 ha	-
AND the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:			
the Immediate future [within 10 years, or 3 generations of any long-lived or key species, whichever is the longer, up to a maximum of 60 years.]	**Critically endangered**	Endangered	Vulnerable
the Near future [within 20 years, or 5 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.]	Endangered	Endangered	Vulnerable
The Medium term future [within 50 years, or 10 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.]	Vulnerable	Vulnerable	Vulnerable

[#] A number of patch size measures may be applied here, depending on what data are available.
1) The mean or the median patch area. In cases where the ecological community is highly fragmented and the patch data distribution is skewed towards mostly small patches, the median would be a more appropriate measure. Otherwise, the smaller of the mean or median should be referred to.
2) The proportion of patches that fall within each size class.
3) Changes in patch size and distribution between the modelled pre-European and currently mapped occurrences.

Criterion 2 aims to identify ecological communities that are geographically restricted to some extent. It is recognised that an ecological community with a distribution that is limited, either naturally or that has become so through landscape modification, has an inherently higher risk of extinction if it continues to be subject to ongoing threats that may cause it to be lost in the future. Demonstrable and ongoing threats to the Elderslie Banksia Scrub Forest have been detailed in Appendix C.

The indicative measures that apply to this criterion are:

- extent of occurrence, an estimate of the total geographic range over which the ecological community occurs;
- area of occupancy, an estimate of the area actually occupied by the ecological community, which generally equates with its present extent;
- patch size and size distribution, an indicator of the degree of fragmentation of the ecological community or the vulnerability of small or otherwise limited patches to particular threats; and
- an assessment of timeframes over which threats could result in loss of the ecological community.

Eligible under Criterion 2 for listing as Critically Endangered

Evidence:

Area of occupancy and extent of occurrence

Data presented by NSW Scientific Committee (2015) indicate the present extent of the ecological community is less than 20 ha, while mapping data coupled with a site visit (see section 1.6), and an independent assessment by Douglas (2015), indicate the area of occupancy to be ~5 ha (i.e. 'very restricted').

Patch size distribution

Natural fragmentation has been exacerbated by the loss of extent of the ecological community and other nearby native vegetation through human-caused impacts (including clearance and degradation from past and ongoing actions).The ecological community is now highly fragmented with more exposed edges. It has a mean patch size of <1 ha (Clements, cited by NSW Scientific Committee, 2015; Douglas, 2015) and median patch size of 0.41 ha (Douglas, 2015), and is considered to be 'very restricted'. Gaps between some patches are likely to limit regeneration opportunities as some key species have restricted seed dispersal mechanisms (Benson and McDougall, 1998) and the intervening landscapes are highly modified.

As detailed in *Description of Threats* (Appendix C), the ecological community is subject to a range of ongoing demonstrable threats, several of which interact. Key threats include past and ongoing impacts from clearance and fragmentation of remnants, as well as weed invasion and altered fire regimes (particularly due to arson) (NSW Scientific Committee, 2015; Steenbeeke, pers. comm., 2014). The loss of area and vegetation condition has compounding impacts through the loss of fauna that play important ecological roles in the ecological community.

The loss, fragmentation and degradation of vegetation in the ecological community are increasingly associated with residential development. Urbanisation removes some threats such as grazing livestock, but presents other challenges for bushland conservation. In Camden LGA, where the only known occurrences of the ecological community are documented, a third of all the proposed residential developments are identified to occur in the Elderslie and Spring Farm areas. Additional threats associated with urbanisation and residential development, include predation and competition by domestic and pest animals; the spread of weeds and disease; under-scrubbing (where understorey vegetation is cleared, slashed, mulched or otherwise suppressed); rubbish dumping; arson (too frequent and/or severe fire) or total exclusion due to proximity of housing and roads; and changes to surface and subsurface hydrology, including stormwater pollution. Even within the planned conservation areas at Spring Farm, the nature and intensity of threats is such that prolonged and skilled management is required to prevent remnants from further degradation and ultimate collapse.

In summary, the ecological community is considered to be 'very restricted' in geographic distribution (based on extent of occurrence, total area of occupancy and patch size), and is subject to a range of ongoing threats that are likely to cause further clearance, fragmentation and loss of integrity. These factors combine to make it probable that the ecological community could be lost in the 'immediate future'. Therefore, the ecological community is **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 3 – Loss or decline of functionally important species

Criterion 3 - Loss or decline of functionally important species			
Category	**Critically Endangered**	**Endangered**	**Vulnerable**
For a population of a native species likely to play a major role in the community, there is a:	very severe decline	severe decline	substantial decline
3.1 Estimated decline over the last 10 years or three generations, whichever is longer of:	at least 80%	at least 50%	at least 20%
to the extent that restoration of the community is not likely to be possible in:	the immediate future	the near future	the medium-term future
3.2: *restoration* of the ecological community as a whole is *unlikely* in	10 years, or 3 generations of any long-lived or key species, whichever is the longer, up to a maximum of 60 years.	20 years, or 5 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.	50 years, or 10 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.

Insufficient information available for listing under Criterion 3.

Although studies that identify functionally important species in the ecological community are not available, the relationship between many species within a forest such as this is important for maintaining ecosystem function.

Plant diversity in the ecological community is important as it ensures food and habitat for a range of fauna; habitat and microclimatic control for other plant species; and maintenance of the abiotic aspects of the ecosystem. Decline in plant diversity in the ecological community correlates with several threatened species of plants, including as many as 10 protected under the EPBC Act (Department of the Environment, 2014a).

Benefits to fauna of diverse and healthy plant assemblages within the ecological community include provision of food for nomadic nectarivores during winter (Leary, 2007) and as hosts for many species of invertebrates (Benson & McDougall, 1998). However, the ability of the ecological community to provide these resources has been diminished in areas where the ecological community is in poor condition or consists entirely of regrowth (e.g. as a result of substantial disturbance). For example, large old eucalypts are a critical resource for several fauna species due to their production of hollows. Many hollow-bearing trees have been lost from patches of the ecological community, and the long delay in replacing them limits the capacity for the ecological community to recover. The loss of many Coast Banksia trees will also have impacted on fauna that use them for food or shelter. The observed loss of fauna from the Cumberland IBRA subregion (including areas of the ecological community) is also likely to have had a negative effect on ecological function, through the reduction of pollination, seed dispersal and soil engineering (Leary, 2007).

Although significant threats will have impacted upon functionally important species within the ecological community, and continue to do so, specific data related to the decline of individual key species or the functional importance within this ecological community are not available. As such there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

Criterion 4 – Reduction in community integrity

Criterion 4 - Reduction in community integrity			
Category	**Critically Endangered**	**Endangered**	**Vulnerable**
The reduction in its integrity across most of its geographic distribution is:	**very severe**	severe	substantial
as indicated by degradation of the community or its habitat, or disruption of important community processes, that is:			

Reference should also be made to the indicative restoration timeframes as outlined under Criterion 3, above.

Eligible under Criterion 4 for listing as Critically Endangered

Evidence:

This ecological community occurs exclusively on a deep Tertiary sand substrate of the lower Nepean River in the highly cleared Cumberland IBRA subregion, with clearing, encroaching housing, and weed invasion the primary cause of loss of its integrity at all known locations across its range. The remaining area is severely fragmented and most, if not all, remnants are subject to impacts from invasive species and urbanisation. Loss of structural integrity and ecological function has occurred due to habitat degradation and fragmentation, weed invasion, changes to vegetation structure and species composition, under-scrubbing, inappropriate fire regimes and a variety of other impacts from residential development and recreational use (NSW Scientific Committee, 2015). These are causing patches of the ecological community to degrade to a significant extent.

It is likely that the ecological function of the Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion has been severely compromised by the loss of many of its soil engineers, pollinators and seed dispersers, which provide critical functionality to the ecological community. The intractability of such issues reduces the likelihood of recovery of the ecological community.

Reduction in integrity through clearing and fragmentation

As previously noted, the ecological community has been extensively cleared across its range and the majority of the remaining patches are small and isolated. Fragmentation and resulting loss of connectivity are likely to result in reduced rates of survival and dispersal by individuals, and interrupted ecological processes. Fragmentation has led to increased degradation of habitat, altered microclimatic and fire regimes, and weed incursion (‘edge effects’), as well as reduced re-establishment of the dominant canopy eucalypt species where the gaps between fragments are wide. The declining integrity and connectivity of native vegetation due to fragmentation is widely recognised to adversely impact upon native species in the western Sydney region (NSW DECCW, 2010). With respect to the Elderslie Banksia Scrub Forest, all known remnants are very small in size and degraded to some extent; none retains the full suite of native species.

In addition to the direct threats of vegetation clearance for houses, roads and energy infrastructure, the ecological community is also under threat from increasing urban activities on adjacent land. A surrounding landscape of modified land and proximity to human residences and activities provides greater opportunity for damage to occur through:

- dumped refuse and garden waste;
- polluted stormwater and sewer discharges;
- predation on and stressing of native fauna by domestic pets and feral animals; and
- some recreational activities (e.g. mountain bike, trail bike and 4WD use).

Reduction in integrity through altered fire regimes

Fire management practices on private lands are likely to have ongoing negative impacts on the ecological community. Remnants are also at risk from arson and accidental ignition of fires (Steenbeeke, pers. comm., 2014). There are a number of ways by which altered fire regimes impact upon the ecological community.

Too frequent fires. Too frequent fire modifies the structural and floristic characteristics of the ecological community, and contributes to a loss of species diversity (e.g. due to the reduced amount of time for some species to mature and set seed, or a loss of essential habitat elements).

- Historically, fires may have been used to suppress regrowth of native species and weeds in pastures established during the earlier period of predominantly agricultural land use in the region.
- Increased fire frequency in the past may partially explain the low native species richness recorded, even from the more intact stands of the ecological community.
- Some species are particularly sensitive to too frequent fire, notably *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), which is a characteristic and key structural and floristic element of the Banksia Scrub form of the ecological community.
- There is a risk that fires may increase as urbanisation encroaches to surround or adjoin all known remnants. Urbanisation puts more people in closer proximity to bushland remnants than occurred for previous land uses. Increased road access past or through remnants also increases the risk of ignitions, e.g. from littered cigarette butts, and of arson.

Fire suppression. Insufficiently frequent and/or intense fire leads to declining native species diversity, structural changes, and 'mesic or mesophyll shift' in which native and/or non-native plants that are intolerant of fire and that discourage combustion can invade or increase in abundance.

- The long-term exclusion of fire may also detrimentally affect the ecological community through loss of understorey plant diversity, especially in the Banksia Scrub form of the ecological community (NSW DEC, 2005). The high proportion of sclerophyllous, and obligate-seeder plant species suggests that fire has been an important natural part of its regeneration cycle. In the absence of suitably frequent and intense fire, many such species will senesce, die, and may be reduced to the seedbank. Whilst some seeds can remain viable in the soil seedbank for decades, if they are not stimulated to germinate due to the long-term suppression of fire or equivalent disturbance, the seedbank will eventually decay, leading to the local extinction of such species.
- Coffee bush (*Breynia oblongifolia*) is one mesic species accepted as a natural component of the ecological community that can become more abundant in the prolonged absence of fire. Its substantive presence in the ecological community may be a result of fire suppression over recent decades. Sweet pittosporum (*Pittosporum undulatum*) is not native to the ecological community, though it does occur in the Greater Sydney area, and is known to thrive and dominate in bushland that has long been unburnt, especially if there is nutrient enrichment of otherwise relatively infertile soils. It is a recognised weed in the ecological community and has the potential to spread in the absence of fire, if not properly managed. 'Mesic shift' can be similar in effect to weed invasion and can include invasion or increased prevalence of non-native plants that would otherwise be excluded or suppressed by suitably frequent and intense fire. This is a significant threat to remnants of the ecological community as all are surrounded by urbanisation, and it is challenging for land managers to undertake appropriate ecological fire management in this context.

When planned fire does occur in such small, increasingly urbanised remnants, it may not achieve the full regenerative effect that is desired. Unplanned fire such as arson, may occur

during converse conditions such as hot and dry weather over summer, and may generate a fire of too high an intensity and that burns a whole remnant or all remnants, rather than leaving some habitat as a refuge for native fauna and fire sensitive flora. The one fire known to have occurred within a remnant of the ecological community over the past 12 years is believed to have originated from arson (Corby, pers. comm., 2015b) rather than planned management. The very small size of all existing remnants also makes it unlikely that fires, especially unplanned ones, would result in mosaic patterns that allow for a variety of burnt and unburnt areas of habitat.

Reduction in integrity through invasive species

Weed invasion is an ongoing serious threat contributing to the ongoing degradation of the ecological community. Highly invasive weeds often are able to establish after some form of disturbance. Disturbances and weed invasion in this ecological community are facilitated by the exposed edges of remnants, as well as altered hydrological flows and increased nutrient run-off that occurs as a result of increasing urbanisation. Once established, weeds adversely affect native species in the ecological community through direct competition or by altering ecosystem processes, such as disrupting food webs or dispersal agents (as when natural pollinators visit weeds rather than native species) or changing fire regimes (for instance the establishment of more flammable invasive grass species into a patch, or conversely, the establishment of fire-retarding vines, creepers and shrubs).

All known remnants of the ecological community are impacted by weeds to some extent, sometimes severely. There are at least 34 emerging weeds reported in the wider Hawkesbury–Nepean region (NSW DECCW, 2010). Additionally, Clements et al. (2002), Clements (2002) and Douglas (2015) recorded a large number of weeds of all forms (grasses, herbs, shrubs, trees, climbers/vines, etc.) throughout the habitat and environs of the ecological community. Table A3 in Appendix A provides a list of such species. African lovegrass (*Eragrostis curvula*) and African olive (*Olea europaea* subsp. *cuspidata*) are regarded as the major weed threats to Elderslie Banksia Scrub Forest (Corby, pers. comm., 2015a), but the high number of emerging weeds further highlights the severity and ongoing nature of the threat that weeds pose to the integrity of the ecological community. They include several Weeds of National Significance, recognised as being highly invasive with severe impacts to agricultural activities and to the natural environment. For instance, bridal creeper (*Asparagus asparagoides*) and blackberry (*Rubus* spp.) occur within the ecological community and are very difficult species to manage.

Similarly to invasive plant species, invasive animals compete with native species for food, nest sites and other resources. Domestic animals (such as cats and dogs) and pest animals (such as foxes, rats, house mice and rabbits) are likely to have contributed to the decline in woodland birds, reptiles and small mammals in remnants of the ecological community. Aggressive native species (particularly birds) pose similar problems for native species, particularly in smaller remnants or poor condition remnants of this ecological community (Jones et al., 1997; NSW DECCW, 2010). Such species use resources and behave aggressively to native species, inhibiting proper functioning and retention of native faunal components in the ecological community.

Reduction in integrity through changes in faunal components and function

Many remnants of the ecological community are now unlikely to support a natural and complete faunal assemblage due to a loss of large, old, hollow-bearing trees; modifications to the understorey; and isolation and fragmentation (Lindenmayer et al., 2006).

As a result of clearing, fragmentation, invasive species and inappropriate fire regimes, the structure of vegetation and habitat elements across the ecological community has been, and continues to be, modified. Effects include fewer large, old trees (which limits the ecological community's provision of specific habitat features such as hollows), loss of Coast Banksia trees

that provide an important food source (e.g. for black cockatoos) and removal of midstorey and ground cover components and their replacement with exotic species. The loss of these features is likely to continue to compromise the ecological community's capacity to support key fauna such as hollow-nesting parrots and gliders, small woodland birds, ground-dwelling mammals and herpetofauna.

Different species and faunal groups are affected in different ways, with some able to persist in remnants, while others disappear altogether. Increases in aggressive native birds (e.g. *Cacatua galerita* (Sulphur-crested Cockatoo), *Manorina melanocephala* (Noisy Miner), *Cacatua sanguinea* (Little Corella)) and introduced birds (e.g. the common myna (*Sturnus tristis*)) drive out many of the smaller woodland bird species through their aggressive behaviour and competition for resources (Jones et al., 1997; NSW DECCW, 2010).

With the reduction and loss of native species, such as insectivorous woodland birds, arboreal and ground-dwelling mammals, important functions are also lost, including consumption of herbivorous insects (possibly helping to prevent tree dieback), pollination, seed dispersal and soil modification/conditioning.

Restorability of the ecological community

Due to the reduction in community integrity that has already occurred, including a substantial reduction in extent, and the pressure of increasing urbanisation, the ecological community cannot be restored to its pre-1750 extent and condition. All remnants of the ecological community will require ongoing active and skilled management, with some requiring substantial restoration efforts (such as weed suppression, feral animal control, exclusion of domestic species and inappropriate recreational uses, reinstatement of appropriate fire regimes, reintroduction/planting of native species, and improved wastewater management practices) to safeguard the component species and function. For the best restoration outcomes, active management would also need to include linking patches of the ecological community with other native vegetation remnants. This is accommodated in the conservation plan for the ecological community within the Camden Contributions Plan (Camden Council, 2011).

Fragmentation of the ecological community is a particularly significant constraint on restorability, with urban areas and roads dividing remnant vegetation and limiting natural regeneration and movement/migration of species among patches. Competition for resources due to weeds limits the survival and regeneration of native plant species. The nature of modification to both the ecological community and its surrounding landscape is such that restoration of the ecological community towards a pre-disturbed state is challenging and unlikely to be accomplished within a short time frame.

The reduction in integrity across its geographic distribution is **very severe**, and the potential for successful restoration in the immediate future is low for the Elderslie Banksia Scrub Forest. Therefore, the ecological community is **eligible** for listing as **Critically Endangered** under this criterion.

Criterion 5 – Rate of continuing detrimental change

Criterion 5 - Rate of continuing detrimental change			
Category	**Critically Endangered**	**Endangered**	**Vulnerable**
Its rate of continuing detrimental change is:	very severe	severe	substantial
as indicated by a) degradation of the community or its habitat, or disruption of important community processes, that is:			
or b) intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:			
5.1 An observed, estimated, inferred or suspected *detrimental change* over the *immediate*[#] past or projected for the *immediate* future of at least:	80%	50%	30%

[#] The immediate timeframe refers to10 years, or 3 generations of any long-lived or key species believed to play a major role in sustaining the community, whichever is the longer, up to a maximum of 60 years.

Insufficient information available for listing under Criterion 5.

Although there has been continuing detrimental change to the ecological community, data are insufficient to determine an overall rate over the recent decade or projected for the future. As such there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

Criterion 6 – Quantitative analysis showing probability of extinction

Criterion 6 - Quantitative analysis showing probability of extinction			
Category	**Critically Endangered**	**Endangered**	**Vulnerable**
A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its geographic distribution, is:	at least 50% in the immediate future.	at least 20% in the near future.	at least 10% in the medium-term future.

Insufficient information available for listing under Criterion 6.

There are no quantitative data available to assess this ecological community under this criterion. As such there is **insufficient information to determine the eligibility** of the ecological community for listing under this criterion.

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