BUNDANON

FLORA & FAUNA REPORT BUNDANON 2023: STORIES OF A DYNAMIC LANDSCAPE

Garry Daly &
Gary Leonard

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Prepared for: Bundanon Trust
PO Box 3343, North Nowra, NSW 2541

Prepared by: Garry Daly and Gary Leonard
Gaia Research Pty Ltd
PO Box 3109, North Nowra NSW 2541

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Disclaimer

The findings of this report are based on the authors' analysis and interpretation of survey results. Views and interpretations presented in the report are those of the author/s and not necessarily those of Bundanon Trust.

Cover image: Bushland at Bundanon. Photo: Rachel Tagg.
Opposite: Bushland at Bundanon. Photo: Rachel Tagg.
Graphic Design: Eliza Hos

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EXECUTIVE SUMMARY

This report was commissioned by Bundanon Trust to reassess the flora and fauna that occurs on Bundanon property since our original report (Daly and Leonard 1996). The estate includes the properties herein named Beweeree (Lot 14,16 and 17 DP751273), Bundanon (Lot 118 and Lot 12 DP751273), Eearie Park (Lot 4 and 5 DP 622583), Riversdale (Lot 1 DP1232368) and leased Crown lands (Lot 12, 13, 15 and Lot* DP751273). The total area of the estate is some 915ha and is a significant part of habitat corridors that run east-west and north-south of Bundanon. Other portions of land in these corridors includes National Parks-Reserves, freehold, land managed by Aboriginal Land Council's and Crown land.

This work focuses on the regionally-rare and threatened species that occupy the living landscape but also provides lists of vertebrates detected on and adjacent to the property. Bundanon is an important part of the Shoalhaven River-Budgong catchment and the Tapitallee bioregion (Daly 2022) and is one of the most biodiverse areas in New South Wales (Daly 2022). To help people understand and conserve this biodiversity we provide pictures and stories of the species listed under *Biodiversity Conservation Act 2016 (BC Act)* and the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* in the profiles.

To illustrate the significance of Bundanon the following nineteen threatened species of fauna have been detected on or adjacent to the site: White-footed Dunnart ***Sminthopsis leucopus***, Eastern Pygmy Possum ***Cercatetus nanus***, Koala ***Phascolarctos cinereus***, Brush-tailed Rock Wallaby ***Petrogale penicillata***, Yellow-bellied Glider ***Petaurus australis***, Grey-headed Flying Fox ***Pteropus poliocephalus***, Eastern Bent-wing Bat ***Miniopterus schreibersii***, Large-eared Pied Bat ***Chalinolobus dwyeri***, Southern Mytois Myotis macropus, Black Bittern ***Ixobrychus flavicollis***, Powerful Owl ***Ninox strenua***, Gang Gang Cockatoo ***Callocephalon fimbriatum***, Glossy Black-Cockatoo ***Calyptorhynchus lathami***, Little Lorikeet ***Glossopsitta pusilla***, White-bellied Sea Eagle ***Haliaeetus leucogaster***, Varied Sitella ***Daphoenositta chrysoptera***, Broad-headed Snake ***Hoplocephalus bungaroides***, Heath Monitor ***Varanus rosenbergi***, Giant Burrowing Frog ***Heleioporus australiacus***, Brush Turpentine ***Rhodamnia rubescens***, and Nowra Heath Myrtle ***Triplarina nowraensis***. In addition the Stuttering Frog ***Mixophyes australis*** has been introduced at Riversdale and the Magenta Lilly Pilly ***Syzygium paniculatum*** has been planted at Bundanon and Riversdale. As well as, one endangered ecological community (EEC) (Swamp Sclerophyll Forest on Coastal Floodplain) has been recorded.

The large number of threatened species is indicative of the area's diversity of soil types, vegetation and presence of hollow-bearing trees. These assets are under threat from clearing and human induced climate change as reflected in the severity of the 2019-2020 Currowan wildfire and subsequent floods in 2021 and 2022. Stories of the distribution and habitat associations of rare species give Bundanon context in the broader living landscape.

Animals do not occur randomly over the landscape but are highly associated with particular vegetation communities. The plants that make up these communities and dictated by abiotic factors such as soil type (fertility and depth), soil moisture and aspect. Associating vegetation communities to distributions of particular species of

animal shows habitat corridors. This is particularly important to conserving threatened species that often occupy specialised habitats.

The human interactions with landscape are major stories of the property. Unfortunately, little is known of the use of the land by Aboriginal people nor stories of country. In contrast we have reasonable information on who owned the land prior to Arthur and Yvonne Boyd purchasing the various parcels of land. Bundanon Trust has started a shared future with traditional owners as reflected by the Firesticks Alliance and Cultural Burns conducted in 2018.

We hope this document fulfils a part of what Arthur and Yvonne Boyd desired, that is to inform people and protect this place. They were custodians of the land from 1973 – 1993 and passed this responsibility onto the Trust to navigate caring for country during the Anthropocene.

Arthur and Yvonne Boyd at Bundanon, Image courtesy Bundanon Trust

DEFINITION OF TERMS

Within this report the following terms are defined.

- **Bundanon** deep gully or deep valley in Dharawal language
- **Bundanon Trust** a public company (registered charity) established in 1993 to manage the assets given to the Australian people by Arthur and Yvonne
- **Exotic Species** means species introduced from outside the area, that are from overseas or interstate.
- **EEC** Endangered Ecological Community as defined by the Biodiversity Conservation Act 2016
- **Native Vegetation** means indigenous vegetation as per the Native Vegetation Act 2003. This includes indigenous trees, shrubs, groundcover plants and aquatic plants.
- **Regeneration** means reproduction from self-sown seeds or by vegetative recovery (sprouting from stumps, lignotubers, rhizomes or roots), which occurs naturally after disturbance.
- **Rehabilitation** The treatment or management of land previously disturbed for the purpose of establishing a biodiverse landscape that supports a diverse range of native fauna.
- **Bundanon** means all land managed by Bundanon Trust and employees of the Trust
- **Yuin** is a group of Australian Aboriginal people that consisted of several tribes and their ancestors occupied land from Cape Howe to the Shoalhaven River.
- **Wodi Wodi** is a subgroup of the Dharawal nation that managed land from the north of the Shoalhaven River to Stanwell Park.

1 INTRODUCTION BY GARRY DALY

1.1 BACKGROUND

This report was commissioned by Bundanon Trust to reassess the fauna that occurs on the property. Gary Leonard and this author prepared a report in 1996. Since that time there have been many changes to the landscape and additional surveys have informed our knowledge of the biodiversity of the property.

Changes to the natural landscape include two revegetation projects, planting of mangroves beside the Shoalhaven River, cattle have been removed from areas that were previously grazed, Cultural burns have been undertaken and the Currowan wildfire burnt a large portion of the region including a part of Bundanon in 2020. Hence, Bundanon has seen a need to update the original report and provide a more comprehensive discussion of the importance of the property to the region's biodiversity.

In this report special attention is given to species currently listed under the New South Wales (NSW) *Biodiversity Conservation Act (2016)* as Bundanon is committed to the conservation of the natural heritage of the land. These stories of animals and changes in land use give Bundanon and the people that manage the land context in this living landscape. Images of threatened species are provided so the reader can associate these animals with the text. A separate electronic space, on Bundanon website, will be developed to provide images of all flora and fauna that exist on the property. This photographic dossier will evolve over time and help artists and citizen scientists draw inspiration, create and document what they have on this land.

The property referred to as Bundanon (Lot 11B DP 7511273) is the site of the historic homestead where Arthur and Yvonne Boyd worked and lived in their later years. However, the entire property is composed of several Lots with an additional four being land leased from the Crown. The properties are herein referred to as Bundanon, Riversdale, Beeweeree and Eearie Park. The property is some 915ha in area (Jacobs 2014).

The introduction and fauna components of this report were prepared by Garry Daly. I appreciate the help given by Michael Andrews, Will Armitage, Grahame McDonald, Mike Leggett and Gary Leonard. From 2018 – 2022 the Stuttering Frog team, being Adam and Ba Acworth, Will Armitage and Grahame McDonald, spent hundreds of hours clearing lantana and planting rainforest trees and winter flowering gums at Riversdale. I thank these passionate friends for their time and company rehabilitating the landscape and creating an arboretum that can now be viewed from the veranda of the Bridge. I also thank Charles Dove, George Lemann, Melinda Norton, Paul Taylor and Kim Touzel who generously contributed images for this text.

In 1996 I chatted with Arthur and Yvonne about the exceptional biodiversity of Bundanon. Arthur made the comment that all art has its roots in nature and he wanted to protect the site for future generations to draw inspiration from the landscape. Ironically, to do this he had to give the place away. I thank Arthur and Yvonne for their altruism and foresight.

1.2 PROJECT OBJECTIVES

The objectives were to:

- give a brief review of the history of the property in regard to human interactions that shaped and or changed the flora and fauna that we find today;
- reassess the flora and fauna found on the property with profiles of the threatened species listed under State and Commonwealth legislation;
- discuss the local and regional distribution of threatened species that were found on or adjacent to Bundanon to put the land into context of habitat;
- identify habitat of conservation significance for forest dependant animals and
- provide data from the surveys in an excel spreadsheet as per requirement under the scientific licence.

2 HISTORY OF BUNDANON

2.1 DESCRIPTION OF BUNDANON

Location, topography, zoning and climate

The property (Berry 1: 25,000 topographic map Latitude -34.83, Long 150.71 GDA 290800 61437300, altitude range is sea level to 150m AHD) is located approximately 15 km north-west of Nowra, on the northern bank of the Shoalhaven River (**Figures 1** and **2**). The land is zoned 1(a) Rural Agricultural Production, 1(d) Rural general use, 7(d1) Environmental Protection, Scenic and 7(e) Environmental Protection, Escarpment under the Shoalhaven City Council Local Environmental Plan (2014) (**Figure 3**). A portion of the property is mapped as land of Ecological Sensitivity (**Figure 4**).

The area has a temperate climate with an average rainfall of c. 1133 mm/year. However, since 2000 the average rainfall has fallen to c. 872 mm/year (see Nowra RAN Stations 068072 and 068076) but in 2022 there was above average rain with about 2000mm recorded. Average minimum and maximum air temperatures are 18 and 24° C for January (summer) and 9.5 and 15° C for July (winter) (Bureau of Meteorology 2007).

Geology and soil

The escarpment along the Shoalhaven River is composed of Nowra Sandstone (Hazelton 1993). This geologic unit outcrops in a band from Bomaderry Creek bushland (Nowra bridge) west to the Hampton bridge in Kangaroo Valley and encompasses the escarpment around Riversdale, Bundanon, Beweeree and Eearie Park. On the river flats the fluvial landscape has sandy alluvial soils of the Shoalhaven Series (Hazelton 1993) that were historically cleared for farming.

Soils of the Nowra series consist of medium to quartz-grained sandstones and occur as moderately deep Brown Podzolic Soils on crests, Soloths and Yellow earths on midslope and Yellow Podzolic Soils on lower slopes and creekbanks. Exposed sandstone plates are occasionally evident on the crests. Soils of the Shoalhaven Series are derived from Alluvium, consisting of gravel, sand, silt and clay (Hazelton 1993).

2019-20 Currowan wildfire

The 2019-20 Currowan wildfire burnt 320,385ha in the Shoalhaven (data from SCC website) and about 50% of Bundanon (**Figure 5**). The intensity varied from a loss of shrub layer to crown fire. There was a loss of old growth, hollow-bearing trees as a result of being burnt.

2.2 NATIVE VEGETATION

The descriptions (and codes given in brackets) of the vegetation communities are taken from the Office of Environment and Heritage (2013), Tozer *et al.* (2010). The description of communities and species lists for the various portions that make up the estate are provided.

The plant communities on the estate include:

- PCT 905: Lilly Pilly - Coachwood warm temperate rainforest (SR567 or PM5A 113)
- PCT 1206: Spotted Gum - Blackbutt shrubby open-forest on the coastal foothills (SR641)
- PCT 1080: Red Bloodwood/Grey Gum Woodland (SR 593)
- PCT 1082: Red Bloodwood/Scribbly Gum Woodland (SR 594)
- Swamp Sclerophyll Forest on Coastal Floodplain (previously described as PCT 694: Blackbutt/Bangalay Forest (SR 516)
- PCT: 1206: Spotted Gum/Blackbutt Tall Open-forest (SR 641)
- PCT: 1079: Red Bloodwood/Blackbutt/ Spotted Gum Open-forest (SR 592)
- PCT 1079: Turpentine/Bloodwood/Sydney Peppermint (SR 658)
- River Oak Open-forest (SR606 or PM5A)
- Regenerating Wattles
- Woodlot
- Exotic pasture

It should be noted that the PCTs described are subject to review and a different classification for South-east NSW may be introduced.

2.3 PREVIOUS SURVEYS OF FAUNA

Previous fauna surveys conducted on or adjacent to Bundanon include studies by Daly and Murphy (1995), Daly and Leonard (1996), Gaia Research (2015, 2016, 2020). These form the basis for the species inventory given in (**Appendix 1**). These surveys included base-line opportunistic, systematic and targeted surveys. Surveys conducted by Michael Murphy and the author led to the creation of Bugong NP (1022ha) and Tapitallee Nature Reserve (95ha) during the Regional Forest Agreement in 2001. These reserves are to the east and west of the estate.

Surveys conducted from 2018-2022 were primarily part of monitoring for the re-introduction of the Stuttering Frog ***Mixophyes australis*** to Riversdale. As part of this project (in partnership with Shoalhaven Landcare) over 1500hrs was spent at Riversdale removing weeds and planting some 5ha of riparian habitat with about 450 rainforest plants and winter flowering eucalypts (see **Appendix 2**).

In addition, Bundanon is working with Shoalhaven Landcare to protect and enhance the habitat for the Broad-headed Snake ***Hoplocephalus bungaroides***. This project involves monitoring the use by the snake of false rock.

Other surveys conducted within 20km of the property have allowed me to put the site into context at a broader scale. These surveys include those conducted at the following locations Bangalee Reserve (Daly and Murphy 1995, Daly 2018), the Anglican Youth Centre (Gaia Research 2008) and freehold land in the headwaters of Bengalee Creek and Tapitallee Creek during the southern Comprehensive Regional Assessment of Forests in NSW (Daly unpub. data).

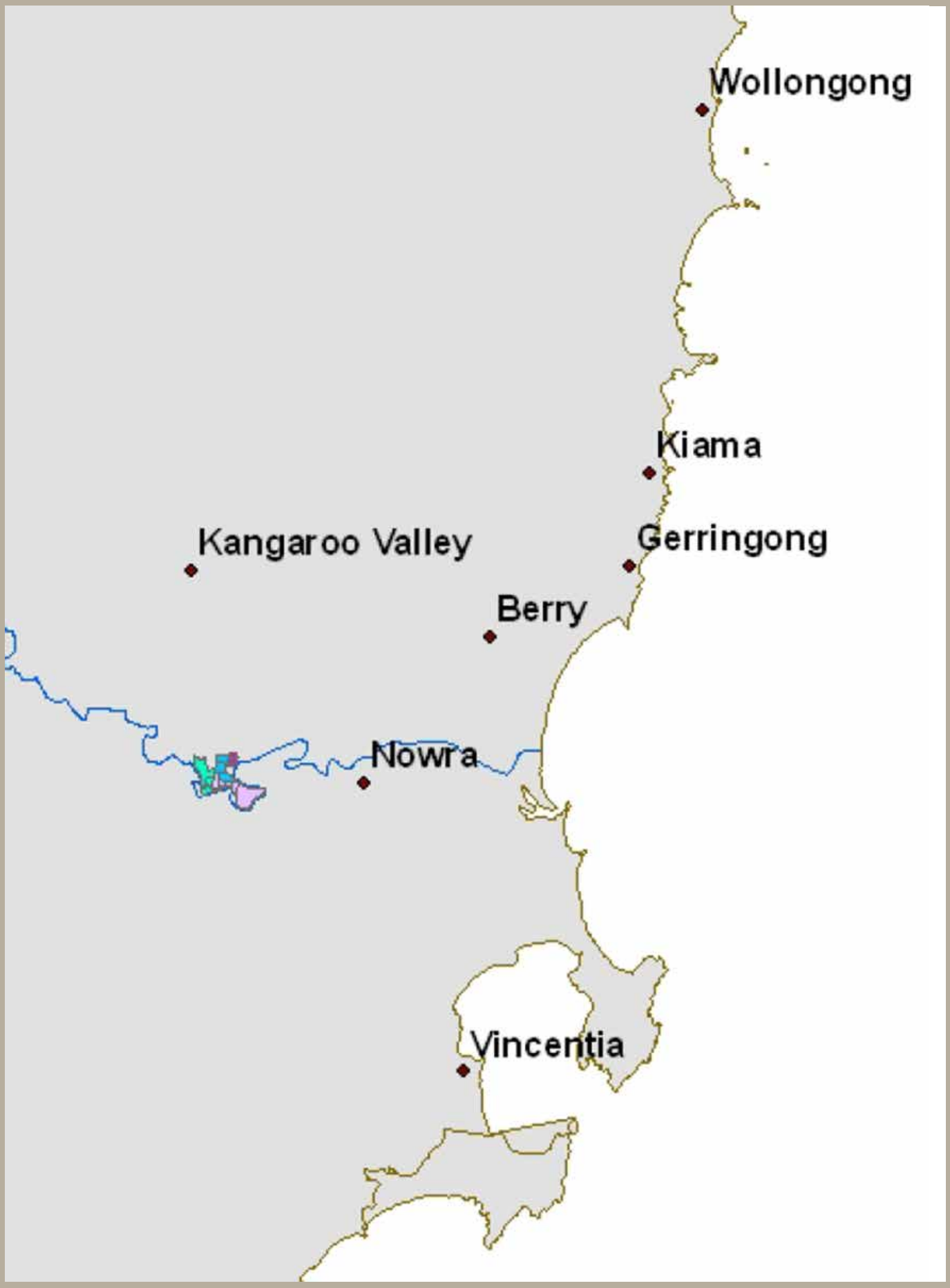


Figure 1
Location of Bundanon in relation to larger towns
Notes: the blue line represents the Shoalhaven River. Map courtesy Total Earth Care Pty Ltd.

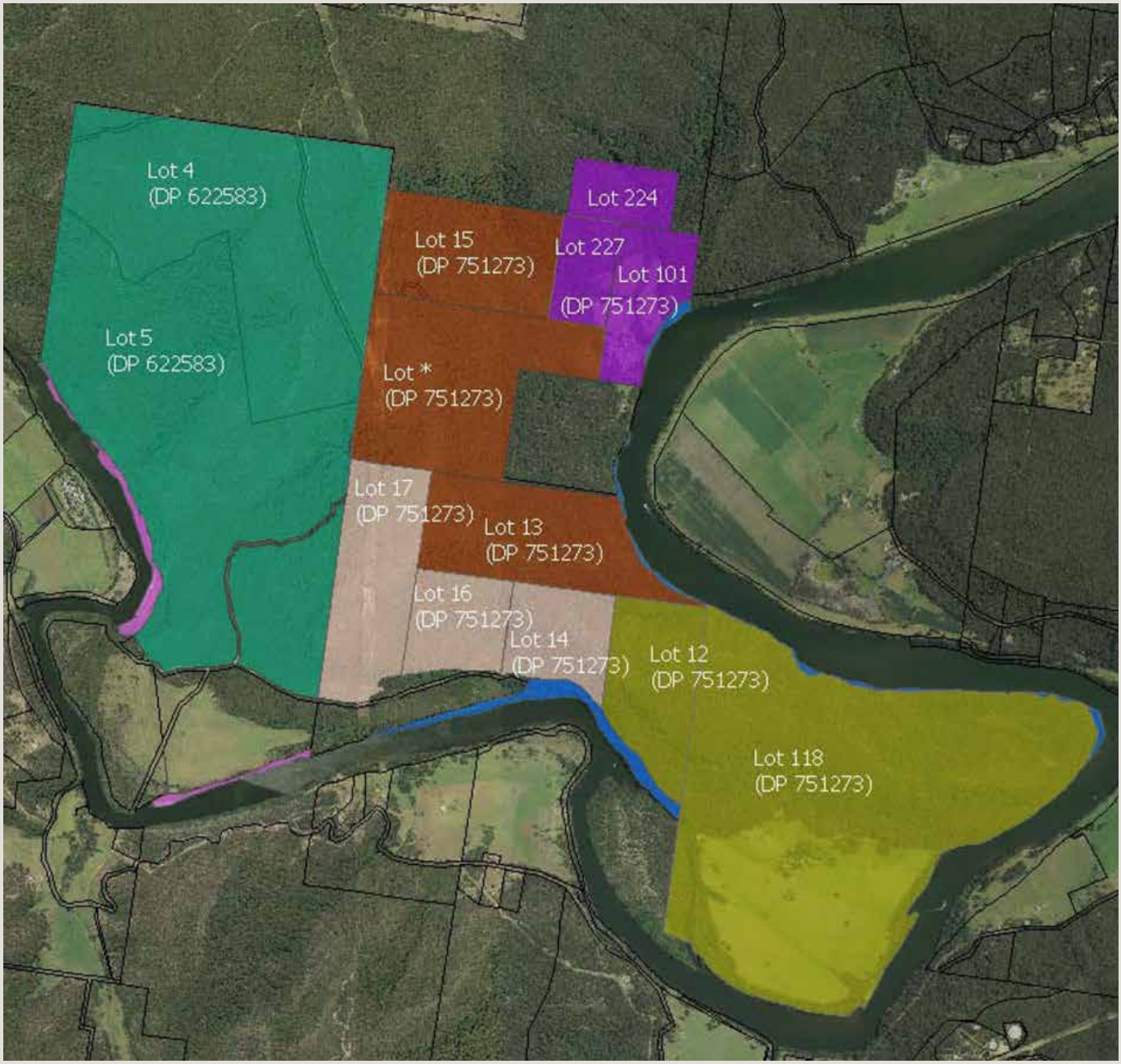


Figure 2
Detail of the properties within Bundanon
Note: Map courtesy Total Earth Care Pty Ltd. The purple Lots of Riversdale have now been consolidated into one.

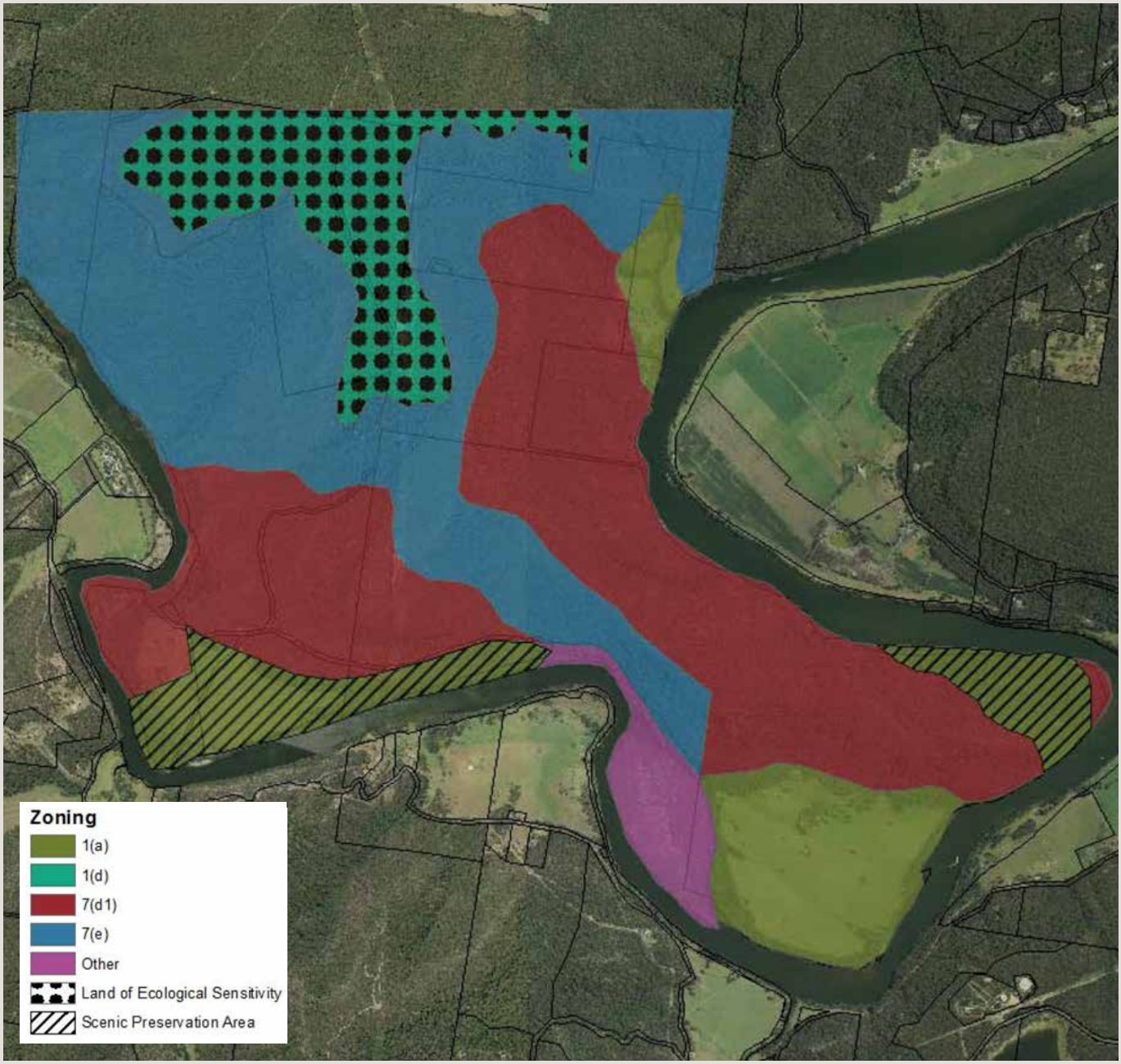


Figure 3
Zoning of land within Bundanon
Note: Map courtesy Total Earth Care Pty Ltd.

2.4 THREATENED FAUNA AND FLORA PREVIOUSLY DETECTED IN THE LOCALITY

Records from the Office of Environment and Heritage's (OEH) Atlas of NSW Wildlife and the author's own databases were referenced for threatened species in the area (Database accessed on 3 July 2022). These databases were used to produce a list of Threatened Species known to occur within ten kilometres of the subject site.

The Atlas includes species, populations and communities listed under the *BC Act (2016)* and the *EPBC Act (1999)*. The conservation status of each species under relevant legislation is indicated in **Table 1**.

This includes:

- Vulnerable - V
- Endangered - E
- Critically Endangered - E1
- Endangered Ecological Community - EEC

In addition records from the author's database have been included in **Table 1**.

Table 1
Threatened Terrestrial Fauna Recorded within 10kms of Subject Site
Note: List taken from BC Act version updated on 3 July 2022 plus the author's database.
Note: recent taxonomic work had split what was originally the Stuttering Frog M. balbus into two species.
The species re-introduced to Bundanon is M. australis

SPECIES COMMON NAME/EEC	SPECIES SCIENTIFIC NAME	BC ACT	EPBC ACT	FOUND ON SITE
Spotted-tailed Quoll	*Dasyurus maculatus*	V	V	No
White-footed Dunnart	*Sminthopsis leucopus*	V		No
Southern Brown Bandicoot	*Isoodon obesulus*	E1	E	No
Koala	*Phascolarctos cinereus*	V		No
Brush-tailed Rock Wallaby	*Petrogale penicillata*	E1	V	Yes
Yellow-bellied Glider	*Petaurus australis*	V		Yes
Eastern Pygmy Possum	*Cercartetus nanus*	V		Adjacent
Long-nosed Potoroo	*Potorous tridactylus*	V	V	No
Grey-headed Flying Fox	*Pteropus poliocephalus*	V	V	Yes
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V		No
Golden-tipped Bat	*Kerivoula papuensis*	V		No
Eastern Freetail Bat	*Micronomus norfolkensis*	V		No
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V		No
Little Bent-wing Bat	*Miniopterus australis*	V		No
Eastern Bent-wing Bat	*Miniopterus orianae oceanensis*	V		Yes
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Yes
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		No

Southern Myotis	*Myotis macropus*	V		Yes
Bush Stone Curlew	*Burhinus grallarius*	E		No
Black Bittern	*Ixobrychus flavicollis*	V		Yes
White-bellied Sea-eagle	*Haliaeetus leucogaster*	V		Yes
Square-tailed Kite	*Lophoictinia isura*	V		No
Little Lorikeet	*Glossopsitta pusilla*	V		Yes
Glossy Black Cockatoo	*Calyptorhynchus lathami*	V		Yes
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Yes
Powerful Owl	*Ninox strenua*	V		Yes
Barking Owl	*Ninox connivens*	V		No
Masked Owl	*Tyto novaehollandiae*	V		No
Sooty Owl	*Tyto tenebricosa*	V		No
Regent Honeyeater	*Anthochaera phrygia*	E1	E	No
Varied Sitella	*Daphoenositta chrysoptera*	V		Yes
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V		No
Scarlet Robin	*Petroica boodang*	V		No
Flame Robin	*Petroica phoenicea*	V		No
Pink Robin	*Petroica rodinogaster*	V		No
Diamond Firetail	*Stagonopleura guttata*	V		No
Heath Monitor	*Varanus rosenbergi*	V		Adjacent
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Yes
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	Yes
Stuttering Frog	*Mixophyes australis*	E1	V	Yes
Brush Turpentine	*Rhodamnia rubescens*	E1	E1	Yes
Nowra Heath Myrtle	*Triplarina nowraensis*	E	E	Yes

A search of the NSW Biodiversity Value Map executed on 1 June 2022 indicates that portions of Bundanon are identified as land with high biodiversity values as defined under the *Biodiversity Conservation Regulation 2017* (**Figure 4**).

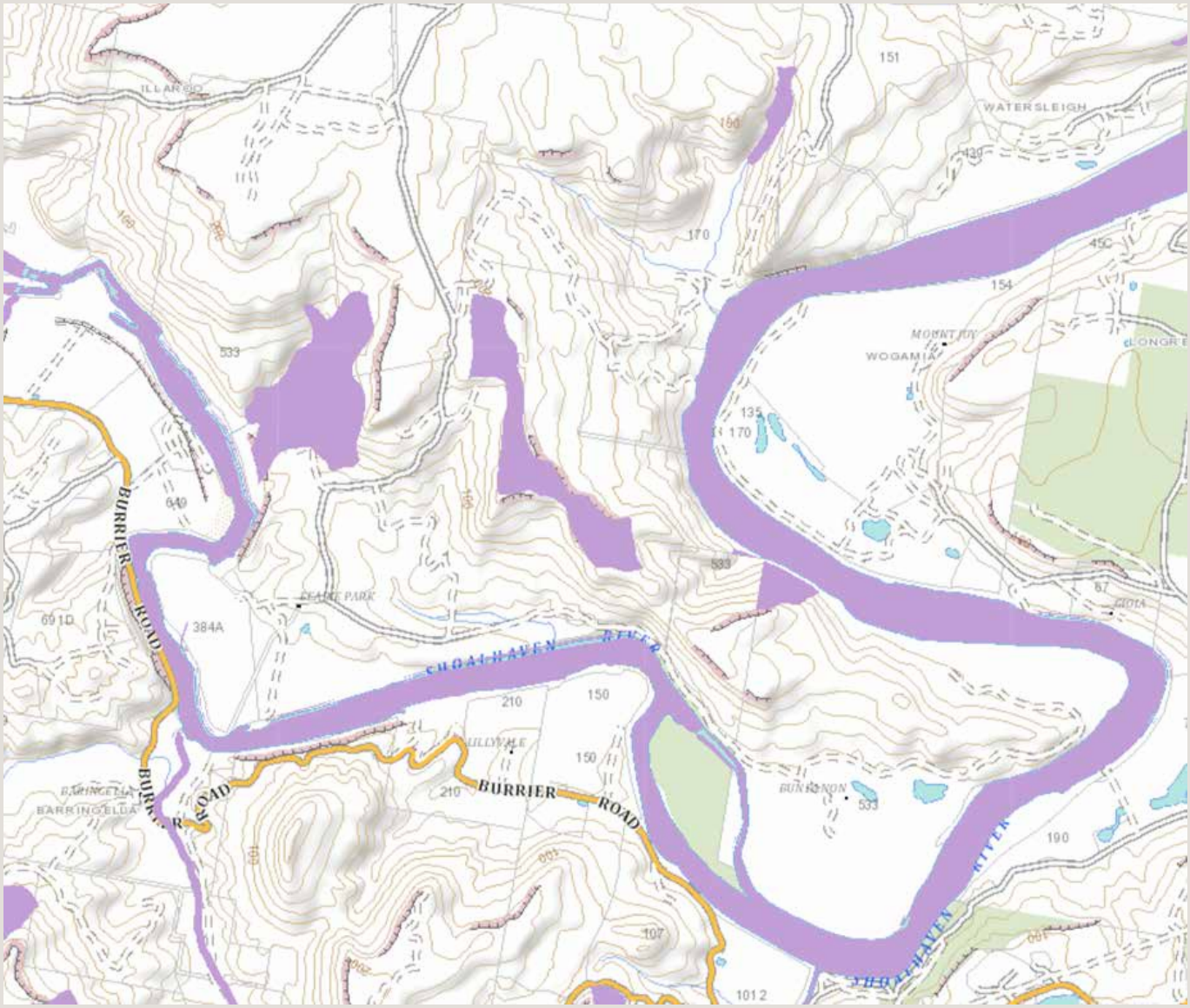


Figure 4
Biodiversity Map showing purple areas of high value
Note: Map courtesy DPE.

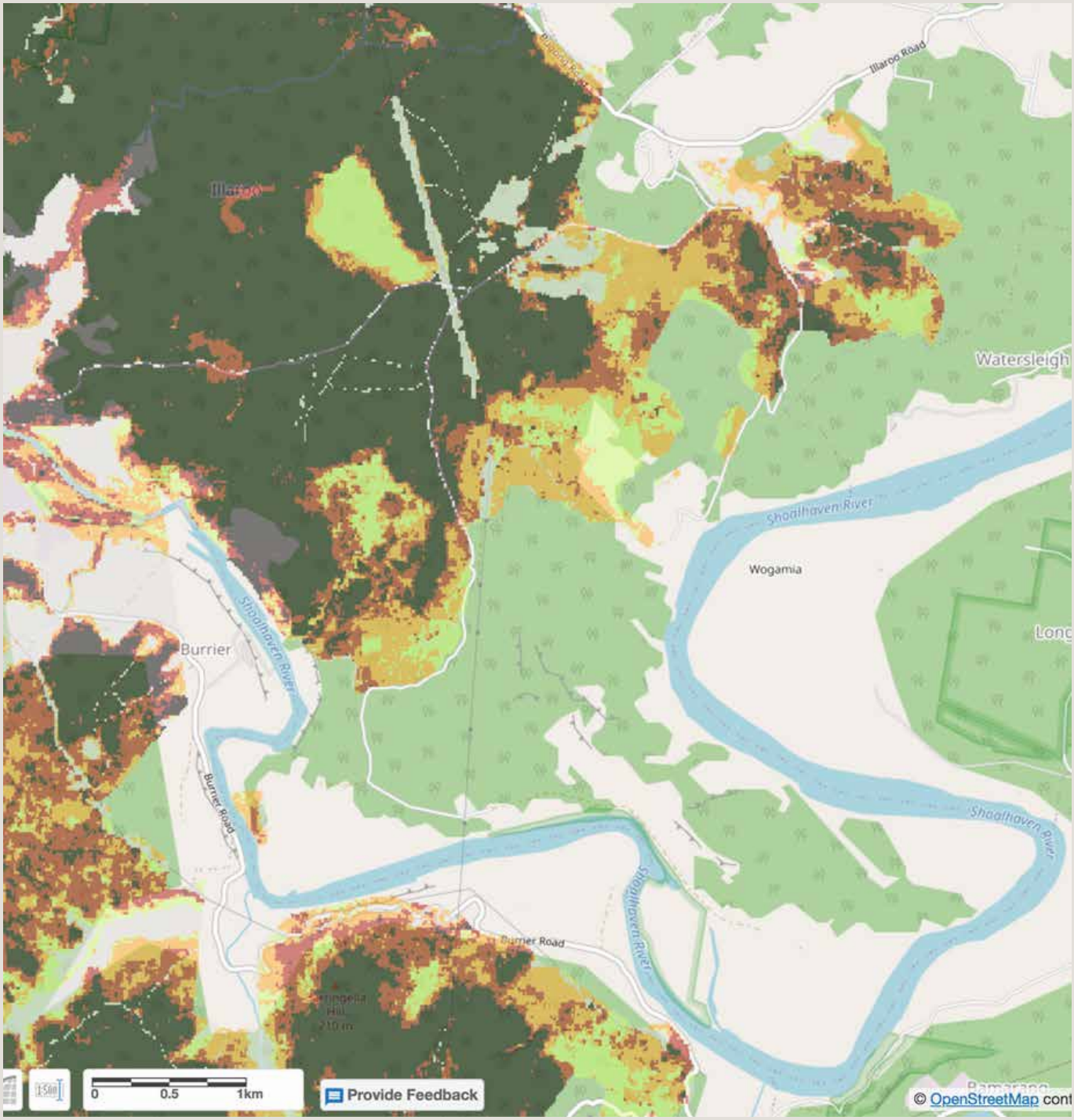


Figure 5
Extent of burn from the 2019-2020 Currowan wildfire
Note: Map courtesy SEED. Note the Currowan wildfire did not overlap the areas of cultural burns

- **BioNet_Flora_Survey_Sites_PCTs**
  Flora Sites (PCT Reference Site)
- **SVTM_NSW_Extant_PCT**
  - **Plant Community Type with labels**

(Not classified) Not classified
(Rainforests) Lismore Basalt Subtropical Rainforest
(Dry Sclerophyll Forests (Shrub/grass sub-formation)) Southwest Rockplate Shrub Woodland
(Rainforests) Lower Richmond Hills Dry-Subtropical Rainforest
(Grasslands) Yass Gorge Rhyolite Grassland
(Wet Sclerophyll Forests (Shrubby sub-formation)) Northern Escarpment New England Blackbutt Wet Forest
(Wet Sclerophyll Forests (Grassy sub-formation)) Lower North White Mahogany-Spotted Gum Moist Forest
(Wet Sclerophyll Forests (Shrubby sub-formation)) Northern Escarpment New England Blackbutt-Tallowwood Wet Forest
(Grassy Woodlands) Jounama Snow Gum Shrub Woodland
(Wet Sclerophyll Forests (Grassy sub-formation)) Lower North Spotted Gum-Mahogany-Ironbark Sheltered Forest
(Grassy Woodlands) Macleay Gorge Rims Shrub Woodland
(Dry Sclerophyll Forests (Shrub/grass sub-formation)) Southeast Hinterland Dry Grassy Forest
(Wet Sclerophyll Forests (Grassy sub-formation)) Southern Tableland Swamp Flats Shrub Woodland
(Grassy Woodlands) Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
(Dry Sclerophyll Forests (Shrubby sub-formation)) Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion

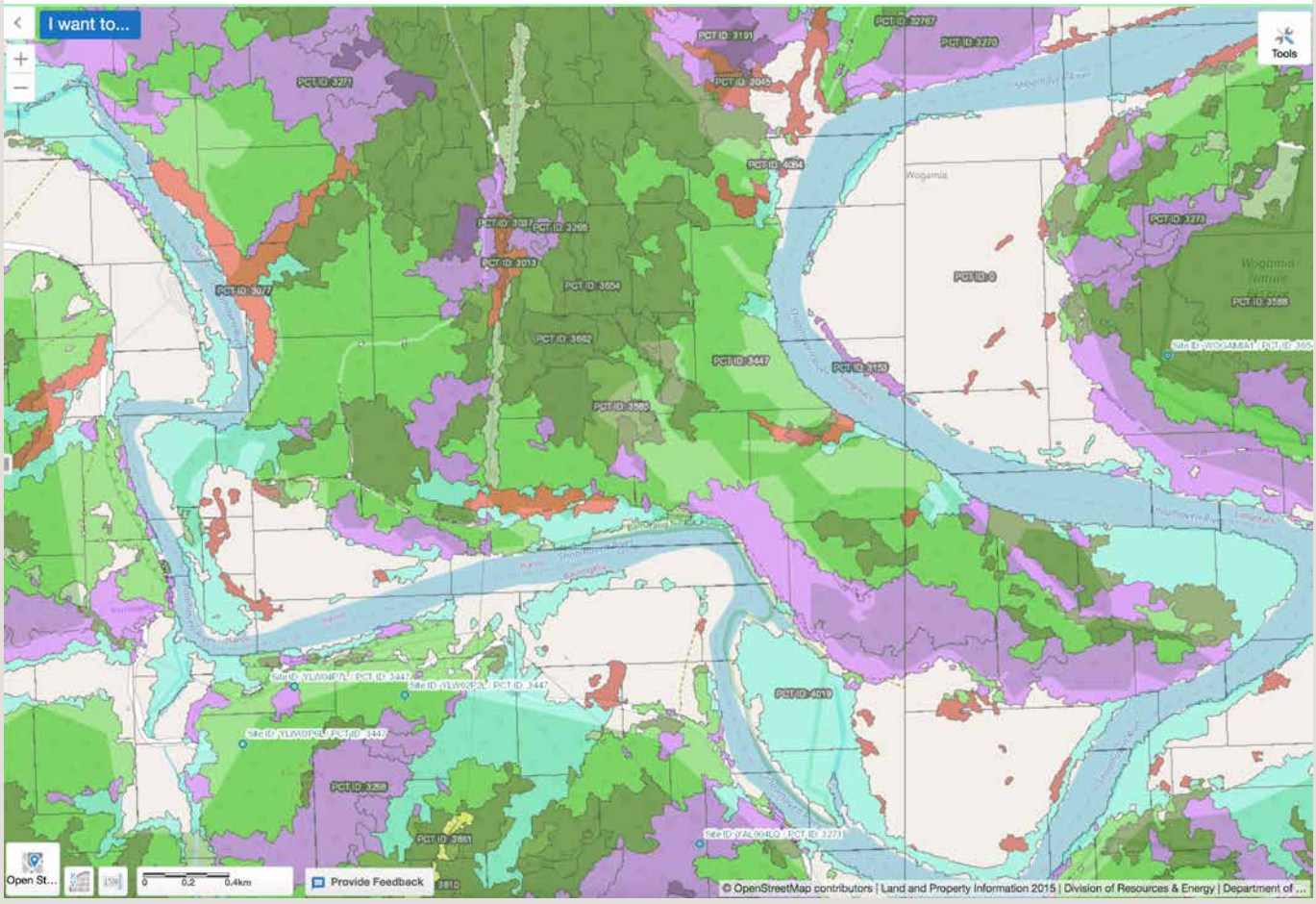


Figure 6
Mapping of vegetation communities at Bundanon
Note: Map courtesy OMVI

3 METHODS

The methods used during the preparation of this report adhere to those devised by the NPWS southern Comprehensive Regional Assessment (CRA) unit (NPWS 1999). They include standard time/area based surveys to provide comparable data on terrestrial fauna.

3.1 ELLIOTT AND CAGE TRAPPING FOR SMALL TO MEDIUM SIZED MAMMALS

Elliott traps are small aluminium traps that have spring mechanism to close the door when the animal enters the trap. Ten A size Elliott traps are set for three days on the ground at twenty metre intervals and baited with a mixture of peanut butter and rolled oats. The traps are placed under bushes or other vegetation so that they were protected from direct sunlight and are checked during the early morning each day to minimise stress to captured animals from heat/ants. The line of Elliott traps is called a transect.

Two cage traps are set along the transect and baited with the above-mentioned mixture plus sardines in oil and set for the same period. One cage trap (55 × 20 × 20 cm) is set at Elliott trap one and the other at Elliott trap 5 along the transect.

3.2 HARP TRAPPING FOR MICROBATS

Harp traps are aluminium rectangles that have rows of fishing line strung within the rectangle. Microbats cannot detect the fishing line with their sonar and fly into the taut line and fall into a calico bag strung under the filaments. The bats then climb up the bag and rest under a sheet of plastic. Harp traps are usually erected within 100 metres of the Elliott trapping transect along narrow trails fringed by thick vegetation and set for the same period as the Elliott traps. The traps were checked daily in the early morning and animals are measured (forearm length) and weighed before being placed in separate cloth bags and released at the point of capture that night.

3.3 FOOT-BASED SPOTLIGHTING FOR ARBOREAL MAMMALS

The majority of marsupials are nocturnal and surveyors use spotlights to observe arboreal (tree-living) mammals. Spotlighting is usually conducted for 30 minutes along and adjacent to the trapping transect and then on narrow trails. Some gliders and possums proclaim their territories by calling. Each species call can be identified by an experienced person and where possible, identified by direct observation. Over the years spotlight equipment has evolved from 12 volt spotlights with 100 watt halogen globes to more compact LED spotlights that emit 1000 lumens. The result is that smaller animals such as Sugar Gliders are more detectable now than before the advent of powerful LED spotlights. Spotlighting is done after call playback to give a longer period of detection.

3.4 NOCTURNAL CALL PLAYBACK

Nocturnal birds and mammals are often detected when they vocalise to proclaim their territory or during social interaction. This behaviour is exploited when surveying by broadcasting pre-recorded calls to elicit a response if that particular species is within the immediate area. The calls of select threatened species are broadcast through a car stereo system. No spotlights were operated during the playback but the immediate area is spot lit after the cessation of the playback.

- Call playback is given in the following order.
- Powerful Owl ***Ninox strenua***
- Barking Owl ***Ninox connivens***
- Masked Owl ***Tyto novaehollandiae***
- Sooty Owl ***Tyto taeniolatus***

- Squirrel Glider ***Petaurus norfolcensis***
- Yellow-Bellied Glider ***Petaurus australis***
- Koala ***Phascolarctos cinereus***
- Bush Stone Curlew ***Burhinus grallarius***

3.5 DIURNAL BIRD SURVEYS

Diurnal birds proclaim their territories and interact with other birds by calling. Each species has specific calls that can be identified by an experienced person (a birdo). Binoculars are also used to observe and identify the animals. Birds are surveyed for a period of 20 minutes within a two hectare area of the transect. Birds detected outside the two hectare plot are also recorded but noted as occurring outside the designated search area.

3.6 DIURNAL REPTILE SEARCHES

Reptiles are surveyed during the day, especially during warm sunny conditions in spring and summer. The methods used to find reptiles are observing animals as they bask or forage and lifting rocks, decorticating bark and fallen logs to detect hiding snakes and lizards. Reptiles are usually surveyed for a period of 60 minutes within the transect.

3.7 NOCTURNAL STREAM-SIDE SEARCHES

Frogs are surveyed usually during warm nights in spring and summer. The methods used to detect frogs are direct observation and recognition of species-specific calls. Frogs are usually surveyed for a period of 30 minutes along a creek but spot searches around ponds and dams are also performed.

3.8 TARGETED SURVEYS AND OPPORTUNISTIC DETECTIONS

Some species (e.g.Yellow-bellied Glider and Glossy-black Cockatoo) benefit from both targeted surveys and opportunistic detections. Species such as the Yellow-bellied Glider incise certain eucalypts and bloodwoods to procure sweet sap. The shape and size of these incisions are specific to this glider and hence locating incised trees is a relatively easy method to detect the animal. The Glossy-black Cockatoo eats the seed of she-oaks, and in the Shoalhaven the Black She-oak ***Allocasuarina littoralis*** is the main food tree. Locating chewed she-oak cones below a feed tree is a valid method to detect this species. During fauna surveys animals heard or seen opportunistically were also recorded.

3.9 FLORA SURVEYS

3.9.1 LITERATURE REVIEW

The following studies were assessed, and Plant species lists included in the reports were examined, in order to establish a comprehensive plant species list for the property. :

- Flora and Fauna of 'Bundanon': Daly and Leonard (1996)
- Monitoring Report; tree planting at two sites at Bundanon (Attwood 2018)
- Plant Species Schedule, Haunted Point: Proust (2018)
- Biobanking Assessment, Living Landscapes Project, Bundanon Trust (Jacobs 2014)
- *Native Trees of the NSW South Coast:* Mills and Jakeman (2010)
- *A Field Guide to the Orchids of NSW and Victoria:* Bishop (2000)

The following studies were assessed to determine the most appropriate vegetation classifications for vegetation on the estate:

- Native Vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes, and SE Corner bioregions: Gellie (2005).
- Compilation Map; Biometric vegetation types and EECs of the Shoalhaven, Eurobodalla and Bega valley LGAs: NSW OEH (2013)
- Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands: Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. (2010)

3.9.2 FIELD SURVEYS

Field surveys were carried out over eight days between August and November 2022. Survey methods were carried out according to Walker and Hopkins (1990), York, Binns and Shields (1991) and Cropper (1993). Aims of the surveys included:

- Confirm occurrences of plant species previously listed;
- Compile a plant species list according to vegetation types and locations (**Appendix 3**);
- Assess previous vegetation mapping and fine-tune extent and location of each vegetation type;
- Ascribe PCTs (Plant Community Types) to each vegetation type, to facilitate future assessments using current NSW government-approved methods (**Appendix 4**);
- Identify locations of Threatened plant species; and suitable habitat for Threatened plant species and
- Identify location and extent of Endangered Ecological Communities (EECs).

4 RESULTS

4.1 THREATENED SPECIES

Survey work detected the following species of animal currently listed as threatened under the BC Act 2016:

White-footed Dunnart ***Sminthopsis leucopus***, Eastern Pygmy Possum ***Cercatetus nanus***, Koala ***Phascolarctos cinereus***, Brush-tailed Rock Wallaby ***Petrogale penicillata***, Yellow-bellied Glider ***Petaurus australis***, Grey-headed Flying Fox ***Pteropus poliocephalus***, Eastern Bent-wing Bat ***Miniopterus orianae oceanensis***, Large-eared Pied Bat ***Chalinolobus dwyeri***, Little Lorikeet ***Glossopsitta pusilla***, White-bellied Sea Eagle ***Haliaeetus leucogaster***, Yellow-bellied Glider ***Petaurus australis***, Gang Gang Cockatoo ***Callocephalon fimbriatum***, Broad-headed Snake ***Hoplocephalus bungaroides***, Heath Monitor ***Varanus rosenbergi*** and Giant Burrowing Frog ***Heleioporus australiacus***. The species found on each area of Bundanon is given in **Appendix 1**.

4.2 MAMMALS

Twenty-one species of mammal have been detected. This includes the ubiquitous Common Wombat ***Vombatus ursinus*** to Australia's smallest microbat the Little Forest Bat ***Vespadelus vulturus***. It is surprising that so many people, who visit Riversdale, state it is the first time they had seen a wombat.

Two species of carnivorous marsupial the White-footed Dunnart ***Sminthopsis leucopus*** and Brown Antechinus ***Antechinus stuartii*** have been trapped either on or near Bundanon. It is very likely that the Spotted-tailed Quoll ***Dasyurus maculatus*** and Mainland Dusky Antechinus ***Antechinus mimetes mimites*** also occur on the site as both species have been found within a few kilometres of the estate. The White-footed Dunnart was trapped on 20 March 1995 about one kilometre north of Riversdale. The animal was vouchered as a token specimen (Australian Museum, Catalogue number M. 32088).

Five species of macropod (kangaroos and wallabies) have been found on Bundanon. The Eastern Grey Kangaroo as introduced to Bundanon in the 1970s (Anon pers. comm.). Since that time it has spread to Riversdale, North Nowra, Cambewarra and even Seven Mile Beach NP since that time. The Eastern Grey Kangaroo is the second largest living macropod being slightly smaller than the Red Kangaroo and part of our megafauna.

Many kangaroos and wallabies including those that occur at Bundanon have a reproductive mechanism that allows them to build up populations in times when food is abundant. The reproductive mechanism is called embryonic diapause, a condition where development of the embryo is temporary suspended. This can be used during times when conditions are poor and the joey would have little chance of survival. When conditions are good this embryo can develop rapidly and when the young leaves the pouch another baby may be born very quickly. So a mother might have one a baby that has left the pouch and one within the pouch attached to a teat. Each joey suckles on separate teats that deliver milk that has different levels of nutrient appropriate for the developmental stage of the young (Dawson 1995).

The gliders and possums are a group that mainly eat leaves, insects and the sap from wattles and certain gums. The Sugar Glider is advantaged by the presence of stands of Black Wattle that has regenerated after cattle have been taken off the estate. Sugar Glider eat the sap that exudes from wattles, Grey Gum and Red Bloodwood (called kino), particularly during winter and shift to eating insects in spring and summer (Smith 1982). Sugar Gliders also forage on Banksia flowers and any gums that have blossom in winter. For this reason we (the Stuttering Frog team) have planted stands of Swamp Mahogany and Forest Red Gum that flower in winter at Riversdale.

Microbats make up nearly one half of the native mammal species at Bundanon! Apart from the Eastern Horseshoe-bat ***Rhinolophus megaphyllus***, Eastern Bent-wing Bat ***Miniopterus orianae oceanensis*** and the Large-eared Pied Bat ***Chalinolobus dwyeri*** the majority of species den in tree hollows. Females of several species form maternity roosts during the time they have their young and exclude males from these areas. All microbats eat insects and spiders and hence the drought prior to the Currowan wildfire and subsequent loss of invertebrates from the fire would have impacted these animals.

The Currowan wildfire also impacted on the gliders and other forest dependant fauna as many old hollow bearing trees were consumed or fell as a result of the inferno. The Shoalhaven and Bundanon have experienced many fires but this megablaze was so large and intense that it impacted animals at a landscape level. The bush that I knew at Budgong and some parts of Eearie estate will never be as rich as before the Currowan wildfire, at least not within my lifetime.

4.3 BIRDS

The changes in the birds in an area from Riversdale north to Cambewarra Range Nature Reserve (Red Rock) from 1926 to 2020 was undertaken by comparing records made by Aubrey Elliott from 1926 -1940 to those between 1985 – 2020 (Daly 2021). During that time 14 species have become locally extinct while 28 have colonised/ recolonised the area. Combining Aubrey's and my data a total of 194 species of bird have been recorded in the broader area, a subset of about 100 species these have been detected at Bundanon (**Appendix 1**).

The changes were mostly attributed to a lack of shooting in recent times, the construction of dams, the regrowth of native vegetation on land that was previously cleared and the Red Fox ***Vulpes vulpes*** colonising the region. Two dams have been constructed on Bundanon and one on Eearie Park and native vegetation has regrown on the steeper slopes. These actions have expanded the habitat for aquatic and forest dependant species but disadvantaged those that occupy grasslands. The Red Fox colonised

the area in 1907 and is implicated in the local extinction of the Bush Stone Curlew ***Burhinus grallarius***. The following is taken from Daly (2022):

Seasonal Migratory birds

Fifty species of birds (26% of the total recorded in the Tapitallee area) are seasonal breeding migrants or are nomadic species that move to the area to access food resources. Some birds migrate from lower latitudes to breed in spring and summer, while others move from higher altitudes to the coastal ranges.

Seasonal migrants such as the Yellow-faced Honeyeater ***Caligavis chrysops***, Scarlet Honeyeater ***Myzomela sanguinolenta***, White-naped Honeyeater ***Melithreptus lunatus***, Silvereye, Noisy Friarbird ***Philemon corniculatus*** and Red Wattlebird ***Anthochaera carunculata*** are detected biannually as they move along the escarpment during their north and south bound migrations. Yellow-faced Honeyeater and White-naped Honeyeater form mixed flocks while the other species move in flocks of their own species. The planting of various trees at Riversdale and Bundanon has provided a foraging stepping-stone for these birds. Most seasonal migrants arrive in spring but the Horsfield's Bronze Cuckoo, Shining Bronze Cuckoo, Tree Martin, Black-faced Cuckoo-shrike may arrive in late winter.

In late summer the Rose Robin ***Petroica phoenicea*** is present being a migrant from higher altitudes. In autumn flocks of dispersing juvenile Satin Bowerbird ***Ptilonorhynchus violaceus*** are abundant and Pied Currawong ***Strepera graculina*** flocks forage on the river flats at Riversdale and Bundanon.

Changes in Species Status

Some birds that occupy fragmented or open-forest have declined while those that occupy forest have increased. Fourteen species (8%) have not been detected for twenty-five years or more and appear to have become locally extinct (**Table 2**). Bundanon has a large area of grassland paddocks and birds that prefer this habitat type can be seen in this area.

Species have declined for a number of reasons. Those that normally inhabit woodland and are nomadic, such as the Black-eared Cuckoo ***Chrysococcys osculans***, Pallid Cuckoo ***Cuculus pallidus***, Regent Honeyeater ***Xanthomyza phrygi***, Jacky Winter ***Microeca leucophaea***, Flame Robin ***Petroica phoenicea***, Scarlet Robin ***Petroica boodang***, Varied Sitella ***Daphoenositta chrysoptera***, White-winger Triller ***Lalage sueurii***, Dusky Woodswallow ***Artamus cyanopterus*** have been affected by removal and simplification of habitat over broad areas of the landscape (Barrett *et al.* 2007, Department of Environment 2016).

Colonising species include the Australian Wood Duck ***Chenonetta jubata***, Figbird ***Sphecotheres vieilloti***, Bar-shouldered Dove ***Geopelia humeralis***, Galah ***Eolophus roseicapillus***, Sulfur-crested Cockatoo ***Cacatua galerita***, Little Corella ***Cacatua sanguinea***, Long-billed Corella ***Cacatua tenuirostris***, Eastern Koel ***Eudynamys orientalis***, Channel-billed Cuckoo ***Scythrops novaehollandiae***, Dollarbird ***Eurystomus orientalis***, Noisy Pitta ***Pitta versicolor***, Cattle Egret ***Bubulcus ibis***, White-winged Chough ***Corcorax melanorhamphos***, Red Whiskered Bulbul ***Pycnonotus jocosus***, Common Starling ***Sturnus vulgaris***, Common Blackbird ***Turdus merula*** and Common Myna ***Sturnus tristis***.

Some of these colonising birds have originated from escaped (liberated) caged animals. These include the Little Corella ***Cacatua sanguinea*** and Long-billed Corella ***Cacatua tenuirostris***. Others are exotic species that have expanded their range from the areas where they were originally liberated. These include Red Whiskered Bulbul, Common Starling, Common Blackbird and Common Myna.

Changes in populations of birds in the area can be attributed to a number of factors. These include shooting animals for the table and sport, the arrival of the Red Fox and subsequent predation of ground

nesting species, clearing bush as part of soldier resettlement after the great war followed by regrowth of native vegetation along the escarpment from c.1980, drought, translocations, climate change, construction of dams and the 2020 wildfire.

At Bundanon and Eearie Park the woodlots (49 and 30ha respectively) planted in 2013-2015 now provide habitat for over thirty species of bird (Touzel and Daly unpub. Data). This demonstrates that revegetation programs can have a positive impact on biodiversity within a relatively short period of time.

Changes in status in relation to drought, translocations and climate change

Blakers *et al.* (1984) states that Galah ***Cacatua roseicapilla***, Little Corella ***C. sanguinea*** and Crested Pigeon ***Ocyphaps lophotes*** are examples of species historically considered to be typical of Australian arid and semi-arid regions that have invaded temperate parts of Australia over the past 100 years. This may also be the situation with the Sulphur-crested Cockatoo ***Cacatua galerita*** (Hoskin 1991). It is widely agreed that, rather than climate change, it is land-cover and land-use changes (primarily vegetation clearance and provision of artificial water sources) that have caused southern range expansions, and similar expansions along the eastern seaboard (Reid 2003).

In the Shoalhaven this may be the situation for the Galah and Crested Pigeon but the Little and Long-billed Corella's invasion of the south coast appears to be a result of the trade in wild birds. In the 1980s pet shops sold many Corellas and some escaped (G. Daly pers. obs.). Bird traders, that is people who under licence collected baby birds from the wild, had a habit of releasing excess animals at the end of a season (G. McDonald pers. comm.). I first observed Little Corellas in Nowra in 1985 and Long-billed Corellas in 1986. They colonised the town from the north using the bridge over the Shoalhaven River as a roost for a period but then shifted to roosting in trees in the town's parks.

Elliott states that the Rainbow Lorikeet ***Trichoglossus moluccanus*** was well known in the district but now rarely seen. He had not seen the species locally. This aligns with historic records of the species being abundant in the late 1800s (Crome and Shields 1992) thereafter declining to a point where it was recorded as first breeding in Sydney in 1947 (Hoskin 1991). Rainbow Lorikeets have expanded their range and density in the Shoalhaven over the last decade. They were absent from much of the Tapitallee area in the 1980s but are now regular visitors. Currently thousands of Little Corellas and Rainbow Lorikeet live in the Nowra central business district roosting in trees beside streetlights (SMH 2019).

The mobility of birds allows them to respond to changes in the environment more rapidly than non-volar species. Torresian species such as the Cattle Egret, Figbird, Channel-billed Cuckoo, Common Koel ***Eudynamys scolopacea***, Pacific Baza ***Nisaetus cirrhatus***, Square-tailed Kite, Bar-shouldered Dove ***Geopelia humeralis***, Noisy Pitta and Dollarbird have expanded south (Keast 1995; McAllen *et al.* 2007). This expansion may be attributed to landscape changes and/or a warming climate (Reid 2003). The expansion of the Channel-billed Cuckoo may be aligned with an increase in the Pied Currawong population since the 1980s (Chafer *et al.* 1999).

Table 2
Locally extinct and declining species of bird
Note: historic data during 1930s from the Elliott notes, status from 1985-2022 from the author

COMMON NAME	SCIENTIFIC NAME	LAST DETECTED IN TAPITALLEE	STATUS TAPITALLEE 1985-2022
Bush-stone Curlew	*Burhinus grallarius*	1920s	Locally extinct, predation by Fox
Wompoo Pigeon	*Ptilinopus magnificus*	1890s	Locally extinct, from shooting
Spotted Turtle-dove*	*Streptopelia chinensis*	1930	Not seen from 1985-2022
Emerald Dove	*Chalcophaps indica*	Fairly common during 1930s	Rarely seen from 1985-2022
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Common 1930s	Uncommon from 1985-2022
Musk Lorikeet	*Glossopsitta concinna*	Common 1930s	Uncommon from 1985-2022
Little Lorikeet	*Glossopsitta pusilla*	Common 1930s	Uncommon except in 2020
Pallid Cuckoo	*Cuculus pallidus*	Uncommon 1930s	Not seen from 1985-2022
Barking Owl	*Ninox connivens*	1990s	Locally extinct, reason unknown
Masked Owl	*Tyto novaehollandiae*	Common 1930s	Rare, bred in Bangalee Reserve 1980s
Red-browed Treecreeper	*Climacteris erythrops*	1930s	Locally extinct, reason unknown
Striated Pardalote	*Pardalotus striatus*	Common 1930s	Uncommon from 1985-2022
Large-billed Scrubwren	*Sericornis magnirostris*	Common 1930s	Uncommon from 1985-2022
Buff-rumped Thornbill	*Acanthiza reguloides*	Common 1930s	Uncommon from 1985-2022
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	Common 1930s	Uncommon from 1985-2022
Regent Honeyeater	*Xanthomyza phrygia*	1930s	Locally extinct from clearing
White fronted Chat	*Epthianura albifrons*	1930s	Locally extinct, Predation?
Jacky Winter	*Microeca leucophaea*	Common 1930s	Uncommon from 1985-2022
Flame Robin	*Petroica rosea*	1930s	Locally extinct from clearing
Hooded Robin	*Melanodryas cucullata*	1930s	Locally extinct from clearing

Varied Sittella	*Daphoenositta chrysoptera*	unknown	Declining from 1985–2022
White-bellied Cuckoo Shrike	*Coracina papuensis*	1930s	Locally extinct from clearing
White-winged Triller	*Lalage sueurii*	Common 1930s	Rarely seen from 1985–2022
Dusky Woodswallow	*Artamus cyanopterus*	Uncommon 1930s	Rarely seen from 1985–2022
Grey Currawong	*Strepera visicolor*	1930s	Locally extinct, competition with Pied Currawong
Fairy Martin	*Hirundo aeriel*	1930s	Locally extinct, reason unknown
Diamond Firetail	*Stagonopleura guttata*	Common 1930s	Locally extinct, predation by Pied Currawong?

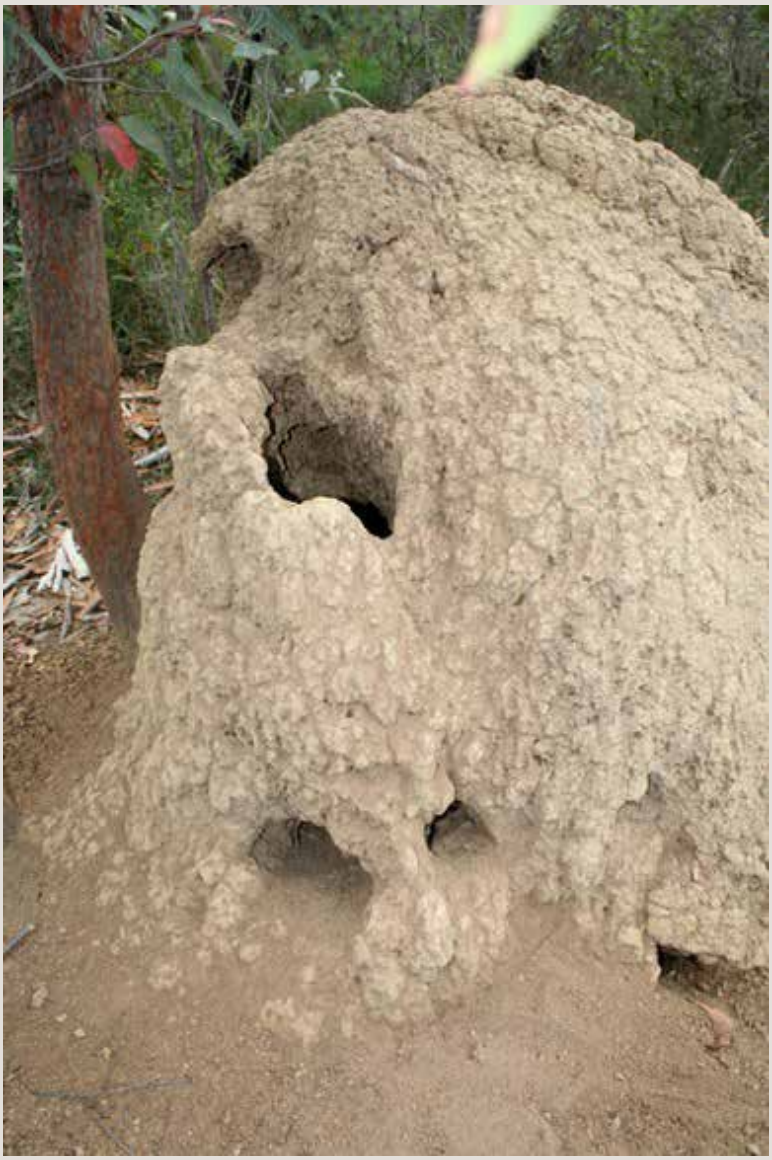
4.4 REPTILES

Fifteen reptiles have been found on or adjacent to Bundanon (**Appendix 1**). The Eastern Water Skink ***Eulamprus quoyii*** and Gippsland Water Dragon ***Intellagama lesueurii howitti*** are highly associated with creeks and the Shoalhaven River. In contrast there is a suite of reptiles that prefer to live on sandstone ridgetops. These rock loving (saxatilis) species include the Lesueur's Gecko ***Amalosia lesueurii***, Heath Monitor ***Varanus rosenbergi***, Red-throated Skink ***Bassiana platynota***, Snake-eyed Skink ***Cryptoblepharus virgatus***, Copper-tailed Skink ***Ctenotus taeniolatus***, Yellow-faced Whip Snake ***Demansia psammophis***, Broad-headed Snake ***Hoplocephalus bungaroides*** and Black Blind Snake ***Ramphotyphlops nigrescens***. A study of the habitat preference of reptiles found more species live on ridge

Lace Monitors mating, Riversdale 2020. Image by G. Daly

sites than gullies or midslope areas (Daly 2006). The reason so many reptiles live on ridge tops and take refuge under loose rocks is that rocks heat up when exposed to direct sun and animals can raise their body heat without being exposed to predators. They come out from under the rocks to forage when they are warm and can move away from danger more quickly than if they were cold.

The two species of goanna that live at Bundanon lay their eggs in termite ***Nasutitermes exitiosus*** mounds during summer. The termites keep the inside of their mounds at a fairly constant temperature and humidity and act as natural incubators for the eggs (King and Green 1999, Ehmann *et al.* 1991). The eggs hatch in spring and the young goannas stay within the termite mound for several weeks before digging their escape.



Termite mound used by Lace Monitors to incubate eggs over several years, Bugong NP. Image by G. Daly

The Black Blind Snake lives most of its life under the ground (fossorial), beneath rocks and fallen logs. In contrast the Broad-headed Snake ***Hoplocephalus bungaroides*** and Barred-sided Skink ***Eulamprus tenuis*** spend quite a bit of time in tree hollows (arboreal). During tree clearing operations I have found Barred-sided Skink in decayed hollows some 30m above the ground demonstrating they climb right to the treetops!

The Shoalhaven River has been a barrier to the dispersal of some species of reptile. For example, the Cunningham's Skink ***Egernia cunninghami*** and Whites Skink ***Liopholis whitii*** occur on the southern side but not on the northern side of the river. Both species live under loose sandstone rocks on ridgelines and this habitat is present on the property and elsewhere in the area from Bomaderry Creek bushland to Hampton bridge in Kangaroo Valley

4.5 AMPHIBIANS

Twelve species of frog have been found on or adjacent to Bundanon.(**Appendix 1**). This includes six species of tree frog and six species of ground dwelling frogs. Tree frogs have suction caps of their toes and fingers whereas ground dwelling species do not. Many species of tree frog climb trees and overwinter in hollows. During clearing operations I have found Peron's Tree Frog ***Litoria peronii*** and the Screaming Tree Frog ***Litoria quaritatus*** in large tree hollows that end in what is colloquially termed mud guts. The hollow is usually formed by the activity of termites and their castings fill the end of the hollow with a sort of mud that is relatively impervious to water. Hence a reservoir exists above the mud. In these situations, the frogs have a ready supply of water and can move up the hollow to an area that provides the humidity they prefer.

4.6 FLORA

4.6.1 Rhodamnia rubescens

Specimens of the Critically Endangered Brush Turpentine ***Rhodamnia rubescens*** have recently been recorded adjacent to a creekline and adjacent to the Museum at Riversdale. Jacobs (2014) recorded an occurrence of this species on the upper slopes to the north-east of Riversdale.

4.6.2 Syzygium paniculatum

Planted specimens of Magenta Lillypilly ***Syzygium paniculatum*** occur near the maintenance shed downslope of the upper car park, Riversdale and adjacent to a creekline on the margins of a patch of warm temperate rainforest, downslope of the maintenance shed. Magenta Lilly Pilly is listed as Endangered under NSW legislation and Vulnerable under Commonwealth legislation.

4.6.3 Triplarina nowraensis

Nowra Heath Myrtle ***Triplarina nowraensis*** occurs adjacent to a creekline flowing within a powerline easement just to the north of the northern boundary of Lot 4, Eearie Park. The surrounding vegetation was slashed as a component of the post-bushfire clean-up and unfortunately this action has provided access for trail bike riders. No specimens of ***Triplarina nowraensis*** have been recorded within Bundanon, although appropriate habitat occurs in several locations throughout the estate. ***Triplarina nowraensis*** is listed as Endangered under State and Commonwealth legislation. Daly and Leonard (1996) included one record of ***Triplarina nowraensis***, although it is likely that this record relates to the record to the north of Lot 4.

Potential habitat occurs within Bundanon for the following threatened species, although no individuals or populations have previously been recorded: ***Cryptostylis hunteriana***, ***Hibbertia puberula***, ***Acacia bynoena***. ***Thesium australe***, ***Melaleuca deanei*** and ***Melaleuca biconvexa***

Brush Turpentine ***Rhodamnia rubescens,*** Riversdale. Image by G. Leonard

Magenta Lillypilly ***Syzygium paniculatum***, Riversdale. Image by G. Leonard

4.6.4 PLANT SPECIES OF REGIONAL SIGNIFICANCE

The following plant species, which were recorded at Bundanon have regional significance (see Mills 1985) and **Table 3**.

Table 3
Regionally significant species of flora

PLANT SPECIES	LOCATION	SIGNIFICANCE
Abrophyllum ornans	Closed forest, creeklines north of Riversdale	Near southern limit of distribution
Melicope micrococca	Closed forest, creeklines north of Riversdale	Near southern limit of distribution
Toona ciliata	Tall Open-forest north of Bundanon	Large specimens rare in region.
Glochidion ferdinandi var. *pubens*	Closed forest, near creekline, north-west of Riversdale	Near southern limit of distribution
Corymbia eximia	Open woodland, north end of Eearie park	Near southern limit of distribution
Jacksonia scoparia	Woodland on plateau north of Bundanon	Uncommon in region
Cyathea cooperi	Closed forest near creeklines, north of Riversdale	Uncommon in region
Myoporum floribundum	Open-forest, lower slopes	Uncommon in region
Zieria cytisoides	Cliff ledges, north of Eearie Park	Uncommon in region

4.6.5 ENDANGERED ECOLOGICAL COMMUNITY

A vegetation type which occurs along parts of the access road to Bundanon Homestead, the riverbanks at Riversdale and lower slopes around Haunted Point complies with the broad description of the Endangered Ecological Community Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions according to the NSW BC Act. This vegetation is proposed to also be listed under the Commonwealth EPBC Act as Swamp Sclerophyll Forest of South-eastern NSW.

Swamp Sclerophyll Forest (***Eucalyptus saligna/E. botryoides*** hybrid canopy species) on low-lying section of access road to the Homestead, Bundanon. Image by G. Leonard

Swamp Sclerophyll Forest (***Melaleuca linariifolia*** canopy species) with spring-fed pond, Haunted Point. Image by G. Leonard

5. THREATENED SPECIES PROFILES

5.1 THREATENED FAUNA

The following species profiles provide information on the distribution and ecology of the threatened species that have been detected on or adjacent to the property. The distribution notes go from the broad to the local scale, that is within Australia, the Shoalhaven and finally on the escarpment and forests north of the Shoalhaven River. More information can be gained from other publications prepared by GD. Some are available from the Shoalhaven Landcare website (go to the pull down tab Resources and then Publications) or the Australian Zoologist (Daly 2021, Daly and Hoye https://doi.org/10.7882/AZ.2022.042).

A recurrent theme discussed in these texts is the value of large old growth trees that support hollows. Hollows are a critical resource for many species that den and nest in these cavities. The hollow-dependant species that have been found on the estate include the Yellow-bellied Glider, several species of microbat, Glossy Black Cockatoo, Gang Gang, Powerful Owl, and the Broad-headed Snake. Forests that lack hollows generally do not have these animals!

White-footed Dunnart *Sminthopsis leucopus*

Description

The White-footed Dunnart looks almost identical to the Common Dunnart ***S. murina***. Both have light grey-brown fur dorsally and a white belly. The eyes and ears are large, and the muzzle is slender and pointed. White-footed Dunnart have a patch of near hairless brown skin on top of the muzzle whereas Common Dunnarts do not.

Distribution

The White-footed Dunnart is found in isolated areas from south-west Vic, along the

coast to Nowra NSW. There is a population in Tasmania and also far north Qld. The north Qld population is separated from the one in NSW by over 2100km and probably is a separate species.

In the Shoalhaven the White-footed Dunnart has been trapped in Booderee NP (King 1980, Lindenmayer *et al.* 2008), Bugong NP (Daly and Murphy 1996), Currambene State Forest (Braithwaite *et al.* 1988), Parma Creek (Barrer 1990), Murramarang NP (Atlas of Living Australia), Conjola NP (Daly *et al.* 1998), Vincentia (Daly 1994, Gaia Research 2001), Dolphin Point (BES 2006), Meroo NP (Daly unpub. data) and Corramy Regional Park (Daly unpub. data). Several of the sites where the White-footed Dunnart was found had recently been burnt. The specimen trapped by Michael Murphy near Riversdale (Daly and Murphy 1996) currently represents the northern limit of the species in NSW. The specimen was lodged with the Australian Museum.

Habitat preference and habits

Over its range the White-footed Dunnart has been detected in a variety of habitat types but in NSW it has been found on ridges and mid-slope in open-forest, woodland and heath (Klomp and Wise 1997, Lunney *et al.* 1986, Daly and Murphy 1996 and Daly *et al.* 1998, King 1980). The population in far northeast Queensland occurs in highland complex notophyll vine-forest (Van Dyke 1985).

In the Shoalhaven the White-footed Dunnart has been found in heathland, woodland and even Spotted Gum forest. Most sites have sandy substrates, except the site in Spotted Gum forest in Corramy Regional Park that had a clay substrate (Daly 2017, unpub. data). At a site near Vincentia animals were trapped in heath that was six years post burn (Daly 2017).

Radio-tracking studies found considerable overlap in the home range if individual animals, which averaged about one hectare (Laidlaw *et al.* 1996).

Reproduction

White-footed Dunnarts mate in summer and give birth up to ten young in September to October. After eight weeks from being born, the young exit their mother's pouch but are suckled for a month longer and then disperse (Lunney 2008).

White-footed Dunnart, Vincentia NSW. Image by G. Daly

Koala *Phascolarctos cinereus*

Description

A marsupial with grey fur above, white below with large fluffy ears and distinct black nose and squat face. The tail is vestigial and generally not seen. Most Koala are seen in trees as they infrequently cross open ground. Male Koala make distinct guttural growls calls in winter.

Distribution

The distribution of Koala is along the wetter portions of Qld from near Cairns south to SA including Kangaroo Island. Prior to the 1930s, the extensive hunting of Koalas fragmented their former distribution in NSW and Qld. In Victoria and South Australia there has been some recovery due to re-introduction programs and the species now occurs in areas where it was not recorded historically (DECC 2008).

Koala, Upper Nepean State Conservation Area, NSW. Image by G. Daly

Koalas are mainly found on flat, fertile, low-elevation soils. The exception is the population, west of the Dividing Range, in the Pilliga area of NSW. This large population occurs in a relatively dry area and in some cases on sandy soils (Predavac 2016). The Recovery Plan (DECC 2008) states that "most populations in NSW now survive in fragmented and isolated habitat and many of the areas in which koalas are most abundant are subject to intense development pressures."

In the Shoalhaven the species is rare but widespread. Most records are from the western portion of Morton NP on higher nutrient soils from Sassafras to the Endrick River. There are scattered records elsewhere including Coolangatta – Seven Mile Beach, Conjola NP and East Lynne. A detailed assessment of Koala in the East Lynne area was conducted by the Eurobodalla Koala Volunteers (2021).

No Koala have yet been found on Bundanon but remnant vegetation indicates the riverflats around Bundanon had extensive stands of Cabbage Gum ***E. amplifolia*** prior to European settlement. Cabbage Gum is a favoured Koala feed tree and unfortunately there are few large trees that remain as the floodplain was cleared for agriculture. However, as part of the Living Landscapes and Stuttering Frog projects stands of Koala feed trees have been planted at Riversdale (Swamp Mahogany ***E. robusta*** and Forest Red Gum ***E. tereticornis***), Bundanon and Eearie Park (Swamp Mahogany, Forest Red Gum, Cabbage Gum and Tallowwood). We hope Koala find these plantations and recolonise the estate.

Habitat preference and habits

The Koala lives almost entirely on eucalypt leaves. It has preferences for particular varieties of eucalypt and these vary from one region to another. On the south coast the primary food tree species are Swamp Mahogany, Cabbage Gum, Ribbon Gum ***E. viminalis*** and Forest Red Gum. These species generally grow on more fertile soils and this provides greater availability of nutrients within leaves (Cork *et al.*1990), which Koala prefers.

Reproduction

Females reach maturity at 2 to 3 years of age (Martin and Handasyde 1990), males at 3 to 4 years. Mating normally occurs between September and February, A healthy female Koala can produce one young each year for about 12 years. Gestation is 35 days. Following birth, the young remain in the pouch for approximately six months and on leaving the pouch remain dependent on its mother and is carried on her back. Young reach independence at about 12 months, although they can remain in the mother's home range for a further 2-3 years (Mitchell and Martin 1990).

Koala in cave overhang Budgong, NSW. Image courtesy M. Norton

Eastern Pygmy Possum
Cercartetus nanus

Description

Grey to light brown above, white below with large eyes and large forward pointing ears. The tail is almost bare of fur and is prehensile (capable of gripping). The body length is 70-110mm and the tail has a similar length.

Distribution

Eastern Pygmy Possums have been found from southern Queensland (Harris *et al.* 2007) to eastern (Bowen and Goldingay 2000; Harris and Goldingay 2005) and South Australia and Tasmania. In the Shoalhaven they have been found at Vincentia, Morton NP, Jerrawangala NP, Bomaderry Ck and in the Tapitallee area from the block of land off Illaroo Road south of the Pony Club. A Fox scat collected near Riversdale contained Eastern Pygmy Possum fur suggesting it occurs on site (G. Daly unpub. data).

Habitat preference and habits

Eastern Pygmy Possums occur in a broad range of habitats from rainforest through sclerophyll forest and woodland to heath. In

the Sydney basin (including the Shoalhaven) the distribution is patchy, but most records are from Scribbly Gum – Red Bloodwood woodland that have a high diversity of plants (including ***Banksia spinulosa***) in the shrub layer. This habitat is widespread on the sandstone plateau above Riversdale and at Eearie Park above Bundanon.

Eastern Pygmy Possums appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68ha and females about 0.35ha. The species feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes (Van Dyke and Strahan 2008, Tulloch and Dickman 2006). They are an important pollinator of heathland plants such as banksias.

Reproduction

Breeding occurs from summer to early winter with births recorded between November and March (Ward 1990). Litter sizes range from 2-6 (Ward 1990) with a mean of 3.9 (Bladon *et al.* 2002). Growth is rapid, young became independent immediately after weaning, and mature as early as 4.5-5.0 months old. Maximum longevity in the field was at least 4 years (Ward 1990).

Eastern Pygmy Possum, Vincentia NSW 2012. Image by G. Daly

Yellow-bellied Glider
Petaurus australis

Description

Grey dorsally with a mid-dorsal black stripe and dark pelage on the arms and legs. The tail is thick and dark coloured and the bellied is a yellowish-white. This glider is rarely seen but usually detected by its loud distinct calls or the presence of incised feed trees.

Distribution

The Yellow-bellied Glider has a disjunct distribution over a wide range of eastern and south-eastern mainland Australia. Populations occur along the western shores of Port Phillip Bay in Vic to the Otway Ranges, west of Melbourne (NPWS 2000). Isolated populations occur along the Victorian-South Australian border and at Atherton, Carbine and Windsor Tablelands in north Queensland (Craig 1985, Russell 1995, Maxwell *et al.* 1986).

In NSW there appears to be a major break in the north-south distribution in the Hunter region. Disjunct isolates occur to the west and south-west of Canberra in the Australian Alps. (NPWS 2000). Disjunct isolates may also occur at Carnarvon George, Blackdown Tablelands and west of Ingham, Queensland from land clearing (G. Daly pers. obs.).

In the Shoalhaven the Yellow-bellied Glider has been detected from Murramarang NP north to Bomaderry Creek. These populations are fragmented as a result of historic clearing for agriculture, power easements, construction of Tallowa dam and the widening of roads.

The habitat corridor for Yellow-bellied Gliders north of the Shoalhaven River is tightly aligned with Grey Gum – Spotted Gum forests along the Shoalhaven River escarpment from Bomaderry Creek to Hampton Bridge, Kangaroo Valley. In this area Grey Gum is the key species dictating the distribution as the glider incises the stems to procure a sweet sap. South of the Shoalhaven River the Yellow-bellied Glider is also highly associated with stands of Grey Gum but the animal also incises Red Bloodwood. In the far south of the Shoalhaven LGA (i.e. Meroo NP and Murramarang NP, there are no Grey Gum and Yellow-bellied Gliders occur in mature Spotted Gum – Blackbutt forest and incise Red Bloodwood and Spotted Gum.

Grey Gums, incised by Yellow-bellied Gliders, have been located on the ridge above Riversdale and on one of the Lots within Beeweeree Park. The occurrence of Grey Gum near the electricity easement below the escarpment at Beeweeree is unusual as this species usually occurs in this type of transition forest along the escarpment edge.

In a previous assessment of Yellow-bellied Gliders (Daly 2005) I used the term songlines to describe the association of the species with food resources across the landscape. Songlines is a reference by Indigenous people to songs or stories telling of country that individuals of an appropriate totem could move through to secure critical resources - food, water and shelter (Chatwin 1987). The Songline for Bundanon family groups of Yellow-bellied Gliders is aligned with Grey Gum that has a distribution in the ecotone forests along the Shoalhaven River escarpment. This Songline is being fragmented by clearing and wildfire (2019-20 Currowan fire) that killed animals and destroyed critical resources such as hollow bearing and sap feed trees.

Habitat preference and habits

The Yellow-bellied Glider occurs in eucalypt forests that range from tall open-forest to woodland. In southern NSW they have been detected from near sea level to 1080 m asl (G. Daly unpub. data). They are a forest dependant species and rely on the presence of hollows, which they use as den sites. Hollows utilised by Yellow-bellied Gliders occur in large mature trees that are usually several hundred years old. They feed on arthropods, sap, honeydew, nectar and manna (Goldingay and Kavanagh 1991).

Their diet varies spatially and temporally. Food resource availability at a given location is linked strongly to the flowering pattern of

A stuffed Yellow-bellied Glider, found dead beside the Princes Highway South Nowra NSW 2017. Image by G. Daly

A Spotted Gum incised by Yellow-bellied Glider showing the distinct V shape. South Durras NSW 2021. Image by G. Daly

tree species within a forest (Kavanagh 1984). The ephemeral nature of their food resources also means that Yellow-bellied Glider habitat is characterised by a mosaic of different tree species, which provide a year-round food supply (Kavanagh 1987). Hence, the Yellow-bellied Glider has a patchy distribution, as many forest associations do not provide sufficient year-round food resources. The exception to this is the Mountain Ash ***E. regnans*** forests in Victoria where they exist primarily in a single canopy species (Millage *et al.* 1991).

The Yellow-bellied Glider has long incisors which they use to bite certain gum trees to procure sap. The bite marks (incisions) are usually V shaped. Yellow-bellied Gliders hang face down and lick the sap as if flows into the sharp point of the V incision. Other species of arboreal mammal, such as the Sugar Glider and Feather-tail Glider also utilise the sap from these incisions (G. Daly pers. obs.).

Within the territory of a family group of Yellow-bellied Gliders only a select few trees will be incised. Goldingay (1987) suggests that sap feeding is periodic and related to an increased flow rate of the incised tree. Sap trees may be incised for certain periods and then left for several years. Factors such as the availability of other food resources (i.e. flowering times) may also influence the incidence of sap feeding. Sap trees can be used over long periods by several generations of glider. Sap feed trees are usually found close to the family groups den trees within their home range.

The Yellow-bellied Glider is nocturnal and usually occurs in family groups of 2-6 animals (Goldingay and Kavanagh 1990). Wild animals may live for six years. They frequently call to other members of the troupe to communicate. The territories of these gliders range from 30-65ha (Goldingay and Kavanagh 1991).

Reproduction

Females usually produce single young per year, but breeding may occur in alternate years (Goldingay and Kavanagh 1990).

Brush-tailed Rock Wallaby
Petrogale penicillata

Description

Thick rufous brown coat above with darker brown colour on the shoulder and the chest is white. A white stripe extends from the upper lip to the ear. The tail is longer than the body and is dark brown.

Distribution

The range of the Brush-tailed Rock-wallaby historically extended from the Grampians in western Victoria to Nanango in south-east Queensland, roughly following the line of the Great Dividing Range. The Brush-tailed Rock Wallaby was once abundant and ubiquitous throughout the mountainous country of eastern Australia (Short and Milkovitis 1990). However, the distribution of the species across its original range has declined significantly in the west and south. They are now absent from Vic and areas south of the Shoalhaven (Wong 1993), with the population in the Warrumbungle Ranges being the western limit.

Populations exist along the Shoalhaven River escarpment from Budgong to Kangaroo Valley (Robinson 1989, Wong 1993, Daly and Murphy 1996, Daly unpub. data). An assessment of the population in the region in 1992 estimated only 40 animals persist, mostly on private land (Wong 1993). Recent surveys indicate the Shoalhaven population is still about 40 animals but this includes some new populations being found (M. Norton pers. comm.). The population off Yarrumumum firetrail does not appear to have persisted after the 2019 - 2020 Currowan wildfire (G. Daly unpub. data). There has been a translocation program undertaken to bolster the Kellets Creek population (M. Norton pers. comm.), which declined to an unsustainable level. A National Recovery Plan has been prepared for this species (Menkhorst and Hynes 2011).

Brush-tailed Rock Wallaby scats have been located on the ridge about Bundanon (M. Norton pers. comm.), this was probably a dispersing young male released at Budgong as part of the translocation program undertaken to bolster the Kellets Creek population. Fox control is necessary to protect the populations in the Shoalhaven as predation by Fox is probably the main cause of the species decline. Feral Goats are also a threat as they displace Rock Wallabies from their cliff overhangs.

The story of the Kellets Creek Brush-tailed Rock Wallaby is interesting. In the late 1980s a friend (Steve Evison) told me of a site where he had found Sooty Owl roosting in a cave and also noted there were different looking scats on the rocks and fallen logs near the cave. As soon as I saw the scats I knew they were quite likely to be those of Brush-tailed Rock Wallaby. When we walked under the escarpment there was a large, isolated rock that was covered in Rock Wallaby scats. The rock had been used by the wallabies for such a long time (many generations) that the oil from their feet had made a dark patina on the surface. I was familiar with this dark patina as I had recently seen it on the breasts of female deities sculptures in India. Further surveys (Daly and Murphy 1996) established the colony extended for several kilometres along that escarpment and at that time probably numbered over 20 animals. By the time Vera Wong conducted her assessment in 1993 the colony had dwindled to about 10 animals.

Habitat preference and habits

Brush-tailed Rock Wallaby inhabit north or west facing caves on rocky escarpments that have sufficient ledges so animals can rest and escape potential predators such as the dogs (Dingo) and Fox. During the day they spend most of their time sheltering or sunning themselves on rocks sheltered by a cave, overhang or vegetation. They venture from these sites at night to forage on vegetation. The diet of Rock Wallabies in Kangaroo Valley was found to be primarily grasses and forbes but the foliage of shrubs and trees was also significant (Short 1989).

The reliance on specific refuges means the Brush-tailed Rock Wallaby lives in small groups or colonies, with overlapping individual home ranges of about 15 ha

(Archer *et al.* 1985). Short (1980) found that home ranges were roughly rectangular around the cliff line, ranging from 6–30ha in size (with an average of 15 ha in size) and 400–900 metres along the cliff (with an average of 700 metres along the cliff).

As stated, Brush-tailed Rock Wallaby are displaced from their refuge caves and ledges by feral Goats. In the Shoalhaven I have located caves where there were old (bleached) rock wallaby scats and recent Goat scats (as indicated by the amount of bleaching of the scats).

Reproduction

Females give birth to one joey at a time, after a gestation period of approximately 30 days (Close 1993). The young remain in the pouch for six months. After the joey first emerges from the pouch, it spends a further 7–20 days in and out of the pouch. As Brush-tailed Rock Wallabies are crepuscular (that is most active at dawn and dusk), young may be left at dawn, dusk or at night in refuges while the mother moves out to feed. Weaning is believed to occur 86 days after leaving the pouch, when the joey is nine months old (Lee and Ward 1989). Sexual maturation of females occurs at 18 months, males at 20–24 months (Lee and Ward 1989). Life expectancy in the wild is 5–10 years or more (Eldridge *et al.* 1988) and can be longer in captivity.

Brush-tailed Rock Wallabies, Barnard River. Image courtesy M. Norton.

Brush-tailed Rock Wallaby scats, Kangaroo Valley, NSW. Image by G. Daly

Brush-tailed Rock Wallaby site at Kellets Creek NSW showing rock ledges with sweat patina on rocks. Image by G. Daly

Grey-headed Flying Fox
Pteropus poliocephalus

Description

Grey head, chest and back rufous, lower back and body black-grey. The wings are black.

Distribution

The Grey-headed Flying-fox occupies the coastal lowlands and slopes of southeastern Australia from about Geelong in Vic to Bundaberg in Qld. They are usually found at altitudes < 200m (DECCW 2009). Areas of repeated occupation extend inland to the tablelands and western slopes in northern New South Wales and the tablelands in southern Queensland. Sightings in inland areas of southern New South Wales and Victoria are uncommon. There are rare records of individuals or small groups west to Adelaide, north to Gladstone and south to Flinders Island.

Grey-headed Flying Fox, Tapitallee, NSW. Image by G. Daly

In the Shoalhaven there were maternity camps at Bomaderry Creek, Budgong, Comerong Island, Kangaroo Valley, Cockwhy Creek and before the Currowan wildfire at Yatte Yattah (Daly 2000). Historically there was a camp at Budgong but it does not appear to have been used for over a decade and this site was burnt in the Currowan wildfire. The Yatte Yattah site was also burnt during the Currowan wildfire and the habitat is not suitable for the species to use as a maternity site. All camps are temporarily being occupied during the warmer months. The Bomaderry Creek camp established in 1990s and at times can support several thousand bats. This camp can split and a section may roost around Frog Hollow in Bomaderry.

Grey-headed Flying-fox have been found at Riversdale and Bundanon. At Bundanon they have been observed to forage on the flowers of Silky Oak ***Grevillea robusta*** but would also forage on flowering Spotted Gum and Red Bloodwood.

Habitat preference and habits

Grey-headed Flying-foxes feed primarily on blossom and fruit in canopy vegetation and supplement this diet with leaves (Ratcliffe 1931, Parry-Jones and Augee 1991, Eby 1995, 1998, Tidemann 1999, Hall and Richards 2000). The majority of animals feed on nectar and pollen from gums (Eucalyptus, Corymbia and Angophora), melaleucas and banksias. Grey-headed Flying-foxes forage over extensive areas with one-way commutes of approximately 50km have been recorded between camps and foraging areas (Eby 1991), although commuting distances are more often less than 20km (Tidemann 1999).

Grey-headed Flying-foxes form camps where adults hang during the day. South of Sydney

these camps are mostly seasonal, and the bats depart during the cooler months of the year. Young Grey-headed Flying-foxes are left at the camp while the mothers forage at night. Disturbance of camps during this period can lead to young being abandoned or distressed. If they fall from their roost tree the young are abandoned. A National Recovery Plan has been prepared for this species (DECCW 2009).

The Shoalhaven there are large stands of Red Bloodwood and Spotted Gum, species that can flower on mass and at these times provide food for Grey-headed Flying-foxes. In years of mass flowering the majority of the entire Grey-headed Flying-fox population will move to the area to take advantage of the food resource. The species also forages on figs and other soft fruits such as Wild Tobacco ***Solanum mauritianum***. After the Currowan wildfire millions of Wild Tobacco germinated in areas where the Grey-headed Flying-foxes formed camps.

Reproduction

Grey-headed Flying-foxes give birth to single pups in October or November (Martin and McIlwee 2002) and lactate approximately to March. Individuals reach reproductive maturity in the second year of life. However, there is evidence that few females younger than three years successfully raise young to independence (McIlwee and Martin 2002).

Large-eared Pied Bat *Chalinolobus dwyeri*

Description

Black above with distinct white edging around the body below. The ears are large and the wattles curled. The forearm range measured for animals caught in the Shoalhaven was between 38.6 - 41.5mm (Daly and Hoye 2023).

Distribution

The Large-eared Pied Bat occurs from near Meroo NP, Nowra (Daly and Hoye in press) to Rockhampton Qld (Van Dyck and Strahan 2008), to the east and west of the Great Dividing Range. The first animal trapped in the Shoalhaven was below the escarpment off the road to Bundanon (Fly By Night 1996). Thereafter it has been trapped in Morton NP and more recently in Meroo NP (Daly and Hoye in press). I also trapped this species at Bugong NP, Emery's plateau and found it several times perched at night (digesting food during the night) under my shed at Tapitallee.

Habitat preference and habits

Large-eared Pied Bats roost in mines, caves, and rock overhangs, especially in sandstone outcrops and gorges. It also uses fairy martin nests and possibly tree hollows (Hoye and Dwyer 1995; Schulz 1998; Schulz *et al.* 1999). In sandstone country in the Sydney basin, it usually roosts in the pock holes on vertical cliff walls (Hoye and Schulz 2008). Usually fewer than 10 animals huddle together at any site. The species hibernates during winter (Hoye and Schulz 2008).

Recorded from a range of habitats, including wet and dry sclerophyll forest, Cyprus pine dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland, but typically in association with sandstone relief (Hoye and Schulz 2008; Pennay 2002). In south-eastern Queensland it has been recorded primarily from higher altitude moist tall open-forest adjacent to rainforest (Schulz *et al.* 1999). In the Shoalhaven, the Large-eared Pied Bat is highly associated with open-forests that grow on Nowra sandstone, including the escarpment along the Shoalhaven River.

Reproduction

Females give birth to one or two babies in November and the young are independent by February (Dwyer 1966). Four lactating females were trapped at Bugong NP in March suggesting a maternity cave was nearby (G. Daly unpub. data)

Large-eared Pied Bat, Morton NP, NSW. Note the distinct white fur edging the underside of the body. Image by G. Daly

Eastern Bent-wing Bat
Miniopterus orianae oceanensis

Description

Dark brown to almost black above, short muzzle and domed head and the ears are rounded and relatively short compared to some other species of microbat. The most distinct feature is the terminal bone of the third wing (the long bone bent over in the image below) is more than half the length of the remaining digit. The forearm range measured for animals caught in the Shoalhaven was between 46.7 - 50.0mm (Daly and Hoye 2023).

Distribution

The Eastern Bent-wing Bat occurs along the east coast from Victoria, New South Wales and Queensland. There are other subspecies/ populations in north-west West Australia and the Northern Territory and one in the west of Victoria and South Australia (Van Dyck and Strahan 2008). Each population is centred on one or two maternity colonies, and the population range is often determined by watersheds (Dwyer 1966 and 1969). Dwyer (1969) indicates that Common Bent-wing Bat in the Shoalhaven belong to two populations which have nursery sites at Church Cave, Wee Jasper and The Drum, Bungonia. I have trapped this species in the upper reaches of Bangalee and Tapitallee Creeks, Riversdale and at Budgong, often beside creeks and or under bridges. One specimen was trapped beside the creek at Riversdale.

Habitat preference and habits

The Eastern Bentwing Bat is essentially a cave-roosting species but is also known to use habitats such as road culverts, storm-water tunnels and other man-made structures. The Eastern Bentwing Bat is known to forage insects in a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998).

In forested areas, it flies above the canopy to hunt, while in riparian rainforest it may fly within a few metres from the ground (G. Daly pers. obs.).

Reproduction

During spring, pregnant females, with some non-pregnant females and juvenile males, congregate at maternity roosts. Up to 100,000 females may congregate in maternity colonies within limestone caves and give birth to single young from December to mid-January. The females stay in these roosts during summer and depart in February. Juveniles depart a month later and both may travel considerable distances to their over-wintering roosts (Hoye and Hall 2008). Roost sites outside the breeding period depend on the sex and age of the individuals.

The young are weaned by 10 weeks and leave the cave in March. (Churchill 1998).

Eastern Bent-wing Bat, Riversdale 2013. Note the wingless fly behind the ear. Image by G. Daly

Southern Myotis *Myotis macropus*

Description

The main feature that distinguishes this species from all other microbats is the feet that have widely spaced toes and long hairs. The forearm range measured for animals caught in the Shoalhaven was between 36 - 42mm (Daly and Hoye 2023).

Distribution

The Southern Myotis occurs along the coast and ranges from Victoria to north-eastern Western Australia and the Murray River to eastern South Australia. In the Shoalhaven I have trapped Southern Myotis across Bangalee Creek in the reserve at Bomaderry, Broughton Creek and Kangaroo River and Brogers Creek. Southern Myotis were detected by Anabat along the Shoalhaven River at Riversdale by G. Hoye in 1996. It is expected this species forage along the river and roost in nearby rock overhangs.

Habitat preference and habits

The Southern Myotis forages over fresh and semi-saline water often along creeks for insects and occasionally fish (Robson

Southern Myotis, Nowra NSW. Image by G. Daly

Southern Myotis foot showing separated toes with long hairs

1984). They rake the surface of the water with their sharp, curved claws of their feet to capture food. They have been found roosting in caves, mines or tunnels under buildings and bridges, in dense foliage (Dwyer 1970a) and tree hollows adjacent to water. Males tend to be solitary and are strongly attached to a particular site (roost) and defend a territory, excluding other males from his harem of females during the breeding season (Dwyer 1970b).

Reproduction

Previous accounts indicate a single baby is born from late September to December in higher latitudes but in central NSW to south-east Qld they can have two young each year and in north Qld they can have three young per year (Richards *et al.* 2008). I caught forty females at Broughton Creek over two nights in February. Six of these bats were pregnant. The capture of pregnant Southern Myotis in January indicates a portion of this population reproduces during late summer. Until this trapping event it was thought that two births a year was a feature of animals from the mid north coast of NSW.

Black Bittern
Ixobrychus flavicollis

Description

Blackish-grey above, with a prominent yellow stripe down each side of the neck, and yellow streaks on the throat and chest. Birds attain about 58cm in length.

Distribution

The Black Bittern has a distribution that includes most of coastal mainland Australia from the Shoalhaven north to Qld, NT and WA. Occasionally birds are seen further south to Gippsland Vic. An isolated population occurs in the south-west of WA. The species also occurs in PNG and Asia.

The Black Bittern has been seen along the Shoalhaven River and its lower tributaries. This includes beside Bengalee Creek, the Shoalhaven River at Bangalee Reserve, the lower reaches of Bomaderry Creek in Bomaderry (nesting in a willow recorded by M. Murphy in 1995) and the creek that originates from Harry Sawkins Park, Nowra in 2020. Diana Wright observed one bird at Ryans Swamp (Jervis Bay) on 6 May 1977, near the punt for Comerong Island in April 1984, Nowra Creek December 1984, one bird at Nowra Creek January 1985, and one bird at Flat Rock Dam 10 January 1987.

Ecology

This is a shy and secretive, bird that is mostly active at dawn, dusk, during overcast days or at night (Marchant & Higgins 1990). It stalks or waits in inconspicuous places for fish and other aquatic animals beside large rivers near the coast and creeks. If discovered, they may assume a cryptic posture with the bill pointed upwards or fly to another location where there is thick canopy and they cannot be seen. The species is more abundant in the tropics than temperate areas with several birds seen beside the Daintree River in Qld and at one site at Shiptons Flat (G. Daly pers. obs.).

Reproduction

The breeding season is thought to occur from December to March (Marchant & Higgins 1990). Nests are a loose platform of stick, built on a branch that overhands water, which is consistent with Murphy's observations at Bomaderry. The clutch size is thought to be between 3-5 eggs (Gilmore and Parnaby 1994)

Black Bittern, Mitchell Park, Cattii, NSW. Image courtesy C. Dove

White-bellied Sea Eagle
Haliaeetus leucogaster

Description

In adults the head, breast and belly, and the feathering on the legs, are white. The back and upper surfaces of the wings are grey, although the wings have black tips. The juveniles differ from the adults in appearance having predominantly dark brown plumage on the upper parts, except for a creamy coloured head. This large raptor has long, broad wings and a short, wedge-shaped tail. They attain 75–85cm in length.

White-bellied Sea Eagle, Kakadu NP, NT 2003. Image by G. Daly

Distribution

The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania and further north into Asia. It follows large rivers inland for considerable distances. Within the Shoalhaven the species is found along the entire coastline and birds regularly fly above the Shoalhaven River, past Riversdale.

Ecology

The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal (del Hoyo *et al.* 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993; Rose 2001). Prey is usually carried to a feeding platform or (if small) consumed in flight.

Breeding adult birds are generally sedentary but are capable of undertaking long-distance movements (Marchant and Higgins 1993). Home ranges occupied by the White-bellied Sea-Eagle can be up to 100 km² (Mooney & Brothers 1986).

Reproduction

The White-bellied Sea-Eagles form monogamous, life-long pairs.They become sexually mature when about six years old (Fleay 1948; Marchant and Higgins 1993). The breeding season extends from June to January (or sometimes February) in southern Australia and usually two (range between 1-3) eggs are laid. The nest is a large structure composed of sticks and lined with leaves, grass or seaweed (Favaloro 1944; Marchant & Higgins 1993). Nests may be built in a variety of sites including tall trees beside or close to the water.

Powerful Owl *Ninox stenua*

Description

The back is grey-brown and the chest is grey with distinct V shaped chevrons. Juveniles have white chests. The eyes are yellow. These birds are mostly detected by their loud deep, double-hoot call that is mostly given at the start of the breeding season during autumn. The Powerful Owl attains 60cm in length and is the largest owl in Australia.

Distribution

The Powerful Owl occurs in tall open-forest along the coast and ranges from the South Australia Victorian border to the Clarke Range central Queensland (Eyre and Schulz 1996). The species has is widely distributed throughout the Shoalhaven and has been found in a number of reserves and urban areas. One pair lives in Bengalee Reserve and (presumably) another pair moved into the Tapitallee area in the mid 2000. Since that time birds are occasionally heard calling (and one seen) in the bushland near the upper reaches of Tapitallee and Bengalee Creeks. An immature female was spotted along Bundanon Road in 2018 (pers com M. Andrews). That specimen was consuming a Sugar Glider, and one bird was recorded calling from Riversdale in 2022.

Ecology

Powerful Owls occupy large permanent home ranges that vary from 300-1500ha in area according to habitat productivity. Studies have measured a range of 800ha for one non-breeding individual and 350ha for one breeding female (Kavanagh 1997).

The habitat of the Powerful Owl is tall, moist eucalypt forests and the mosaic of wet and dry sclerophyll forests occurring on undulating, gentle terrain nearer the coast. Optimal habitat includes a tall, shrub layer and abundant hollows supporting high densities of arboreal marsupials such as the Greater Glider Petauroides volans and Common Ring-tailed Possum ***Pseudocheirus peregrinus***.

The Powerful Owl is a specialised predator of arboreal mammals, particularly the Greater Glider and Common Ring-tailed Possum (Debus and Chafer 1994, McNabb 1996 and Kavanagh 1997). These two mammals comprise more than 80% of the diet in NSW (DEC 2006). Other mammals eaten include the Grey-headed Flying Fox ***Pteropus poliocephalus*** and Sugar Glider ***Petaurus breviceps***. Powerful Owls may also eat birds such as the Pied Currawong and large parrots (Debus and Chafer 1994, G. Daly pers. obs.).

Tree hollows used by the Greater Glider form in trees older than 120 years old. Trees used by owls for nesting form in trees older than 165 and probably older than 250 years (Mackowski 1984, Lindenmayer *et al.* 1991, Milledge *et al.* 1991). So, the Powerful Owl required blocks of old growth forest to sustain a population of its prey and also for nesting. Given these requirements the species can be viewed as a surrogate for the health of an entire forest.

Powerful Owl, Jervis Bay NP, NSW. Image by G. Daly

Reproduction

Powerful Owls form monogamous, life-long pairs. Most (84%) pairs nest each year and most of those nesting (93%) produce at least one young (Kavanagh 1997). Nesting occurs in the hollows of eucalypts in unlogged, unburnt gullies and lower slopes within 100m of streams or minor drainage lines. Nesting hollows are greater than 45cm wide and 100cm deep and are surrounded by canopy trees and subcanopy or understorey trees or tall shrubs. Laying is strictly seasonal, occurring mainly in June (mid-May to mid-July). A clutch of 1-2 eggs can be laid per year although, rarely, a replacement clutch may be laid if the first attempt fails early in the egg stage. The incubation period is 5 weeks.

Gang-gang Cockatoo
Callocephalon fimbriatum

Description

Grey above and below with a small wispy crest. Males have bright red heads and crests but females lack the bright red colour and do have pinking barring on their chest. The Gang-gang Cockatoo ranges in length from 32-37cm.

Young male Gang Gang, Seven Mile Beach NP, NSW. Image by G. Daly

Distribution

The Gang-gang Cockatoo is distributed from southern Victoria through south and central eastern New South Wales (Shields and Crome 1992). There are some records from the Tweed valley in northern NSW but these may be in error or so-called blow in birds. Historically they occurred on King Island and have been introduced to Kangaroo Island.

The local population of Gang-gang Cockatoos occurs over the coastal and escarpment forests. However, the birds have very large home ranges and movements are not well understood. They are not uncommon in the Tapitallee area and flocks of 20 have been seen in the 1980s but more recently only pairs have been heard. Behaviour of some birds suggests breeding may have occurred in the upper Tapitallee catchment.

Ecology

In summer, the Gang-gang Cockatoo occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). The species undertake nomadic as well as seasonal movements and may occur at apparently random points within their range.

Reproduction

The Gang-gang Cockatoo requires hollows in the trunks or large limbs of large trees in which to breed (Gibbons 1999; Gibbons and Lindenmayer 2000). Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water (Beruldsen 1980). Breeding usually occurs between October and January (Chambers 1995).

Glossy Black-Cockatoo
Calyptorhynchus lathami

Description

Males are blackish brown, except for their prominent, red tail-panels. Females are dark brownish with extensive yellow patches on the head and neck, Female tail panels tend to be more orange-red than the males and have black bars between the coloured sections. The Glossy Black-Cockatoo ranges in length from 45-50cm.

Distribution

The Glossy Black-Cockatoo inhabits woodland and open-forest along the east coast and ranges from central Victoria to southern Queensland (Simpson and Day 1996). There is an isolated subpopulation on Kangaroo Island in South Australia. Within its range there are three identified subspecies (Higgins 1999).

The species is widespread in the Shoalhaven and occurs primarily on the coastal plain where stands of their feed trees, the Black She-oak ***Allocasuarina littoralis*** occur. The species is largely absent from rainforest, tall open-forest and generally heathland. The distribution of the species is mostly obtained from records of people seeing the chewed she-oak cones under feed trees. In the area Glossy Black Cockatoos feed on Black She-oaks beside Illaroo Rd, within Bangalee Reserve and the Budgong area. Nesting has been recorded at Illaroo farm (Anon pers. comm.). They have been recorded at Bundanon on the ridge above the amphitheatre and beside the road to Riversdale, where they feed on Black She-oak ***Allocasuarina littoralis***.

Ecology

The diet of the Glossy Black-Cockatoo is specialised. In the north of their range they frequently eat Forest Oak ***Allocasuarina torulosa*** but in the southern half of their range their main food is the Black She-oak. In the Shoalhaven they mainly eat Black Oak seed but have also been recorded feeding on Scrub She-oak ***Allocasuarina distyla*** at Vincentia (G. Daly pers. obs.).

Black She-oak are killed by high intensity fires. The 2019-20 Currowan wildfire destroyed many Glossy Black Cockatoo feed trees and it will take many years before seedlings attain maturity and produce food for this parrot. The unburnt forest at Bundanon is now an important food resource for the local population of Glossy Black-Cockatoo.

Glossy Black Cockatoo, Vincentia NSW, 2013. Image by G. Daly

Black She-oak cones chewed by Glossy Black Cockatoo. Image by G. Daly

Reproduction

The Glossy Black-Cockatoo requires old growth trees, which have suitable hollows for nesting and an abundance of She-oak trees for feeding. Birds have been recorded to nest within ten kilometres of primary feeding areas (Garnett *et al.* 1999, Higgins 1999). Although a number of the breeding locations for this subspecies have been documented (Blakers *et al.* 1984; Barrett *et al.* 2004), the breeding biology of the subspecies that occurs in the Shoalhaven has not been studied in detail (Higgins 1999). Egg laying has been recorded from April to June with usually one egg being laid (Higgins 1999). The incubation time ranges from 28-33 days in captivity and the female remains on the nest during this time and is fed by the male (Higgins 1999). Hence the requirement for an abundance of feed trees within close proximity to the nest tree. Young fledge some 60-105 days and then remain with the parents for another 3-4 months. Pair bonding is strong and appears to be monogamous (Higgins 1999). There is also a high degree of nest fidelity with previous nest sites being used in subsequent seasons (Garnett *et al.* 1999, Higgins 1999).

Little Lorikeet *Glossopsitta pusilla*

Description

The Little Lorikeet is one of the smallest Australian Lorikeets measuring 16-19cm. The body is bright green and the head is green with red forehead and throat patches that do not extend behind the eye. There is a dull orange-yellow patch on the nape.

Distribution

The Little Lorikeet is endemic to Australia. It is found from the South Australian – Victorian boarder north to near Cooktown (Higgins 1999, Barrett *et al.* 2003). In New South Wales Little Lorikeets are distributed in eucalypt forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett *et al.* 2003). In NSW, the main areas of observations are from the northern rivers, north-west slopes and the south coast (Higgins 1999).

In the Shoalhaven I have found the Little Lorikeet to be a summer-autumn migrant. There are no records of breeding in the area. Birds are highly associated with Scribbly Gum – Grey Gum woodlands and Spotted Gum forests that are in flower. During the 1980s flocks of 20 birds would regularly fly over the headwaters of Tapitallee – Bengalee creeks but in recent years the number of birds are fewer (G. Daly pers. obs.). Elliott states that at times this species was very common especially in 1940 when Spotted Gums were in flower.

Flocks of Little Lorikeet were seen and heard at Riversdale in 2019 when stands of Spotted Gum were in flower. Birds were seen and heard calling as they flocked around the patch of Spotted Gum uphill from Bundanon Art Museum.

Ecology

There is no evidence of regular migration, but Little Lorikeets are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. However, long term investigation of the breeding population on the north-western slopes indicates, that breeding birds are resident from April to December, and even during their non-resident period, they may return to the nest area for short periods if there is some tree-flowering in the vicinity (Courtney and Debus 2006). In the Shoalhaven the species is regularly detected during late summer when Scribbly Gum flower, although they have been observed feeding on blossom of other species such as Grey Gum, Swamp Mahogany and Blackbutt (G. Daly pers. obs.).

Numbers of Little Lorikeets appear to have declined on the south-west slopes and south coast of NSW (R. Allen unpub. data, cited in Courtney and Debus 2006), and on the north-west slopes of NSW (Courtney and Debus 2006). During the mid 1980s and early 1990s they were a common species in

the Budgong area but have since declined (G. Daly pers. obs.). They are regularly heard and seen at Wirrin Wirra nursery, Tomerong. From these data it appears that there has been at least a moderate reduction in population size over the past 15 years or three-generation lengths, a time frame appropriate to the life cycle of the species (Scientific Committee determination 2008).

Reproduction

The breeding biology of Little Lorikeets is little known, except for one long-term set of observations (43 years) on the north-western slopes (Courtney and Debus 2006). This work, consistent with anecdotal records from around the country, indicates that nest hollows are located at heights of between 2 and 15 m, mostly in living, smooth-barked eucalypts (Scientific Committee determination 2008). Nest-hollows are used 'traditionally', with the same hollow known to be occupied for at least 29 years (not necessarily by the same individuals) (Courtney and Debus 2006). The breeding season extends from May to September (Higgins 1999) and as long as eucalypt nectar and pollen are available throughout this period, two broods of fledglings can be raised in a season. Clutches range between three to five eggs (Higgins 1999) and broods of three and four young have been recorded, with a single fledgling recorded from one nest (Courtney and Debus 2006). Little Lorikeets in captivity are known to breed at one year of age (Scientific Committee determination 2008) and this suggests a minimum age for maturation in the wild of one year. A life span of 10 years in the wild is a reasonable estimate for a parrot of this size (Scientific Committee determination 2008). An approximation of generation time based on the age of maturity plus half of the length of the reproductive period of the life cycle (IUCN 2006) produces an estimate of generation time of approximately five years.

Little Lorikeet. Image courtesy C. Dove

Varied Sitella
Daphoenositta chrysoptera

Description

A relatively small bird (10cm in length) with a slightly upturned bill. The tail is short and the eyes and feet are yellow. The breast is pale and the wings have dark grey primary feathers. In the Shoalhaven birds have a dark grey head.

Distribution

The Varied Sittella is a sedentary species and inhabits most of mainland Australia except the treeless deserts and open grasslands. It has a near continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). In the Shoalhaven this species is most frequently detected in Scribbly Gum - Red Bloodwood woodlands on the coastal plain. In the Tapitallee area, it is found in the woodlands and open-forest along the Shoalhaven River, such as Bangalee Reserve.

Ecology

The Varied Sittella inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The bird is usually seen in small groups feeding on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy.

The species decline has been attributed to forest clearing and removal of habitat in the shrub layer (Watson *et al.* 2003). The sedentary nature of the bird makes cleared agricultural land a potential barrier to movement. The survival and viability of populations depend on habitat connectivity, patch size and disturbance such as habitat simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Watson *et al.* 2001; Seddon *et al.* 2003). The Varied Sittella is also adversely affected by the dominance of Noisy Miners ***Manorina melanocephala*** in woodland patches (Olsen *et al.* 2005). 'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes in NSW under the BC Act 2016 but this has not halted the loss of habitat.

Varied Sitella, Jervis Bay, NSW 2015 Image courtesy C. Dove

Reproduction

It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated as 5 years (Debus and Soderquist 2008).

Heath Monitor
Varanus rosenbergi

Description

Dark grey above with small cream spots and indistinct darker cross bands from the neck to the tail. A pale edged black stripe runs from the eye over the ear opening. Maximum total length is 1100mm.

Distribution

The Heath Monitor occurs in southern WA, SA (including Kangaroo Island), western Victoria, the Snowy mountains and from Nowra to the mid-coast regions of NSW (OEH 2012; Swan *et al.* 2004; Wilson and Swan 2008).

Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. In the Shoalhaven, the species has been detected in Morton NP and Budgong NP on Nowra sandstone. One animal was seen on the road into Riversdale in 1996. There are several termite mounds beside that road that are used by goannas (mostly Lace Monitors) to incubate their eggs.

Habitat preference and habits

The Heath Monitor inhabits coastal heaths and woodland and sclerophyll forests, primarily on sandy soils where there are rock outcrops and termite mounds. The home range varies from 4 - 43ha and the diet consists of insects (particularly baby monitors), reptiles, birds and mammals (King and Green 1979; King and Green 1999) including rabbits (Traynor 2010). A dissected road killed animal at Menai contained Jacky Dragon, Copper-tailed Skink and crickets (G. Daly pers. obs.). One animal was caught on the author's place at Tapitallee in semi-cleared land on a ridge some distance from sandy soils, rock outcrops and woodland. When seen the lizard ran away, scaled a sapling to about 1.5m and remained motionless (froze) on the opposite side of the stem to me. It thought it was not detected until caught.

Reproduction

Mating occurs in spring (Vincent and Wilson 1999) and egg laying occurs in summer (King and Green 1999) with 10 - 17 (average of 14) eggs being laid in termite ***Nasutitermes exitiosus*** mounds, which incubate over winter and hatch in early spring, about eight months after they are laid (Ehmann *et al.* 1991; King and Green 1999). The young hatch and stay within the termite mound for several weeks before digging their escape.

Heath Monitor Bugong, NSW 2021. Image by G. Daly

Road killed Heath Monitor Morton NP, NSW 2019. Image by G. Daly

Broad-headed Snake
Hoplocephalus bungaroides

Description

Black above with numerous yellow spots that may form cross bands, grey beneath. The head is broad and flat. Total length is usually 600mm or less.

Habitat preference and habits

The Broad-headed Snake is largely confined to Triassic and Permian sandstones, from the Clyde River catchment south-west of Nowra in the south to Wollemi National Park in the north. It has been found in the Royal National Park and the upper Blue Mountains at Blackheath and Newnes. Major populations occur in the Blue Mountains, southern Sydney, an area north-west of the Cumberland Plain, and the Nowra hinterland (DECC 2008). The southern limit of the species is within the Shoalhaven local government area at *The Castle.* The Broad-headed Snake has been found on Nowra sandstone along the Shoalhaven River escarpment (Daly 2006) and also on Snapper Point sandstone in McDonald SF (*G. Daly unpub.* data).

The Broad-headed Snake is often found in rocky outcrops and adjacent sclerophyll forest and woodland (Cogger *et al.* 1993; DECC 200; Daly 2005). The most suitable sites occur in sandstone ridgetops (Cogger *et al.* 1993). Near Bathurst snakes occur in forest growing on shale or conglomerate slopes and bluffs (Cogger *et al.* 1993).

Common canopy species include Yellow Bloodwood ***Corymbia eximia***, Red Bloodwood ***C. gummifera***, Silvertop Ash ***Eucalyptus sieberi***, Grey Gum and Sydney Peppermint ***E. piperita***. Snakes prefer sites with a west to north-west aspect (DECC 2008). Although most Broad-headed Snakes are found under tightly fitting loose sandstone rocks positioned on north-west facing sandstone ridgelines the species is also arboreal, and lives in trees for periods during the year (Webb and Shine1997).

The Broad-headed Snake is nocturnal to crepuscular (active at dusk) and is considered an 'ambush predator', preying predominantly on lizards, particularly the Lesueur's Velvet Gecko and several species of skink including White's Skink, Copper-tailed Skink, Weasel Skink and Red-throated Skink and the Eastern Water Skink (Wells 1981; Webb and Shine 1994; G. Daly unpub. data).

Reproduction

The Broad-headed Snake gives birth to 4-12 live young from January to March (Shine and Fitzgerald 1989; Swan and Birkett 2009). Neonates take 4 - 6 years to reach maturity. In captivity a large number are still born or non developed ova (slugs) are produced (Swan and Birkett 2009). Newborn snakes measure from 218 - 234mm (Swan and Birkett 2009). Animals in captivity can live for about 20 years (M. Anstis pers. comm.).

Broad-headed Snake, Nowra, NSW 2007. Image by G. Daly

Giant Burrowing Frog
Heleioporus australiacus

Description

Brown-grey above with prominent eyes and a series of yellow markings from below the eye along the flanks and around the cloaca. Males have enlarged forearms and a series of spines on several fingers. Females do not have enlarged forearms or spines. Frogs are rotund.

Distribution

The Giant Burrowing Frog's distribution lies between Walhalla, Victoria to Puttey State Forest, central NSW (Atlas of Living Australia accessed 1/7/16). However, within this area the populations are highly fragmented and a major disjuncture exists in animals found between Narooma and Ulladulla, south of Nowra, a distance of about 100km (Daly 1996).

Recent genetic studies (Mahony *et al.* 2021) found two lineages that represent subspecies. So far, all genetic samples in the Shoalhaven are from the southern subspecies (***flavopunctatus***) and hybrid animals were found in Budderoo NP. The southern subspecies is distinct as it has more yellow spots around the cloaca.

Giant Burrowing Frog tadpoles were found in one creek on the plateau of Eearie Park in the early 1990s (Daly 2019). Searches of the site in 2020 failed to find tadpoles.

Habitat preference and habits

The Giant Burrowing Frog occupies a range of substrates and vegetation communities and this wide variation in habitat is profoundly different by that occupied by the southern and northern forms. In the Shoalhaven it has been found on Hawkesbury, Nowra and Snapper Point sandstones (Hazelton 1993). The exception was a population south of Ulladulla that occurs on undifferentiated sediments (Rose 1966) but at that site exposed sandstone and a sandy overlay was present. The frog has been found in Booderee National Park (NP), Bomaderry Creek bushland, Bugong NP, Cambewarra Range NP, Jervis Bay NP, Morton NP and McDonald State Forest from 20-700m ADH.

Breeding sites were intermittent creeks flowing over exposed sandstone rocks. Rock pools typically had a depth that ranged between 0.1 - 0.4 m. The vegetation at sites where frogs and tadpoles were detected has been classified by OEH (2013) and include Red Bloodwood - Grey Gum shrubby forest, Red Bloodwood - Blackbutt - Spotted Gum shrubby open-forest, Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open-forest, Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland. However, the sites were ecotonal, with two or more communities in close proximity to the creeks. This was especially the case where breeding sites were found adjacent to escarpments (Daly 2019). All sites experienced fire and most were burnt during the 2019-20 Currowan wildfire.

Giant Burrowing Frog spawn located under Sawsedge showing slightly pigmented eggs. Image by G. Daly

Clutch size, eggs and ovipositing sites

Eggs were laid in a foam mass within the leaves of Coral Fern ***Gleichenia microphylla*** and Sawsedge ***Gahnia sieberiana*** that grow beside creeks. Three eggs masses from the Jervis Bay population contained between 698 – 807 eggs. There were laid in February, March and April. The eggs hatched after 4 - 10 days (Daly 2019).

Tadpoles

Tadpoles may reach 80mm in total length (Anstis 2018) are benthic and feed on algae growing on rocks. The body is black to a uniform dark grey colour. In the field tadpoles and metamorphlings were smaller in size to that cited above with tadpoles attaining a total length of 65mm. Metamorphlings measured 20-24mm (snout-vent length).

Male Giant Burrowing Frog showing spines on the forearms, Cambewarra Range NR, NSW. Image by G. Daly

Giant Burrowing Frog tadpole Jervis Bay NP, NSW. Image by G. Daly

5.2 THREATENED FLORA

Magenta Lilly Pilly
Syzygium paniculatum

Description and Ecology

In the Shoalhaven, when occurring in natural conditions, this species occurs as a tree to 15m with a dense canopy of green, glossy leaves. The fruit is "a globular berry, reddish" (Mills and Jakeman 2010).

Magenta Lilly Pilly is "widely cultivated. Trees found growing in or near urban areas probably originate from specimens planted in gardens. The species is readily available at plant nurseries..."(Mills and Jakeman 2010).

The preferred habitat of Magenta Lilly Pilly is " littoral rainforest on sand or in subtropical rainforest on sandy soil derived from sandstone" (Mills and Jakeman 2010).

Magenta Lilly Pilly is listed as Endangered under the NSW TSC Act and as Vulnerable under the Commonwealth EPBC Act. (Mills and Jakeman 2010).

Distribution

Mills and Jakeman (2010) state that this species is "rare on the South Coast, where it has a very patchy distribution; the species occurs in widely scattered locations, usually in small stands of littoral rainforest. Magenta Lilly Pilly occurs in rainforest on Beecroft Peninsula and in moist eucalypt forest to the west of Jervis Bay. Its southern limit is at Conjola lake" (Mills and Jakeman 2010). The state-wide distribution is Jervis Bay to Bulahdelah (Floyd 1989). There is an isolated population beside Mahogany Ck, North Nowra (GD).

Magenta Lilly Pilly growing (probably planted) beside creek tributary, Riversdale. Image by G. Leonard

Scrub Turpentine
Rhodamnia rubescens

Description and Ecology

Scrub Turpentine is a tree, which may reach 25m in good conditions, usually with a dense canopy. The leaves are distinctively 3-veined and the fruit is a berry, which turns from red to black as it ripens. This species was described as "a common pioneer species in eucalypt forests" by Floyd (1989), although infestations of Myrtle Rust have decimated the populations of this species in recent years and is now listed as Critically Endangered under the EPBC Act and BC Act.

Distribution

Scrub Turpentine occurs in all rainforest subforms except cool temperate rainforest from Batemans Bay to Gympie (Floyd 1989). In the Shoalhaven, Brush Turpentine occurs in rainforest gullies from Murramarang National Park to the Batemans Bay Area (Mills and Jakeman 2010).

Early-mature Brush Turpentine, Riversdale. Image by G. Leonard

5.3 DESCRIPTIONS OF VEGETATION TYPES

PCT 694: Swamp Sclerophyll Forest

This vegetation type is described as Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions according to the NSW BC Act and is proposed as Swamp Sclerophyll Forest of South-eastern Forest according to the Commonwealth EPBC Act. The vegetation type is an Endangered Ecological Community.

Structure

Structure of this vegetation type is variable, according to topography, soils and disturbance history. Canopy varies from Open-forest with trees to 25m to Shrubland with shrubs and small trees to 8m. Mid-storey may be dense or sparse, depending on factors including soil type, soil moisture and disturbance history. Under the tree canopy there are mesic shrub species, while under the shrub canopy, mid-storey species are generally sclerophytic. Groundcover may include grasses, ferns, sedges and rushes.

The Foliage Projective Cover (FPC – see Fisher, Scarth, Armston and Danaher 2018) of the tree canopy ranges from 5 to 15% and the shrub canopy from 10 to 20%. FPC of the mid-storey ranges from 5 to 25% and FPC of the groundcover ranges from 20 to 70%.

Occurrence

This vegetation type mostly occurs as a narrow band along the gradient between the lower slopes and floodplain, although there are several more extensive patches on benches of the lower slopes. This vegetation type occurs along lower sections of the access road to Bundanon Homestead and on several benches and lower slopes around Haunted Point. Scattered patches of this vegetation occur along the riverbanks at Bundanon, Eearee Park and Riversdale.

Floristics

The most common tree species is ***Eucalyptus saligna/E. botryoides*** hybrid. The Blue gum hybrids are replaced by Forest Red gum ***Eucalyptus tereticornis*** from the Artists in Residence compound towards the river. The Forest Red Gums are older, in comparison to most of the Blue gum hybrids, although there is good self-recruitment of Forest Red Gums towards the river. Occasional canopy species include Rough-barked Apple ***Angophora floribunda*** and Turpentine ***Syncarpia glomulifrera*** subsp. ***glomulifera***.

Small tree species include Smooth Cheese tree ***Glochidion ferdinandi*** var. ***ferdinandi***, Lilly Pilly ***Syzygium smithii***, False Rosewood ***Synoum glandulosum*** subsp. ***glandulosum***, Broad-leaved Hops ***Dodonaea triquetra***, Pink Tips ***Callistemon salignus***, Black Oak ***Allocasuarina littoralis***, Cabbage Palm ***Livistona australis*** and Wattle species, especially ***Acacia binervata***, ***Acacia irrorata*** subsp. ***irrorata*** and ***Acacia longifolia*** subsp. ***longifolia***. Around ponds and drainage lines shrub species include Lemon-scented tea-tree ***Leptospermum polygalifolium*** subsp. ***polygalifolium***, Snow in Summer ***Melaleuca linariifolia*** and Prickly-leaved Paperbark ***Melaleuca styphelioides***.

Ground-cover species include Saw-sedge ***Gahnia clarkei***, Bracken ***Pteridium esculentum***, ***Rainbow Fern Calochlaena dubia***, Batswing fern ***Hypolepis muelleri***, Spiny-headed mat-rush ***Lomandra longifolia*** and Blady Grass ***Imperata cylindrica***.

Swamp Sclerophyll Forest upslope from Artists in Residence Compound. Tree in left fore-ground is Blue Gum hybrid; Tree in centre background is Forest Red Gum. Image by G. Leonard

Narrow patches of Swamp Sclerophyll Forest occur along the river banks adjacent to Riversdale. Image by G. Leonard

PCT 905: Lilly Pilly/ Coachwood Warm Temperate Forest

Structure

Trees to 25m, but usually less than 20m. FPC varies from 20 to 55%, depending on location. Mid-storey species mainly consisting of shrubs and small trees varies from 3 to 10m, with FPC ranging from 10 to 30%. Groundcover of ferns and forbs to 1m with FPC of 15%.

Occurrence

This vegetation type occurs in sheltered locations, mainly narrow gullies with drainage lines and occasionally on sheltered escarpment slopes where there is adequate moisture. The most extensive and complete, continuous patches occur at Riversdale, downslope of "the Bridge" and along a section of creekline which crosses the access road to Bundanon Homestead.

Floristics

Common canopy species include Lilly Pilly ***Acmena smithii***, Sassafras ***Doryphora sassafras***, Ironwood ***Backhousia myrtifolia***, Smooth Cheese tree ***Glochidion ferdinandi*** var. ***ferdinandi*** and Brush Daphne ***Pittosporum undulatum***. Shrub and edge species include Brush Muttonwood ***Myrsine howittiana***, Native Olive ***Notelaea longifolia***, Blueberry Ash ***Elaeocarpus reticulatus***, Water Gum ***Tristaniopsis laurina***, Orange Thorn ***Pittosporum multiflorum*** and Black Wattle ***Callicoma serratifolia***.

Climbers and lianes include Common Milk Vine ***Marsdenia rostrata***, Wonga Wonga Vine ***Pandorea pandorana*** subsp. ***pandorana*** and Lawyer Vine ***Smilax australis***.

Forbs include Rainbow Fern ***Calochlaena dubia***, Gristle Fern ***Blechnum cartilagineum***, Batswing Fern ***Histiopteris incisa*** and Prickly Rasp Fern ***Doodia aspera***.

Some elements of sub-tropical rainforest occur, especially Giant Stinging Tree ***Dendrocnide excelsa*** (see Floyd 1990), which occurs as scattered individuals along the riverbanks and in adjacent vegetation.

Warm Temperate rainforest along creekline, downslope from "the Bridge", Riversdale. Image by G. Leonard

Warm temperate rainforest around the Spring, Bundanon. Image by G. Leonard

PCT 1082: Red Bloodwood/ Scribbly Gum Open-Woodland

Structure

Open to very open woodland with heath mid-storey. Trees to 12m and FPC from 10 to 15%, depending on location. Mid-storey species consisting of shrubs and often forming heathland. Height to 3m, with FPC to 30%. Groundcover consisting of sedges, grasses and forbs to 1m, with FPC to 25%.

Occurrence

This vegetation type occurs on the plateaux at the north and north-west portions of the estate, especially in the northern section of Eearie Park and Crown Land. Most of this vegetation was burnt during the 2020 fires and is recovering at varying rates.

Floristics

Common canopy species include Scribbly Gum ***Eucalyptus racemosa***, Red Bloodwood ***Corymbia gummifera***, Yertchuk ***Eucalyptus consideniana*** and Stringybarks, especially ***Eucalyptus imitans*** and ***E. capitellata***.

Common shrub species include Flaky-bark Tea-tree ***Leptospermum trinervium***, Banksia species, especially ***Banksia ericifolia*** subsp. ***ericifolia*** and ***Banksia spinulosa***, Mountain Devil ***Lambertia formosa*** and Dagger Bush ***Hakea teretifolia***.

Groundcover species include ***Lepyrodia scariosa***, ***Goodenia spp.***, Screw Fern ***Lindsaea linearis*** and Silky Purple Flag ***Patersonia sericea*** var. ***sericea***.

Red Bloodwood/Scribbly Gum Open-Woodland, recovering from fire. Note rock plate with fern gardens. Image by G. Leonard.

PCT 1080: Red Bloodwood/Grey Gum Woodland

Structure

Open-Forest with open mid-storey and understorey. Trees to 25 m and FPC from 15 to 25%, depending on factors including topography and fire history. Mid-storey species consisting of shrubs and juvenile trees to 5m, with FPC to 25%. Groundcover consisting of sedges, grasses and forbs to 1m, with FPC to 25%.

Occurrence

This vegetation type occurs on lower slopes of the escarpment and occurs within Eearie Park and Crown Land and the northern portions of Riversdale. Further downslope and on the plateaux Grey Gum is absent, although Red Bloodwood occurs further upslope and downslope. Some parts of this vegetation type were burnt during the 2020 fires.

Floristics

Common canopy species include Sydney Peppermint ***Eucalyptus piperita***, ***Turpentine Syncarpia glomulifera*** subsp. ***glomulifera*** and Red Bloodwood ***Corymbia gummifera***.

Common shrub species include Prickly Moses ***Acacia ulicifolia***, Narrow-leaved Geebung ***Persoonia linearis***, Flaky-bark Tea-tree ***Leptospermum trinervium***, Hairpin Banksia ***Banksia spinulosa*** and Flax-leaf Wattle ***Acacia linifolia***.

Groundcover species include ***Lepidosperma laterale***, Blue Flax Lily ***Dianella caerulea*** var. ***caerulea***, Many-flowered saw-sedge ***Lomandra multiflora*** and Kangaroo Grass ***Themeda triandra***.

Red Bloodwood/Grey Gum Woodland. Image by G. Leonard

PCT 1283: Turpentine/Red Bloodwood/Sydney Peppermint Forest

Structure

Open woodland with open mid-storey and understorey. Trees to 25m and FPC from 5 to 10%. Mid-storey species consisting of shrubs and juvenile trees to 6m, with FPC to 20%. Groundcover consisting of sedges, grasses and forbs to 1m, with FPC to 20%.

Occurrence

This vegetation type occurs on lower slopes in Eearie Park and Beeweree. It is apparent that most of this vegetation has been burnt several times, with the result that self-recruited Turpentine has formed monotypic thickets.

Floristics

Common canopy species include Red Bloodwood ***Corymbia gummifera***, Turpentine ***Syncarpia glomulifera*** subsp. ***glomulifera***, Sydney Peppermint ***Eucalyptus piperita*** and occasionally Blackbutt ***Eucalyptus pilularis*** and Rough-barked Apple ***Angophora floribunda***.

Common shrub species include Narrow-leaf Geebung ***Persoonia linearis***, Hairpin Banksia ***Banksia spinulosa***, Blueberry Ash ***Elaeocarpus reticulatus***, Sickle-leaf Wattle ***Acacia falciformis*** and Blunt-leaved Wattle ***Acacia obtusifolia***.

Groundcover species include Bracken ***Pteridium esculentum***, ***Lepidosperma laterale***, ***Lepidosperma urophorum***, Blue Flax Lily ***Dianella caerulea*** var. ***caerulea*** and Wiry Panic ***Entolasia stricta***. ***Billardiera scandens*** and ***Smilax glyciphylla*** are common scramblers.

Turpentine/Red Bloodwood/Sydney Peppermint Forest. Image by G. Leonard

PCT 1206: Spotted Gum/ Blackbutt Tall Open-forest

Structure

Open-forest and Tall Open-forest with open mid-storey and generally dense understorey. Trees to 28 m and FPC from 10 to 25%. Mid-storey species consisting of shrubs and juvenile trees to 10 m, with FPC to 20%. Groundcover consisting of sedges, grasses and forbs to 1m, with FPC to 25%.

Occurrence

This vegetation type occurs on lower slopes in Eearie Park, Beeweree, Bundanon and Riversdale. The patches vary in age/class, with possible influences from previous logging and fires.

Floristics

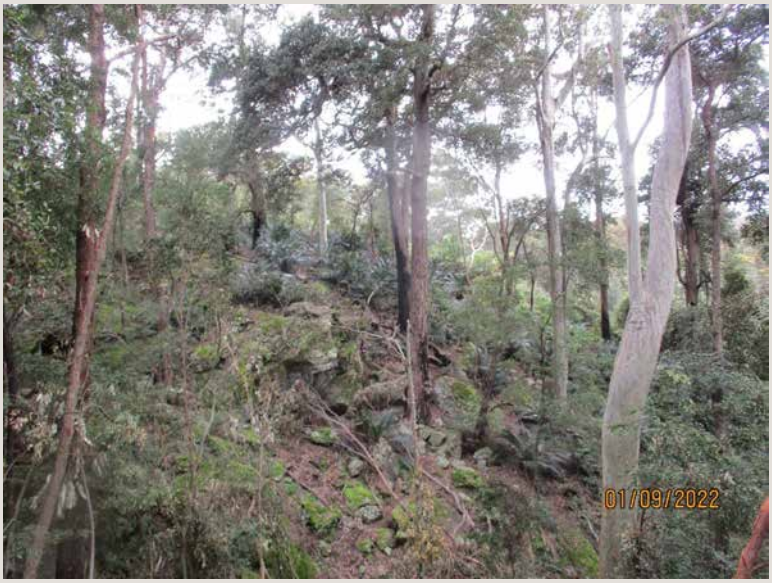
Common canopy species include Spotted Gum ***Corymbia maculata***, Red Bloodwood ***Corymbia gummifera***, White Stringybark ***Eucalyptus globoidea*** and Scribbly Gum ***Eucalyptus racemosa***. Mature Black Oak ***Allocasuarina littoralis*** also forms a canopy component on some rocky slopes. In most patches Spotted Gum is the most common canopy species. Although Blackbutt ***Eucalyptus pilularis*** is included as a canopy species for this vegetation type, it is uncommon to absent in most Spotted Gum patches in the estate.

Common shrub species include Burrawang ***Macrozamia communis***, (occasionaly forming extensive monotypic patches), Narrow-leaf Geebung ***Persoonia linearis***, Hairpin Banksia ***Banksia spinulosa***, Two-vein Hickory ***Acacia binervata***, Broad-leaf hop bush ***Dodonaea triquetra***, Lemon-scented tea-tree ***Leptospermum polygalifolium***, and Needlebush ***Hakea sericea***.

Groundcover species include Many-flowered Mat-rush ***Lomandra multiflora***, ***Lepidosperma laterale***, Blue Flax Lily ***Dianella caerulea*** var. ***caerulea***, Apple Berry ***Billardiera scandens*** and Wiry Panic ***Entolasia stricta***.

Spotted Gum Forest on lower escarpment, Bundanon. Image by G. Leonard

Spotted Gum Forest on lower escarpment, Bundanon. Image by G. Leonard



Red Bloodwood – Blackbutt – Spotted Gum Open-forest on mid-slopes, Beeweree. Image by G. Leonard

Red Bloodwood – Blackbutt – Spotted Gum Open-forest on lower slopes, Beeweree. Image by G. Leonard

PCT 1079: Red Bloodwood/ Blackbutt/Spotted Gum Open-forest

Structure

Open-forest and Tall Open-forest with shrubby mid-storey and generally dense understorey. Trees to 25 m and FPC from 10 to 25%. Mid-storey species consisting of shrubs and juvenile trees to 8 m, with FPC to 20%. Groundcover consisting of sedges, grasses and forbs to 1m, with FPC to 25%.

Occurrence

This vegetation type occurs on upper slopes in Eearie Park, Beeweree, Bundanon and Riversdale. The patches vary in age/class, with possible influences from previous logging and fires. This vegetation type intergrades with other vegetation types such as with Red Bloodwood - Grey Gum Woodland on upper, rocky slopes, Spotted Gum – Blackbutt Forest on lower slopes, Warm temperate Rainforest in sheltered sites and Swamp Sclerophyll Forest on moist sites.

Floristics

The suite of species for Red Bloodwood – Blackbutt – Spotted Gum Open-forest is similar to that for Spotted Gum – Blackbutt Open-forest. Other canopy species which may be common, depending on slope, aspect and altitude include Turpentine ***Syncarpia glomulifera*** subsp. ***glomulifera***, Grey Ironbark ***Eucalyptus paniculata*** subsp. ***paniculata***, Thin-leaved Stringybark ***Eucalyptus eugenioides***, shrub species which may be common include Sydney Golden Wattle ***Acacia longifolia*** subsp***. longifolia***, Prickly Moses ***Acacia ulicifolia***, Grass tree ***Xanthorrhoea concava*** and Prickly Beard-heath ***Leucopogon juniperinus***.

MISCELLANEOUS VEGETATION TYPES

River Oak Forest

Scattered patches of PCT 1206 River Oak Forest (***Casuarina cunninghamiana***) occur along the river banks, although in most cases they occur as isolated fragments of previously cleared vegetation.

River Oak Fragments; cleared paddocks downslope of Bundanon Homestead. Image by G. Leonard

River Oak fragments, Eearie Park. Image by G. Leonard

River Mangrove

A small patch of River Mangrove ***Aegiceras corniculatum*** occurs in the river bank adjacent to the Riverdale Jetty. This patch has been planted and, although apparently surviving, growth and development appear to be minimal.

Patch of planted River Mangrove, Riversdale. Image by G. Leonard

Carbon plantation

Several patches of planted vegetation for carbon sequestration occur on the previously cleared floodplain areas at Bundanon and Eearie Park.

Carbon Forest, Eearie Park. Image by G. Leonard

6 DISCUSSION

6.1 THREATENED SPECIES

The majority of the nineteen threatened species of animal detected on or adjacent to Bundanon are forest dependent, that is they require native forests to persist. Species such as the Yellow-bellied Glider, Powerful Owl, Gang Gang Cockatoo, Glossy Black-Cockatoo, Little Lorikeet and Broad-headed Snake require hollow bearing trees for den and nest sites. Tree hollows used by the Powerful Owl for nesting form in trees greater than 150 and probably greater than 200 years old (Mackowski 1984, Lindenmayer *et al.* 1991, Milledge *et al.* 1991). Even though the hollows used by the other above-mentioned species may not be as large as the ones used by Powerful Owl the message is **for these species to persist they require old growth forest.**

The majority of the threatened species of animal have home ranges that extend to land beyond the property. Hence, the continued existence of these species depends on the adjoining land retaining forest. For example, those animals that can fly such as the Grey-headed Flying Fox, Eastern Bent-wing Bat, Gang Gang Cockatoo and Little Lorikeet are known to make large seasonal movements over the landscape. The persistence of these species requires forest to be retained in National Parks, State Forests, Aboriginal managed land and freehold over large areas in NSW.

At a smaller scale in the localised area, there is a need to keep and strengthen the conservation of habitat along the Shoalhaven River escarpment for species such as the White-footed Dunnart, Eastern Pygmy Possum, Yellow-bellied Glider, Large-eared Pied Bat, Broad-headed Snake, Heath Monitor and Giant Burrowing Frog. Not only do these animals require specialised habitat such as caves, heathland, termite mounds and rock outcrops but for the species to persist, there needs to be connectivity to the broader population so genetic diversity is maintained. Fragmentation of native vegetation can cause populations of animals to become isolated and over time their viability may not be sustained. The term used to describe this is inbreeding depression, that is the genetic diversity dwindles over time making the animals less fit to survive.

Given these requirements for forest dependant fauna and if we want to maintain the rich diversity that exists at Bundanon then **conservation of bush over the various land tenures is necessary**.

6.2 THREATS TO THE FAUNA OF BUNDANON

There are numerous threats to the fauna across the property, they include predation from exotic animals, disease and climate change (wildfire and changes in fire frequency).

Exotic predators

The most detrimental introduced predators in the region are the Red Fox ***Vulpes vulpes***, feral Cat ***Felis catus*** and Plague Minnow ***Gambusia holbrooki***. The following is a brief history of their introduction to Australia and the impacts they have on our wildlife.

Red Fox

The Red Fox was deliberately introduced from England to Victoria about 1860 (Abbott 2011) as an animal to hunt for sport. It took until about 1888 for the species to spread to southern New South Wales (Abbott 2011). Fox was first detected in the Tapitallee area of the Shoalhaven in 1907 (Elliott notes) so the species has been here for about 115 years.

Based on an historical analysis of bounties paid on Fox and what was considered pest ground dwelling marsupials in New South Wales noticeable declines of medium-sized animals occurred within 7-13 years of the establishment of the Fox (Short 1998). The Fox is known to eat small ground-dwelling marsupials within what is considered the critical weight range (between 35 and 5500gms, Burbidge and McKenzie 1989).

Predation by Fox is a contributor to the decline and local extinction of ground nesting birds.

In the Shoalhaven the Fox is implicated in the local extinction of the Eastern Quoll ***Dasyurus viverrinus***, Southern Brown Bandicoot ***Isoodon obesulus***, Red-necked Pademelon ***Thylogale thetis***, Parma Wallaby ***Macropus parma*** and Bush-stone Curlew ***Burhinus grallarius***. It is also implicated in the decline of the Spotted-tailed Quoll, Long-nosed Potoroo, Koala and Brush-tailed Rock Wallaby. Fox are a major predator of Long-necked Turtle ***Chelodina longicollis*** eggs (G. Daly pers. obs.) and many ground-nesting shorebirds including the endangered Little Tern ***Sternula albifrons***. I have seen a Fox chasing a small Swamp Wallaby at Riversdale.

A Fox baiting program occurs at Riversdale and Eearie Park in association with the Brush-tailed Rock Wallaby conservation strategy. Outside of this area other properties have feral animal controls in association with Shoalhaven Landcare.

Cat

The Cat ***Felis catus*** was deliberately introduced from England to Australia multiple times at various locations. It is posited that Cats became feral around Sydney by 1820 (Abbott 2008). Since then, Cats have colonised all of the country and some estimates state some 3.8 million domestic and 2.8 million wild Cats inhabit Australia.

Cats have been responsible for the rapid and catastrophic loss of wildlife, causing some species to become threatened, endangered and even extinct. Feral cats are recognised as a potential threat to 74 mammals, 40 birds, 21 reptiles and four amphibian species. Predation by Cats is responsible for the loss of 1.6 billion native animals every year, with feral cats responsible for some 1.4 billion of this number. On average a single feral cat in the bush kills about 44 frogs, 225 reptiles, 130 birds and 390 mammals per year (Threatened Species Recovery Hub 2020). Pet cats collectively kill some 1 million animals per day (Commonwealth of Australia).

These Fox were shot around a dairy in a single night, illustrating that they can attain high densities where food is abundant. Image courtesy P. Taylor.

Plague Minnow

The Plague Minnow is a small freshwater fish originally introduced into Brisbane, Australia in 1925 (Lloyd and Tomasov 1985, Black 1972) and Sydney in the 1930s to eat mosquito larvae and reduce the risk of malaria. The fish was imported as an aquarium fish but some were released into creeks around Sydney, Melbourne and Brisbane. Plague Minnow preys upon frog and fish eggs, tadpoles and fish (Daly 1995; Pyke 2005; Reynolds 2009).

This species is now widespread along the east coast of Australia. They are abundant in the warm shallows of the Shoalhaven River. One unfortunate trait of Plague Minnow is their innate tendency to swim upstream during periods of flood. This behavioural adaptation drives them to colonise waterbodies in the distal reaches of creeks. The Shoalhaven River has had several floods between 2019 and 2022 and Plague Minnow colonised the lower reaches of the creeks and ponds at Riversdale and the dam at Bundanon. Fortunately Plague Minnow dislike shaded cool water and do not penetrate into the area at Riversdale where the Stuttering Frog may breed. However, they will remain in the dam at Bundanon until it dries during a drought.

Plague Minnow swimming against the current and through a piped overflow to access a pond. The fish piled several high to use their bodies to get over a lip in the pipe. Image by G. Daly

Disease

The main disease that has impacted the fauna of the property is the infectious frog chytrid fungus (causing Chytridiomycosis). The disease was first discovered in 1993 in dead and dying frogs in Australia. It had been present in Australia since about 1978 and is now widespread here and in many other countries. Chytrid is a water borne pathogen that either infects the keratin layer in the skin of frogs directly or implants on the keratin in the teeth of tadpoles. The fungus lives in the teeth until the tadpole metamorphoses into a frog. At that stage, the fungus migrates into the keratin layer of the skin and can cause death (Department of Environment, Climate Change and Water 2009).

Infected animals, with a high zoospore count of chytrid, may be lethargic, wasted and have reddened limbs. Fortunately, most species of Australian frog persist with low levels of chytrid. However, the Green and Golden Bell Frog and Stuttering Frog are susceptible to death from the fungus. These two species may have historically occurred at Bundanon. We have re-introduced the Stuttering Frog to Riversdale (see Bundanon's website for more information) but at present there are no signs the animals persist or have bred. The Green and Golden Bell Frog has declined in abundance and distribution and now occurs in fragmented populations along the coast of northern Victoria and NSW. The Shoalhaven is one of the strongholds for the species with populations at Coomonderry Swamp, the Crookhaven floodplain, Sussex Inlet and Meroo NP.

The most significant plant disease, which occurs on the estate is Myrtle Rust. Spores and tissue damage associated with this fungal disease were recorded in 2022 (yet to be confirmed) on the foliage of Scrub Turpentine at Riversdale, and on the foliage of Lemon-scented Myrtle ***Backhousia citriodora*** within the Tree Lines Track at Bundanon, as well as in several specimens of Malay Apple ***Syzygium jambos***, growing within Bundanon homestead garden.

Fungal damage on foliage of Malay Apple. Image by G. Leonard

Lemon-scented Myrtle with apparent infestation of Myrtle Rust. Image by G. Leonard

Climate Change

Climate change is the elephant in the room. Within the last 10 years there has been an increase in temperatures above 40°C in large areas of NSW, primarily attributed to human induced climate change (State of the Climate report 2022). Temperatures above 45°C, especially over several days appear to be particularly damaging for birds (McKechnie *et al.* 2012) and Flying Fox. As predicted by McKechnie *et al.* (2012) the frequency of very hot weather events and extreme maximum air temperatures have increased since the 2012 publication (State of the Climate report 2019). The impact of excessive heat on avifauna is not well documented along the east coast but is likely to impact populations, especially in combination with drought. On 1 February 2020 several residents recorded 48°C in the Tapitallee area (J. Hilditch and K. Touzel pers comm.).

The impact of excess heat on Grey-headed Flying Fox is better documented than the impacts of birds. Grey-headed Flying Fox are stressed when temperatures reach 40°C and often abandon their young during heat wave events (Mo *et al.* 2021). Given the documented die-offs of Grey-headed Flying Fox in the last decade and the predicted extreme heat wave events already experienced in the last decade this species will become extinct in the wild this century.

Excessive heat in combination with drought are the driving forces for bushfires. The 2020 Currowan wildfire severely impacted animal populations. One person (B. Acworth pers. comm.) reported many small passerines dead around their house after the fire. Apparently, they took refuge around the building but perished from heat. Few birds were detected on this property and the broader Shoalhaven immediately post burn indicating a high mortality. I observed the charred remains of Yellow-tailed Black Cockatoo and Red-necked Wallaby after the fire indicating that even larger species with extensive home range perished.

The 2020 Currowan wildfire not only killed animals directly but also consumed many large hollow-bearing trees that were habitat for microbats, gliders, parrots, owls, reptiles and frogs. This habitat may take 120 years or more to reform, in the absence of additional wildfire.

Baby Grey-headed Flying Fox found dead at Yatte Yatte NR, NSW in 2019. Many baby bats were abandoned by their mothers during the extreme drought and heat. Image by G. Daly

Great Glider found in Murramarang NP NSW after the 2019-20 wildfire. Image courtesy G. Lemann

Burnt Red-necked Wallaby found on Emerys plateau, NSW after the 2019-20 wildfire. Image Courtesy K. Touzel.

7 THE FUTURE BY GARRY DALY

7.1 WEB PLATFORMS

Additional surveys will no doubt add more species to the lists given in **Appendix 1**. Unfortunately, more animals will be added to the State and Federal lists of fauna threatened with extinction. Given these facts this document should be seen as a waypoint in time. But how can we all contribute to our knowledge of the natural landscape of the Bundanon?

There are various citizen scientist platforms that allow everyone increase our knowledge of the distribution of plants and animals. The main platforms that people are using include iNaturalist, AussieBackyard bird count, and the Frog ID app **(https://www.frogid.net.au/)**. However, our main body of records is the Atlas of Living Australia (ALA).

I would like to see Bundanon have its own platform where visitors can log in, take images with their mobile phone and or record calls or simply identify a species at a particular location. Participants or interested people could then log in and see who saw or heard what animal (or plant) at that place and time. The ALA does this but not for the geographic unit of Bundanon. Coupled with the presentation of high-quality images taken from the property and placed on the website, the citizen scientist input would add an extra layer of participation for guests.

7.2 GOVERNMENT AND NON-GOVERNMENT AGENCIES

Currently Bundanon has working relationships with Landcare Australia, Shoalhaven Landcare (Riverwatch and the Stuttering Frog working groups), National Parks (Fox baiting to protect Brush-tailed Rock Wallaby), the Royal Australian Navy, several universities and various Aboriginal Groups including the Wodi Wodi and Yuin people of the south coast. Working relationships with these parties will progress conservation of habitat, protection of rare animals and management of land via cultural burns. **The estate is a living landscape.**

7.3 REHABILITATED LAND

Cattle no long graze adjacent to the river at Bundanon, Riversdale and Eearie Park. Instead, Wombat and Eastern Grey Kangaroo now graze on the exotic grasses. Much of the land historically used for grazing has been planted with native shrubs and trees for carbon credits, habitat expansion, connectivity and education. Much more work needs to be done especially at places where wattles and lantana have colonised previously cleared land. There should be specific aims and objectives for revegetating areas. Our work with the Stuttering Frog aims to enhance the riparian habitat at Riversdale to better cater for this amphibian but the arboretum contains many species used by Aboriginal people as food and hence links with the existing education program. The planting of winter flowering gum also provides a food resource for birds and already three species of honeyeater (Lewins, Eastern Spinebill and Little Wattlebird) have been seen foraging in Swamp Mahogany and Forest Red Gum that are only two years old! We hope to continue this work as a demonstration to visitors of how a landscape can change in a positive way in just a few years. Ultimately, it would be great if Koala found their way to the forests planted at Bundanon, Eearie Park and Riversdale.

Cultural burns are another tool to create and maintain habitat. The strong bond developed during the National Indigenous Fire Workshop and Cultural Fire Day in 2018 is ongoing. If burns encourage native grasses such as Kangaroo Grass ***Themeda triandra*** and Weeping Grass ***Microlaena stripoides*** to recolonise the river flats under widely spaced gums then the landscape would be along the path of repair.

7.4 RE-INTRODUCTIONS

Most efforts of re-introducing animals back into unfenced landscapes have failed as the cause of their original demise had not been arrested. For Australian mammals and ground nesting birds the primary cause is predation from Fox and feral Cats and that is why contemporary work is done to construct feral proof fences over large areas prior to introduction into safe havens (see Australian Wildlife Conservancy). Shoalhaven Fox Control program is spearheading an entire local government blanket of Fox control. There have been great results but ultimately, we need biological controls for Fox and feral Cats.

It would be wonderful to once again, hear the haunting call of the Bush Stone Curlew, bellows of male Koala or see Red-necked Pademelons at Bundanon.

7.5 CONSERVATION AGREEMENTS

Within NSW there are two main types of conservation agreements under the Biodiversity Conservation Trust (BCT) of NSW. One is in-perpetuity being on the title and the other is a permanent offset agreement. There are revocable private land conservation agreements but do not contribute to the National Reservation System targets.

Under these programs, the BCT uses a range of delivery mechanisms to encourage and support landholders to participate in private land conservation, including fixed price offers, conservation tenders, voluntary applications, grants, co-investment partnerships and a revolving fund.

We encourage the Trust to consider entering conservation agreements for portions of the property to access funds for weed and feral animal control. Our preference is for in-perpetuity voluntary conservation agreements as the biodiversity offset scheme, as the Audit Office of NSW (2022) has found “The effectiveness of the Scheme’s implementation by DPE and the Biodiversity Conservation Trust (BCT) has been limited. A market-based approach to biodiversity offsetting is central to the Scheme’s operation but credit supply is lacking and poorly matched to growing demand: this includes a potential undersupply of in-demand credits for numerous endangered species. Key concerns around the Scheme’s integrity, transparency, and sustainability are also yet to be fully resolved. As such, there is a risk that biodiversity gains made through the Scheme will not be sufficient to offset losses resulting from the impacts of development, and that DPE will not be able to assess the Scheme’s overall effectiveness.”

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Appendix 1 Species of fauna found on and near Bundanon

Nomenclature is based on Van Dyke and Strahan (2008), Clements (2022) and Australian Society of Herpetologists (2022).

Detections of fauna were by M. Andrews, G. Daly and K. Touzel. Clear cells indicate species not recorded but expected to occur. All trapping conducted by G. Daly under appropriate ethics and scientific licences.

KEY			
RECORD		LOCATION	
A	detected adjacent to the site	C	Crown lease
B	AnaBat	Bu	Bundanon
C	chewed cones	E	Eearie Park
I	Incised trees	R	Riversdale
O	observed	Be	Beeweeree
S	scats/incisions		
T	trapped		
W	heard		
*	introduced species		

MAMMALS							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Tachyglossidae	*Tachyglossus aculeatus*	Echidna	O	O	O	O	O
Dasyuridae	*Antechinus stuartii*	Brown Antechinus		T			
	Sminthopsis leucopus	White-footed Dunnart			A		
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot		O			
Phascolarctidae	*Phascolarctos cinereus*	Koala			A		
Vombatidae	*Vombatus ursinus*	Common Wombat	O	O	O	O	O
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum		O			
Petauridae	*Petaurus australis*	Yellow-bellied Glider	I				
	Petaurus breviceps	Sugar Glider		O	W		
Pseudocheiridae	*Petauroides volans*	Greater Glider					
	Pseudocheirus peregrinus	Common Ringtail Possum					
Tarsipedidae	*Acrobates pygmaeus*	Feathertail Glider		O			

FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	O	O	O	O	O
	Macropus robustus	Wallaroo		O		O	
	Macropus rufogriseus	Red-necked Wallaby	O	O		O	
	Petrogale penicillata	Brush-tailed Rock-wallaby		S			
	Wallabia bicolor	Swamp Wallaby	O	O	O	O	O
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying Fox		O	W		
Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	T		T		
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	T				
	Chalinolobus gouldii	Gould's Wattle Bat					
	Chalinolobus morio	Chocolate Wattle Bat		T	T		
	Miniopterus orianae oceanensis	Eastern Bent-wing Bat			T		
	Myotis macropus	Southern Myotis			B		
	Nyctophilus geoffroyi	Lesser Long-eared Bat		T			
	Nyctophilus gouldi	Gould's Long-eared Bat		T			
	Vespadelus darlingtoni	Large Forest Vespadelus					
	Vespadelus vulturnus	Little Forest Vespadelus		T	T		
Muridae	*Rattus fuscipes*	Bush Rat		T			
	Rattus rattus	Black Rat		O	O		
Leporidae	*Oryctolagus cuniculus*	Rabbit *					
Canidae	*Vulpes vulpes*	Red Fox *		O	O	O	
Cervidae	*Cervus timorensis cross*	Samba x Rusa *	i	O	S	O	O

BIRDS							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Anatidae	*Chenonetta jubata*	Maned Duck		O			
	Anas superciliosa	Pacific Black Duck		O			
	Anas castanea	Chestnut Teal		O	O		
	Anas gracilis	Grey Teal		O			
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe		O			
Columbidae	*Macropygia amboinensis*	Brown Cuckoo-dove			W		
	Phaps chalcoptera	Common Bronzewing		O	W		
	Ocyphaps lophotes	Crested Pigeon		O			
	Leucosarcia melanoleuca	Wonga Pigeon		O	W		
	Geopelia humeralis	Bar-shouldered Dove		O	W		
	Lopholaimus antarcticus	Topnot Pigeon					
Cuculidae	*Cuculus pallidus*	Pallid Cuckoo					
	Cacomantis variolosus	Brush Cuckoo			W		
	Cacomantis flabelliformis	Fan-tailed Cuckoo			W		
	Chrysococcys lucidus	Shining Bronze Cuckoo					
	Scythrops novaehollandiae	Channel-billed Cuckoo		O	W		
	Eudynamys orientalis	Pacific Koel		W	W		
Podargidae	*Podargus strigoides*	Tawny Frogmouth		O			
Caprimulgidae	*Eurostopodus mystacalis*	White-throated Nightjar			A		
Aegothelidae	*Aegothehes cristatus*	Australian Owlet Nightjar					
Apodidae	*Hirundapus caudacutus*	White-throated Needletail					
Rallidae	*Porphyrio melanotus*	Australasian Swamphen					
	Gallinula tenebrosa	Dusky Moorhen					
	Fulica atra	Eurasian Coot					
Charadriidae	*Vanellus miles*	Masked Lapwing		O	O	O	
Turnicidae	*Turnix varius*	Painted Buttonquail				O	O
Laridae	*Larus novaehollandiae*	Silver Gull				O	
Anhingidae	*Anhinga melanogaster*	Australasian Darter			W		

FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant		O			
	Phalacrocorax carbo	Great Cormorant		O			
Pelicanidae	*Pelecanus conspicillatus*	Australian Pelican		O			
Ardeidae	*Egretta novaehollandiae*	White-faced Heron		O	O		
	Ardea intermedia	Intermediate Egret					
	Ardea pacifica	Pacific Heron		O			
	Ardea ibis	Cattle Egret					
	Ardea alba	Great Egret		O			
	Nycticorax coledonicus	Nankeen Night Heron					
	Ixobrychus flavicollis	Black Bittern			A		
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle		O	O	O	
	Elanus axillaris	Black-shouldered Kite		O			
	Accipiter fasciatus	Brown Goshawk					
	Accipiter novaehollandiae	Grey Goshawk					
	Accipiter cirrhocephalus	Collared Sparrowhawk					
	Aquila audax	Wedge-tailed Eagle		O	O		
Strigidae	*Ninox strenua*	Powerful Owl		O	W		
	Ninox novaeseelandiae	Southern Boobook			W		
Alcedinidae	*Alcedo azurea*	Azure Kingfisher		O	O		
	Dacelo novaeguineae	Laughing Kookaburra		O	W	O	
	Todiramphus sanctus	Sacred Kingfisher			W		
Meropidae	*Merops ornatus*	Rainbow Bee-eater					
Coraciidae	*Eurystomus orientalis*	Dollarbird					
Falconidae	*Falco peregrinus*	Peregrine Falcon		O		A	
	Falco cenchroides	Nankeen Kestrel		O			
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black Cockatoo		O	O	O	
	Calyptorhynchus funereus	Yellow-tailed Black-cockatoo		O	O	O	
	Callocephalon fimbriatum	Gang-gang Cockatoo					
	Eolophus roseicapillus	Galah		O	O		
	Cacatua sanguinea	Little Corella		O	O		

BIRDS							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
	Cacatua galerita	Sulphur-crested Cockatoo		O	O	O	
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		O	O		
	Glossopsitta concinna	Musk Lorikeet					
	Glossopsitta pusilla	Little Lorikeet			O		
	Alisterus scapularis	Australian King-Parrot		O	O		
	Platycercus elegans	Crimson Rosella		O	O		
	Platycercus eximius	Eastern Rosella		O			
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	O	O	O	O	
Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird			W		
	Ptilonorhynchus violaceus	Satin Bowerbird		O	O		
Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper			W		
Maluridae	*Malurus cyaneus*	Superb Fairy-wren		O	O		
	Malurus lamberti	Variegated Fairy-wren		O			
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird		O			
	Anthochaera chrysoptera	Little Wattlebird		O			
	Philemon corniculatus	Noisy Friarbird			W		
	Manorina melanophrys	Bell Miner			A		
	Manorina melanocephala	Noisy Miner		O	O		
	Caligavis chrysops	Yellow-faced Honeyeater		O	O		
	Lichenostomus leucotis	White-eared Honeyeater					W
	Lichenostomus melanops	Yellow-tufted Honeyeater	O				
	Melithreptus lunatus	White-naped Honeyeater	O				
	Meliphaga lewinii	Lewins Honeyeater		O	O		
	Acanthorhynchus tenuirostris	Eastern Spinebill		O	W		
	Phylidonyris novaehollandiae	New Holland Honeyeater				O	
	Myzomela sanguinolenta	Scarlet Honeyeater			W		
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		O	W		
	Pardalotus striatus	Striated Pardalote		W			

FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Acanthizidae	*Origma solitaria*	Rock Warbler		O			
	Sericornis citreogularis	Yellow-throated Scrubwren			O		
	Sericornis frontalis	White-browed Scrubwren			O		
	Gerygone mouki	Brown Gerygone			O		
	Gerygone olivacea	White-throated Gerygone					
	Acanthiza pusilla	Brown Thornbill		O			
	Acanthiza reguloides	Buff-rumped Thornbill				O	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill		O			
	Acanthiza nana	Yellow Thornbill		O			
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike			O		
	Coracina tenuirostris	Cicadabird					
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				O	
Psophodidae	*Psophodes olivaceus*	Eastern Whipbird		O	W		
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler		W	W		
	Pachycephala rufiventris	Rufous Whistler					
	Colluricincla harmonica	Grey Shrike-thrush		O	W		
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole			W		
Artamidae	*Cracticus tibicen*	Australian Magpie		O	O	O	
	Artamus cyanopterus	Dusky Woodswallow					
	Cracticus torquatus	Grey Butcherbird		O	W		
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail		O	O		
	Rhipidura rufifrons	Rufous Fantail			O		
	Rhipidura leucophrys	Willie Wagtail		O	O	O	
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch			O		
	Monarcha cyanoleuca	Satin Flycatcher					
	Grallina cyanoleuca	Magpie Lark		O	O	O	
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough		O			
Corvidae	*Corvus coronoides*	Australian Raven	O	O	O	O	O
	Strepera graculina	Pied Currawong		O	O	O	

BIRDS							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Petroicidae	*Microeca leucophaea*	Jacky Winter		O		O	
	Petroica rosea	Rose Robin		O			
	Eopsaltria australis	Eastern Yellow Robin		O	O		
Acrocephalidae	*Acrocepephalus australis*	Australian Reed-warbler					
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		O	O		
	Petrochelidon nigricans	Tree Martin					
Zosteropidae	*Zosterops lateralis*	Silvereye		O	W		
Sturnidae	*Sturnus vulgaris*	Common Starling*		O			
Turdidae	*Zoothera lunulata*	Bassian Thrush			W		
	Turdus merula	Common Blackbird*		O			
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird			W		
Estrildidae	*Neochmia temporalis*	Red-browed Firetail			O		
Motacillidae	*Anthus novaeseelandiae*	Australian (Richard's) Pipit		W			

REPTILES							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Chelonidae	*Chelodina longicollis*	Long-necked Turtle					
Gekkonidae	*Amalosia lesueurii*	Lesueur's Gecko		O		O	
Agamidae	*Amphibolurus muricatus*	Jacky Lizard					
	Intellagama lesueurii howitti	Gippsland Water Dragon			O		
Varanidae	*Varanus rosenbergi*	Heath Monitor			A		
	Varanus varius	Lace Monitor			O		
Pygopodidae	*Pygopus lepidopodus*	Scaly Foot					
	Anepischetosia maccoyi	Maccoy's Skink					
	Cryptoblepharus pulcher	Elegant Snake-eyed Skink		O			
Scincidae	*Ctenotus taeniolatus*	Copper-tailed Skink		O			
	Eulamprus quoyii	Eastern Water-skink			O		
	Eulamprus tenuis	Barred-sided Skink			O		
	Lampropholis delicata	Grass Skink			O		
	Lampropholis guichenoti	Garden Skink		O			
	Saproscincus mustelinus	Weasel Shadeskink			O		
	Tiliqua scincoides	Common Bluetongue					
Pythonidae	*Morelia spilota*	Diamond Python			O		
Typhlopidae	*Ramphotyphlops nigrescens*	Black Blind Snake					
Elapidae	*Cacophis squamulosus*	Golden-crowned Snake					
	Demansia psammophis	Yellow-faced Whip Snake		O			O
	Drysdalia rhodogaster	Masters Snake					
	Hemiaspis signata	Swamp Snake					
	Hoplocephalus bungaroides	Broad-headed Snake		O	A		
	Notechis scutatus	Eastern Tiger Snake					
	Pseudechis porphyriacus	Red-bellied Black Snake			O		
	Pseudonaja textilis	Eastern Brown Snake					
	Cryptophis nigrescens	Small-eyed Snake		O		O	

AMPHIBIANS							
FAMILY	SPECIES	COMMON NAME	BE	BU	R	E	C
Hylidae	*Litoria citropa*	Blue Mountains Tree Frog			O		O
	Litoria fallax	Dwarf Tree Frog		W	O		
	Litoria latopalmata	Broad-palmed Frog			W		
	Litoria peronii	Peron's Tree Frog		W	W		
	Litoria nudidigitus	Leaf Green Tree Frog			O		
	Litoria quaritatus	Screaming Tree Frog			W		
	Litoria verreauxii	Verreaux's Tree Frog					
Limnodynastidae	*Heleioporus australiacus*	Giant Burrowing Frog				O	
	Limnodynastes peronii	Brown-striped Frog		O	O		
	Mixophyes australis	Stuttering Frog			O		
	Mixophyes fasciolatus	Great Barred Frog			O	O	
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet		W	W	O	
	Pseudophryne bibronii	Bibron's Toadlet		O	W		

Appendix 2 Native Trees and shrubs planted at Bundanon and Riversdale

Note: trees and shrubs planted at Riversdale were part of the Stuttering Frog reintroduction project funded by the Environmental Trust grant from 2018-2021 and were grown from local seed by Berry Landcare Nursery, Milton Rural Landcare Nursery, Wollongong Botanic Gardens and GD. Trees and shrubs planted at Bundanon (49ha) and Eearie Park (30ha) were for the Living Landscapes grant in 2013-2015

COMMON NAME	SCIENTIFIC NAME	BU/E	RIVERSDALE
Cedar Wattle	*Acacia elata*	x	
Sally Wattle	*Acacia floribunda*	x	
Green Wattle	*Acacia irrorata* subsp. *irrorata*	x	
White Wattle	*Acacia linifolia*	x	
	Acacia longifolia subsp. *longifolia*	x	
Lilly-pilly	*Acmena smithii (syn. Syzygium smithii)*	x	30
Swamp Oak	*Casuarina glauca*	x	
Black She-oak	*Allocasuarina littoralis*	x	
Smooth Backed Apple	*Angophora costata* subsp. *costata*	x	
Rough-barked Apple	*Angophora floribunda*	x	
Broad-leaved Apple	*Angophora subvelutina*	x	
Common Acronychia	*Acronychia oblongifolia*		13
Native Quince	*Alectryon subcinereus*		14
Red Ash	*Alphitonia excelsa*		5
Bangalow Palm	*Archontophoenix cunninghamiana*		6
Grey Myrtle	*Backhousia myrtifolia*		25
Old Man Banksia	*Banksia serrata*	x	
Flame Tree	*Brachychiton acerifolius*	x	14
Kurrajong	*Brachychiton populneus* subsp. *populneus*	x	1
Coffee Bush	*Breynia oblongifolia*		4
Black Wattle	*Callicoma serratifolia*		8
Crimson Bottlebrush	*Callistemon citrinus*		
Riveroak	*Casuarina cunninghamiana* subsp. *cunninghmiana*	x	
Red Bloodwood	*Corymbia gummifera*	x	
Spotted Gum	*Corymbia maculata*	x	

COMMON NAME	SCIENTIFIC NAME	BU/E	RIVERSDALE
Churnwood	*Citronella moorei*		1
Coachwood	*Ceratopetalum apetalum*		9
Brittlewood	*Claoxylon australe*		1
Jackwood	*Cryptocarya glaucescens*		30
Black Plum	*Diospyros australe*		5
Giant Stinging Tree	*Dendrocnide excelsa*		1
Native Tamarind	*Diploglottis australis*		31
Large-leaved Hopbush	*Dodonaea triquetra*	x	
Hedgehog Grass	*Echinopogon caespitosus*		49
Koda	*Ehretia acuminata*	x	
Pigeonberry Ash	*Elaeocarpus kirtonii*		3
Blue Berry Ash	*Elaeocarpus reticulatus*		2
Red-fruited Olive Berry	*Elaeodendron australe*		10
Yellow Ash	*Emmenosperma alphitonioides*		12
Corkwood	*Endiandra sieberi*		25
Cabbage Gum	*Eucalyptus amplifolia* subsp. *amplifolia*	x	
Bangalay	*Eucalyptus botryoides*	x	
River Peppermint	*Eucalyptus elata*	x	
Tallowwood	*Eucalyptus microcorys*	x	
Grey Ironbark	*Eucalyptus paniculata* subsp. *paniculata*	x	
Blackbutt	*Eucalyptus pilularis*	x	
Sydney Peppermint	*Eucalyptus piperita*	x	
Scribbly Gum	*Eucalyptus racemosa*	x	
Red Mahogany	*Eucalyptus resinifera* subsp. *resinifera*	x	
Swamp Mahogany	*Eucalyptus robusta*	x	70
Blue Gum	*Eucalyptus saligna*	x	
Hard-leaved Scribbly Gum	*Eucalyptus sclerophylla (sic)*	x	
Forest Red Gum	*Eucalyptus tereticornis*	x	65
Bolwarra	*Eupomatia laurina*		29
Sand Paper Fig	*Ficus coronata*		6

COMMON NAME	SCIENTIFIC NAME	BU/E	RIVERSDALE
Morton Bay Fig	*Ficus macrophylla f. macrophylla*		7
Small-leaved Fig	*Ficus obliqua* var. *obliqua*		64
Port Jackson Fig	*Ficus rubiginosa*		64
Deciduous Fig	*Ficus henneana*		57
Guoia	*Guoia semiglauca*		5
Native Mulberry	*Hedycarya angustifolia*		9
Willow-leaved Hakea	*Hakea salicifolia* subsp. *salicifolia*	x	
Needlebush	*Hakea sericea*	x	
Smooth Helicia	*Helicia glabrifolia*		1
Bleeding Heart	*Homalanthus populifolius*		7
Australian Indio	*Indigofera australis*	x	
Coastal Teatree	*Leptospermum laevigatum*	x	
Bolly Gum	*Litsea reticulata*		15
Matt-rush	*Lomandra longifolia*		100
Bracelet Honey-myrtle	*Melaleuca armillaris* subsp. *armillaris*	x	
	Melaleuca decora	x	
Swamp Paperbark	*Melaleuca ericifolia*	x	
Snow-in-summer	*Melaleuca linarifolia*	x	
Prickly-leaved Paperbark	*Melaleuca stypheloides*	x	
Thyme honey Paperbark	*Melaleuca thymifolia*	x	
White Cedar	*Melia azedarach*		5
Muttonwood	*Myrsine variabilis*		35
Snow-wood	*Pararchidendron pruinosum* var. *pruinosum*		32
Rough-fruited Pittosporum	*Pittosporum revolutum*	x	10
Bird Lime Tree	*Pisonia umbellifera*		2
Brown Pine	*Podocarpus elatus*		21
Featherwood	*Polyosma cunninghamii*		2
Celery Wood	*Polyscias elegans*		30
Pencil Cedar	*Polyscias murrayi*		10
Black Apple	*Planchonella australis*		1

SPECIES	COMMON NAME	BU/E	RIVERSDALE
Hairy Psychotria	*Psychotria loniceroides*		18
Yellow Aspen	*Sarcomelicope simplicifolia* subsp. *simplicifolia*		5
Flintwood	*Scolopia braunii*	x	
Maidens Blush	*Sloanea australis*		2
Scrub Beefwood	*Stenocarpus salignus*	x	
Turpentine	*Syncarpia glomulifera* subsp. *glomulifera*	x	
False Rosewood	*Synoum glandulosum* subsp. *glandulosum*		34
Brush Cherry	*Syzygium australe*		30
Pepperberry	*Tasmannia insipida*		15
Native Peach	*Trema tomentosa* var. *aspera*		3
Native Heath	*Tropocarpa laurina*		20
Wilkiea	*Wilkea huegeliana*		3

Appendix 3 Plant species located at Bundanon

KEY	
*	not indigenous to Australia
@	Australian species, not indigenous to Shoalhaven LGA
!	species of conservation significance
1.	Carbon Forest plantings (Attwood 2018) and Living Landscapes (Jacobs 2014) and associated grassland
2.	Garden and landscape plantings; also rainforest plantings; Bundanon and Riversdale (see Appendix 2)
3.	Bundanon and associated grassland
4.	Eearie Park; associated grassland and Crown Land
5.	Beeweeree
6.	Riversdale and associated grassland

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
LYCOPODIOPSIDA							
Selaginellaceae							
Selaginella uliginosa	Swamp Selaginella			y	y	y	
PTERIDOPHYTA							
Aspleniaceae							
Asplenium australasicum	Bird's nest Fern			y			y
Asplenium flabellifolium	Necklace Fern			y	y	y	y
Azollaceae							
Azolla filiculoides	Pacific Azolla			y			y
Blechnaceae							
Blechnum cartilagineum	Gristle Fern			y	y	y	y
Blechnum minus	Soft Water Fern			y			
Blechnum nudum	Fishbone Water Fern			y			
Blechnum patersonii subsp. *patersonii*	Strap Water Fern			y			
Doodia aspera	Prickly Rasp Fern			y	y	y	y
Doodia caudata	Small Rasp Fern				y		
Dicksoniaceae							
Calochlaena dubia	Rainbow Fern			y	y	y	y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Cyatheaceae							
Cyathea australis	Rough Tree Fern			y		y	y
Cyathea cooperi	Scaly Tree Fern			y			
Davalliaceae							
Davallia solida var. *pyxidata*	Hare's Foot Fern			y	y		y
Dennstaedtiaceae							
Dennstaedtia davallioides	Lacy Ground Fern			y			
Histiopteris incisa	Bat's wing Fern			y			
Hypolepis muelleri	Harsh Ground Fern			y			
Pteridium esculentum	Bracken, Gurgi	y	y	y	y	y	y
Dryopteridaceae							
Lastreopsis decomposita	Trim Shield-fern			y			
Lastreopsis microsora subsp. *microsora*	Creeping Shield-fern			y	y		
Gleicheniaceae							
Gleichenia dicarpa	Pouched Coral Fern				y	y	
Gleichenia microphylla	Scrambling Coral Fern					y	
Sticherus flabellatus var. *flabellatus*	Umbrella Fern						
Hymenophyllaceae							
Hymenophyllum cupressiforme	Common Filmy Fern			y			y
Lindsaeaceae							
Lindsaea linearis	Screw Fern			y	y	y	
Lindsaea microphylla	Lacy Wedge Fern						y
Lomariopsidaceae							
@ Nephrolepis cordifolia	Fishtail Fern		y				
Osmundaceae							
Todaea barbara	King Fern			y			y
Polypodiaceae							
Platycerium bifurcatum	Elkhorn Fern			y			
Pyrrosia rupestris	Rock Felt Fern			y	y		y
Pteridaceae							
Adiantum aethiopicum	Common Maidenhair			y	y	y	y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Adiantum formosum	Black Stem			y			
Adiantum hispidulum var. *hispidulum*	Rough Maidenhair			y			y
Pellaea falcata	Sickle Fern			y	y	y	y
Pteris tremula	Tender Brake					y	
Schizaceae							
Schizaea bifida	Forked Comb Fern			y	y		
Sinopteridaceae							
Cheilanthes sieberi subsp. *sieberi*	Poison Rock Fern			y	y	y	y
CONIFEROPSIDA							
Araucariaceae							
@ Araucaria bidwillii	Bunya Bunya	y	y				
** Araucaria columnaris*	Cook Pine		y				
** Araucaria heterophyllus*	Norfolk Island Pine	y	y				
Pinaceae							
** Cedrus deodara*	Himalayan Cedar		y				
** Pinus radiata*	Monterey Pine		y				
Podocarpaceae							
** Afrocarpus andinus*	Yellow Wood		y				
Podocarpus elatus	Plum Pine		y				y
Taxodiaceae							
** Taxodium distichum*	Bald Cypress		y				
Zamiaceae							
Macrozamia communis	Burrawang			y	y	y	y
MAGNOLIOPSIDA							
Acanthaceae							
Pseuderanthemum variabile	Pastel Flower			y	y	y	y
Brunoniella australis	Blue Trumpet		y	y		y	y
Brunoniella pumilio	Dwarf Blue Trumpet			y			y
Aizoaceae							
Tetragonia tetragonioides	Warrigal Greens		y	y			y
Amaranthaceae							

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Alternanthera denticulata	Lesser Joyweed			y			
* *Amaranthus retroflexus*	Redroot Amaranth	y	y				
Anacardiaceae							
* *Pistacia chinensis*	Pistachio		y				
Aphanopetalaceae							
Aphanopetalum resinosum	Gum Vine			y			y
Apiaceae							
Actinotus helianthi	Flannel Flower				y	y	y
Actinotus minor	Lesser Flannelflower			y	y	y	y
Centella asiatica	Gotu Cola			y	y	y	y
Cyclospermum leptophyllum	Slender Celery						y
Daucus glochidiatus	Native Carrot			y	y		
Platysace lanceolata	Shrubby Platysace				y	y	
Platysace linearifolia	-				y	y	
Xanthosia tridentata	Rock Xanthosia				y	y	y
* *Foeniculum vulgare*	Fennel	y	y	y			
Apocynaceae							
* *Araujia sericifera*	Moth Vine		y	y			y
Marsdenia flavescens	Hairy Milk Vine			Y		y	y
Marsdenia rostrata	Milk Vine			Y	y	y	y
Marsdenia suaveolens	Scented Marsdenia			y	y	y	y
Parsonsia straminea	Common Silkpod		y	y			
* *Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	y	y	y	y		y
Tylophora barbata	Bearded Tylophora			y			y
Aquifoliaceae							
* *Ilex aquifolium*	Holly		y				
Araliaceae							
Astrotricha latifolia	-			y			y
Hydrocotyle acutiloba	-			y			y
Hydrocotyle geraniiflora	Forest Pennywort		y	y			
Hydrocoytle laxiflora	Stinking Pennywort			y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Hydrocotyle tripartita	Pennywort						
Polyscias murrayi	Pencil Cedar		y	y		y	y
Polyscias elegans	Celery Wood		y	y		y	y
Asteraceae							
* *Ageratina adenophora*	Crofton Weed	y	y	y			y
* *Ageratina ripara*	Mistflower			y			
* *Aster subulatus*	Bushy Starwort			y	y		
C Bidens pilosa	Pitchforks	y	y	y	y	y	y
Brachyscome aculeata	Hill Daisy				y	y	
* *Carduus pycnocephalus*	Slender Thistle	y					
Cassinia aculeata	Dogwood			y	y	y	y
Cassinia trinerva	-						y
* *Chicorium intybus*	Chicory	y	y				
Chrysocephalum apiculatum subsp. *apiculatum*	Common Everlasting				y	y	y
* *Cirsium vulgare*	Thistle	Y	Y	y			
* *Conyza bonariensis*	Flax-leaf Fleabane	Y	Y	y			
* *Conyza sumatrensis*	Tall Fleabane	Y	Y	y			
* *Coreopsis lanceolata*	Calliopsis	Y	y				
* *Cotula coronopifolia*	Water Buttons			y			
* *Delairea odorata*	Cape Ivy	y	y	y			y
Euchiton japonicus	Creeping Cudweed				y	y	
Coronidium elatum subsp. *elatum*	-				y		
* *Hypochaeris radicata*	Cat's Ear	y	y	y			
Lagenophora gracilis	Slender Lagenophora				y	y	
Lagenophora stipitata	Blue Bottle-daisy					y	
Olearia microphylla	-					y	
Olearia tomentosa	Toothed Daisy-bush			y		y	y
Olearia viscidula	Wallaby weed			y			
Ozothamnus diosmifolius	Rice flower			y	y	y	y
Pseudognaphalium luteoalbum	Jersey Cudweed	y	y	y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Senecio pinnatifolius var. *pinnatifolius*	-					y	
Senecio linearifolius var. *arachnoideus*	Fireweed groundsel	y	y	y			y
* *Senecio madagascariensis*	Fireweed	y	y	y			y
Senecio minimus	-				y		
Senecio quadridentatus	Cotton Fireweed				y		
Sigesbeckia orientalis subsp. *orientalis*	Indian-weed	y	y	y	y		
* *Soliva anthemifolia*	Dwarf Jo-Jo	y	y				
* *Sonchus asper*	Prickly Sow-thistle	y	y	y			y
* *Sonchus oleraceus*	Common Sowthistle	y	y				
* *Tagetes minuta*	Stinking Roger	y	y	y	y		
* *Taraxacum officinale*	Dandelion	y	y				y
* *Xanthium spinosum*	Bathurst Burr		y				
Atherospermataceae							
Doryphora sassafras	Sassafras			y	y		y
Basellaceae							
* *Anredera cordifolia*	Madeira Vine	y	y	y			
Bignoniaceae							
* *Catalpa bignonioides*	Indian Bean		y				
* *Jacaranda mimosifolia*	Jacaranda		y				
Pandorea pandorana subsp. *pandorana*	Wonga Wonga Vine		y	y			y
Boraginacaea							
Ehretia acuminata var. *acuminata*	Koda	y		y			
Brassicaceae							
* *Hirschfeldia incana*	Buchan Weed	y	y	y			
Rorippa laciniata	Watercress			y			
* *Rorippa palustris*	Marsh-cress		y	y			
Callitrichaceae							
* *Callitriche stagnalis*	Common Starwort	y	y				
Campanulaceae							
Wahlenbergia communis	Tufted Bluebell		y	y			y
Wahlenbergia gracilis	Sprawling Bluebell			y	y		

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Wahlenbergia stricta subsp. *stricta*	Tall Bluebell			y	y		y
Cannabaceae							
* *Celtis sinensis*	Hackberry		y				
Trema tomentosa var. *aspera*	Native Peach		y	y	y	y	y
Caprifoliaceae							
* *Lonicera japonica*	Japanese Honeysuckle		y				
Caryophyllaceae							
* *Cerastium fontanum*	Mouse-ear Chickweed	y	y				
* *Paronychia brasiliana*	Brazilian Whitlow		y				
Stellaria flaccida	Forest Star-wort			y	y	y	y
* *Stellaria media*	Common Chick-weed		y	y			
Casuarinaceae							
Allocasuarina diminuta subsp. *mimica*							y
Allocasuarina littoralis	Black Oak	y		y	y	y	y
Casuarina cunninghamiana subsp. *cunninghamiana*	River Oak	y	y				
Casuarina glauca	Swamp Oak	y		y			
Celastraceae							
Celastrus australis	Staff Climber			y			
Denhamia silvestris	Orange Bush			y			y
Elaeodendron australe var. *australe*	Red-fruited Olive-plum	y		y	y		y
Chenopodiaceae							
* *Chenopodium album*	Fat Hen	y	y				
* *Chenopodium murale*	Nettle-leaf Goosefoot	y	y				
Einadia hastata	Shrubby Berry-saltbush						y
Chloanthaceae							
Chloanthes stoechadis						y	
Convolvulaceae							
Dichondra repens	Kidney Weed	y	y	y	y	y	y
Crassulaceae							
Crassula sieberiana				y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Cunoniaceae							
Callicoma serratifolia	Black Wattle	y		y		y	y
Ceratopetalum apetalum	Coachwood	y		y			y
Ceratopetalum gummiferum	NSW Christmas Bush			Y	y	y	y
Schizomeria ovata	Native Crab Apple			y			
Dilleniaceae							
Hibbertia acicularis							
Hibbertia aspera subsp. *aspera*	Rough Guinea flower					y	y
Hibbertia dentata	Trailing Guinea-flower			y	y		y
Hibbertia diffusa	Prostrate Guinea-flower				y		
Hibbertia monogyna	-			y	y		
Hibbertia obtusifolia	Hoary Guinea-flower			y			
Hibbertia pedunculata	-					y	
Hibbertia riparia	Erect Guinea-flower			y			
Hibbertia scandens	Climbing Guinea-flower			y			y
Droseraceae							
Drosera binata	Forked Sundew					y	y
Drosera pygmaea	Pygmy Sundew					y	
Drosera spatulata						y	
Ebenaceae							
Diospyros australis	Black Plum			y	y		y
Elaeocarpaceae							
Elaeocarpus kirtonii	White Quandong		y				
Elaeocarpus reticulatus	Blueberry Ash		y	y	y		y
Sloanea australis	Maiden's Blush; cudgerie		y	y			
Tetratheca thymifolia	Thyme-leaf Black-eyed Susan					y	
Ericaceae sf. Epacridoideae							
Brachyloma daphnoides subsp. *daphnoides*	Daphne Heath					y	
Epacris pulchella	Wallum Heath					y	
Epacris microphylla	Coral Heath					y	

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Leucopogon ericoides	Bearded heath					y	
Leucopogon juniperinus	Juniper Beard-heath					y	
Leucopogon lanceolatus subsp. *lanceolatus*	Lance-leaf Beard-heath			y	y		y
Lissanthe strigosa	Peach Heath			y	y	y	y
Melichrus urceolatus	Urn-heath					y	
Monotoca scoparia	Prickly-Broom heath			y	y	y	
Styphelia triflora	Pink Five-corners					y	
Trochocarpa laurina	Waddy Wood		y	y			y
Escalloniaceae							
Abrophyllum ornans	Native Hydrangea			y			y
Polyosma cunninghamii	Featherwood		y				
Euphorbiaceae							
Amperea xiphoclada var. *xiphoclada*	Broom Spurge					y	
Claoxylon australe	Brittlewood			y			y
Homalanthus populifolius	Bleeding Heart Tree			y	y	y	y
Ricinocarpos pinifolius	Wedding Bush					y	
Eupomatiaceae							
Eupomatia laurina	Bolwarra	y		y	y		y
Fabaceae (sf. Caesalpinoideae)							
** Gleditsia triacanthos*	Honey Locust-bean		y				
** Senna pendula* var. *glabrata*	Cassia	y	y	y			y
** Senna septrionalis*	Arsenic Bush			y			
Fabaceae (sf. Faboideae)							
Aotus ericoides	-					y	
Bossiaea ensata	Small Leafless Bossiaea					y	
Bossiaea heterophylla	Variable Bossiaea					y	
Bossiaea obcordata	Spiny Bossiaea					y	y
Daviesia acicularis						y	y
Daviesia alata						y	
Daviesia ulicifolia	Gorse Bitter-pea			y		y	y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Grona varians		y	y	y			y
Dillwynia ramosissima						y	
Dillwynia sieberi	Prickly Parrot-pea				y	y	
** Erythrina x sykesii*	Indian Coral		y				
Glycine clandestina	Love Creeper	y	y	y	y		y
Glycine microphylla				y			
Glycine tabacina	Love Creeper			y			
Gompholobium glabratum	Golden Glory Pea					y	
Gompholobium grandiflorum						y	
Gompholobium minus	Dwarf Wedge-pea					y	
Goodia lotifolia	Clover-tree			y			
Hardenbergia violacea	Purple Twining-pea	y	y	y			y
Hovea linearis	Narrow-leaf Hovea					y	
Hovea longifolia	Long-leaf Hovea					y	
Indigofera australis	Native Indigo	y		y	y		y
Jacksonia scoparia	Dogwood			y			
Kennedia prostrata	Dusky Coral-pea					y	
Kennedia rubicunda	Dusky Coral Pea			y	y	y	y
Machaerina gunnii	Slender Tick-trefoil	y	y	y			y
Maekawaea rhytidophylla	Rusty Tick-trefoil	y		y			
Mirbelia baueri						y	
Mirbelia rubiifolia	Heathy Mirbelia					y	
Phyllota phylicoides	Heath Phyllota					y	
Platylobium formosum	Handsome Flat-pea					y	y
Platylobium parviflorum						y	
Pullenaea gunnii	Slender Tick-trefoil					y	y
Pultenaea blakelyi	Blakely's Bush-pea					y	y
Pultenaea daphnoides	Large-leaf Bush-pea			y			y
Pultenaea retusa	Blunt-leaf Bush-pea					y	
Pultenaea linophylla						y	
Pultenaea stipularis	Handsome Bush-pea					y	y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Pultenaea tuberculata	Wreath Bush-pea					y	
Pultenaea villosa	Hairy Bush-pea			y		y	y
* *Robinia pseudoacacia*	Black Locust		y				
Sphaerolobium vimineum	Leafless globe-pea			y			
* *Trifolium campestre*	Hop Clover	y	y				
* *Trifolium dubium*			y				
* *Trifolium fragiferum*	Strawberry Clover	y	y				
* *Trifolium repens*	White Clover	y	y				
Viminaria juncea	Native Broom			y			y
Fabaceae (Mimosoideae)							
@ *Acacia elata*	Cedar Wattle	y					
Acacia binervata	Two-veined Hickory			y	y		y
Acacia binervia	Coast Myall					y	y
Acacia falcata	Sickle Wattle			y	y		
Acacia filicifolia	Fern-leaved Wattle			y			y
Acacia floribunda	White sally Wattle	y		y			y
Acacia hispidula	Rough-leaved Acacia					y	
Acacia implexa	Hickory			y			
Acacia irrorata subsp. *irrorata*	Rough-stemmed Wattle	y		y	y		y
Acacia linifolia	White Wattle	y					
Acacia longifolia subsp. *longifolia*	Sydney Golden Wattle	y		y	y	y	y
Acacia maidenii	Maiden's Wattle			y			y
Acacia mearnsii	Mearns' Wattle			y			y
Acacia melanoxylon	Blackwood			y	y		y
Acacia myrtifolia	Myrtle Wattle					y	
Acacia obtusifolia	Blunt-leaf Wattle					y	
Acacia suaveolens	Sweet Wattle					y	
Acacia subtilinervis	Net-veined Wattle				y		
Acacia terminalis subsp. *glabrous form* (M. Hancock 94)	Sunshine Wattle					y	
Acacia ulicifolia	Prickly Moses					y	

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Pararchidendron pruinosum var. *pruinosum*	Snow wood; talingora		y	y			
Fagaceae							
* *Quercus robur*	European Oak		y				
Gentianaceae							
* *Centaurium erythraea*	Pink Stars	y	y				
Geraniaceae							
Geranium solanderi var. *solanderi*	Native Cranesbill	y	y	y			y
Goodeniaceae							
Goodenia bellidifolia						y	
Goodenia hederacea subsp. *hederacea*	Ivy Goodenia					y	
Goodenia heterophylla				y	y		
Goodenia ovata	Hop Goodenia			y			y
Scaevola ramosissima	Snake-flower					y	
Haloragaceae							
Gonocarpus micranthus subsp. *micranthus*	Creeping Raspwort			y	y	y	y
Gonocarpus micranthus subsp. *ramosissimus*	Creeping Raspwort					y	
Gonocarpus teucrioides	Raspwort			y			y
Myriophyllum variifolium	Water Millfoil			y			
Hypericaceae							
Hypericum gramineum	Small St John's Wort	y	y	y	y		y
Hypericum japonicum	Matted St John's Wort			y			
* *Hypericum perfoliatum*	St John/s Wort		y				
Lamiaceae							
Plectranthus graveolens				y		y	y
Plectranthus parviflorus	Cockspur flower					y	
Prostanthera incisa	Cut-leaved Mint-bush					y	
Prostanthera lasianthos	Victorian Christmas Tree			y			y
Prostanthera saxicola var. *montana*	Slender Mint-bush					y	
Prostanthera violacea	Violet Mint-bush					y	y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
* *Stachys arvensis*	Stagger Weed	y	y				
Lauraceae							
Cassytha pubescens	Devil's twine			y		y	
* *Cinnamomum camphora*	Camphor Laurel		y				
Cryptocarya glaucescens	Jackwood			y			y
Cryptocarya microneura	Murrogun			y			y
Endiandra sieberi	Corkwood			y			
* *Laurus nobilis*	Laurel		y				
Litsea reticulata	Bolly Gum		y	y			
Lobeliaceae							
Isotoma axillaris						y	
Lobelia purpurascens	Whiteroot	y	y	y	y	y	y
Loganiaceae							
Logania albiflora							y
Mitrasacme polymorpha	Mitre Weed					y	
Loranthaceae							
Amyema congener				y			y
Amyema miquelii				y			
Amyema pendula subsp. *pendula*	Drooping Mistletoe			y			
Dendrophthoe vitellina	Creeping Mistletoe						y
Magnoliaceae							
* *Magnolia grandiflora*	Bull Bay	y					
* *Magnolia x soulangeana*	Saucer Magnolia		y				
Malvaceae sens lat.							
Abutilon oxycarpum				y			
Androcalva fraseri	Brown Kurrajong			y	y		y
Brachychiton populneus subsp. *populneus*	Kurrajong	y					
Brachychiton acerifolius	Flame tree	y		y	y		y
Lasiopetalum ferrugineum						y	
Lasiopetalum parviflorum						y	
* *Malva parviflora*	Mallow	y	y	y			y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
* *Modiola caroliniana*	Red-flowered Mallow	y	y	y			y
* *Sida rhombifolia*	Paddy's Lucerne	y	y	y			y
Meliaceae							
Melia azedarach	White Cedar	y		y	y		y
Synoum glandulosum subsp. *glandulosum*	False Rosewood		y	y			y
Toona ciliata	Red Cedar	y		y			
Menispermaceae							
Sarcopelatum harveyanum	Pearl Vine			y	y		y
Stephania japonica	Snake Vine			y			y
Monimiaceae							
Doryphora sassafras	Sassafras			y			y
Hedycarya angustifolia	Native Mulberry		y	y			
Wilkiea huegeliana	Veiny Wilkiea		y	y			y
Moraceae							
Ficus coronata	Sandpaper Fig	y		y	y		y
Ficus henneana	Deciduous Fig	y		y			y
Ficus obliqua var. *obliqua*	Small-leaved Fig	y		y			y
Ficus rubiginosa	Port Jackson Fig	y	y	y			y
* *Morus alba*	Mulberry		y				
Myrsinaceae							
Aegiceras corniculatum	River Mangrove		y				
Myrsine howittiana	Brush Muttonwood			y			y
Myrsine variabilis	Muttonwood			y			y
Myrtaceae							
Angophora floribunda	Rough-barked Apple	y		y	y		y
Angophora costata subsp. *costata*	Smooth-barked Apple	y	y				
Angophora subvelutina	Broad-leaved Apple	y	y				
@ *Backhousia citriodora*	Lemon-scented Backhousia		y				
Backhousia myrtifolia	Ironwood	y		y			y
Baeckea brevifolia						y	
Callistemon citrinus	Crimson Bottlebrush	y	y	y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Callistemon linearis	Narrow-leaved Bottlebrush			y			
Callistemon salignus	Pink Tips	y		y			y
@ Callistemon viminalis	Weeping Bottlebrush		y				
Calytrix tetragona	Common Fringe-myrtle					y	
Corymbia eximia		y			y		
Corymbia eximia x C. maculata	Bloodwood hybrid	y					
Corymbia gummifera	Red Bloodwood	y	y	y	y	y	y
Corymbia maculata	Spotted Gum	y	y	y	y	y	y
Eucalyptus agglomerata	Blue-leaved Stringybark			y			y
Eucalyptus amplifolia subsp. *amplifolia*	Cabbage Gum	y	y	y			
Eucalyptus botryoides x E. saligna hybrid	Bangalay hybrid	y		y	y	y	y
Eucalyptus botryoides	Bangalay		y				
Eucalyptus camaldulensis	River Red gum	y					
Eucalyptus capitellata	Brown Styringybark					y	
Eucalyptus consideniana	Yertchuck					y	
Eucalyptus elata	River Peppermint	y	y				y
Eucalyptus eugenioides	Thin-leaved Stringybark			y	y	y	y
Eucalyptus globoidea	White Stringybark			y	y		y
Eucalyptus imitans	Southern Sandstone Stringybark					y	
Eucalyptus longifolia	Woollybutt			y			y
@ Eucalyptus microcorys	Tallowwood	y	y				
Eucalyptus paniculata subsp. *paniculata*	Grey Ironbark	y	y	y	y	y	y
Eucalyptus pilularis	Blackbutt	y	y	y		y	y
Eucalyptus piperita	Sydney Peppermint	y	y	y	y	y	y
Eucalyptus punctata	Grey gum			y	y	y	y
Eucalyptus racemosa subsp. *racemosa*	Scribbly gum	y	y			y	y
Eucalyptus resinifera subsp. *resinifera*	Red mahogany	y	y	y			y
Eucalyptus robusta	Swamp Mahogany	y	y				y
Eucalyptus saligna	Sydney Bluegum		y				
Eucalyptus scias subsp. *callimastha*	Large-fruited Red Mahogany	y					

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Eucalyptus sieberi	Silvertop Ash					y	
Eucalyptus sclerophylla (sic)	Scribbly Gum	y	y				
Eucalyptus tereticornis	Forest Red Gum	y	y	y			y
Euromyrtus ramosissima	Rosy Beckea					y	
Kunzea ambigua	Tick Bush			y	y	y	y
Leptospermum arachnoides						y	
Leptospermum juniperinum	Prickly Tea-tree					y	
Leptospermum laevigatum	Coast Tea-tree	y	y				
Leptospermum morrisonii					y	y	
Leptospermum parvifolium						y	
@ Leptospermum petersonii	Lemon-scented Tea-tree		y				
Leptospermum polygalifolium subsp. *polygalifolium*	Tantoon			y	y		y
Leptospermum rotundifolium	Round-leaf Tea-tree					y	
Leptospermum sejunctum							y
Leptospermum trinervium	Flakey-bark Tea-tree			y	y	y	y
@ Lophostemon confertus	Brushbox		y				
Melaleuca armillaris subsp. *armillaris*	Bracelet Honey-myrtle	y	y	y			
@ Melaleuca bracteata	Black Tea-tree	y					
Melaleuca decora	White Feather Honey-myrtle	y	y	y	y	y	y
Melaleuca ericifolia	Swamp Paperbark		y	y			
Melaleuca linariifolia	Snow in Summer	y	y	y	y	y	y
@ Melaleuca quinquenervia	Swamp Paperbark		y				
Melaleuca styphelioides	Prickly-leaf Paperbark	y	y	y	y	y	y
Melaleuca thymifolia	Thyme Honey-myrtle	y	y			y	
! Rhodamnia rubescens	Scrub Turpentine		y				y
Sannantha pluriflora				y		y	
Syncarpia glomulifera subsp. *glomulifera*	Turpentine		y	y	y	y	y
Syzygium australe	Brush Cherry		y	y			y
** Syzygium jambos*	Rose Apple		y				
! Syzygium paniculatum	Magenta Lilly Pilly		y				y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Syzygium smithii (syn. Acmena smithii)	Lilly Pilly	y	y	y	y		y
Tristaniopsis collina	Hill Kanuka					y	
Tristaniopsis laurina	Water Gum			y			y
Nyctaginaceae							
Pisonia umbellifera	Birdlime Tree		y				
Ochnaceae							
* *Ochna serrulata*	Mickey Mouse Plant	y	y	y			y
Oleaceae							
* *Ligustrum lucidum*	Large-leaved Privet	y	y	y			
* *Ligustrum sinense*	Small-leaved Privet			y			y
Notelaea longifolia f. longifolia	Large Mock-olive			y	y		y
Notelaea venosa	Smooth Mock-olive			y			
* *Olea europaea* subsp. *cuspidata*	African olive	y	y				
Onagraceae							
Epilobium billardierianum subsp. *cinereum*	Willow Herb			y			
Ludwigia peploides subsp. *montevidensis*	Water Primrose		y	y			
* *Oenothera stricta* subsp. *stricta*			y				
Oxalidaceae							
* *Oxalis corniculata*		y	y				
Oxalis perennans				y			y
Papaveraceae							
* *Fumaria muralis* subsp. *muralis*	Wall Fumitory	y	y	y			y
Passifloraceae							
* *Passiflora edulis*	Passionfruit			y	y		y
Passiflora herbertiana	Native Passionflower			y	y		
* *Passiflora subpeltata*	White Passionflower			y	y		
Phyllanthaceae							
Breynia oblongifolia	Coffee Bush			y	y	y	y
Glochidion ferdinandi var. *ferdinandi*	Smooth Cheese-tree			y	y	y	y
Glochidion ferdinandi var. *pubens*	Hairy Cheese-tree				y		y
Phyllanthus gunnii	Scrubby Purge					y	

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Phyllanthus hirtellus	Thyme Spurge			y			
Poranthera microphylla						y	
Phytolaccaceae							
* *Phytolacca octandra*	Inkweed	y	y	y			y
Picrodendraceae							
Micrantheum ericoides						y	
Pittosporaceae							
Billardiera scandens	Hairy apple Berry			y	y	y	y
Bursaria spinosa subsp. *spinosa*	Blackthorn		y	y			y
Pittosporum multiflorum	Orange Thorn			y	y		y
Pittosporum revolutum	Rough Pittosporum	y	y	y	y		y
Pittosporum undulatum	Brush Daphne		y	y	y	y	y
Plantaginaceae							
* *Callitriche stagnalis*	-			y			
Gratiola pedunculata	Stalked Brooklime			y			
Plantago debilis	Slender Plantain		y				
* *Plantago lanceolata*	Plantain	y	y	y			y
Platanaceae							
* *Platanus x hispanica 'Acerifolia'*	London Plane		y				
Polygalaceae							
Comesperma ericinum	Matchheads					y	
Polygonaceae							
Muehlenbeckia gracillima	Slender Lignum			y	y		y
Persicaria hydropiper	Water Pepper	y		y			
Persicaria lapathifolia	Pale Knotweed			y			
Persicaria praetermissa				y			
Persicaria prostrata	Creep[ing Knotweed			y			
* *Rumex acetosella*	Sheep Sorrel	y	y	y	y	y	y
Rumex brownii	Swamp Dock		y	y			
* *Rumex conglomeratus*	Clustered Dock	y	y	y			
* *Rumex crispus*	Curled Dock	y	y	Y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
* *Rumex sagittatus*	Turkey Rhubarb			y	y	y	
Primulaceae							
* *Lysimachia arvensis*	Blue Pimpernel	y	y				
Myrsine howittiana	Brush Muttonwood			y	y		
Myrsine variabilis	Muttonwood		y	y			y
Samolus valerandi	Water Pimpernel			y			
Proteaceae							
Banksia ericifolia subsp. *ericifolia*	Heath-leaved Banksia					y	
Banksia paludosa subsp. *paludosa*	Swamp Banksia					y	
Banksia serrata	Old-man Banksia						
Wiriyagan	y	y	y				
Banksia spinulosa	Hairpin Banksia					y	
Conospermum longifolium subsp. *longifolium*						y	
Grevillea arenaria subsp. *arenaria*	Sand Grevillea					y	
Grevillea linearifolia	Linear-leaf Grevillea					y	
@ *Grevillea robusta*	Silky Oak		y				
Hakea dactyloides	Finger Hakea			y	y	y	y
Hakea salicifolia subsp. *salicifolia*	Willow-leaved Hakea	y	y				y
Hakea sericea	Needlebush	y	y			y	
Helicia glabrifolia	Pale Oak	y					
Isopogon anemonifolius	Broad-leaf Drumsticks					y	
Isopogon anethifolius	Narrow-leaf Drumsticks					y	
Lambertia formosa	Mountain Devil					y	
Lomatia ilicifolia	Holly Lomatia					y	
@ *Macadamia integrifolia*	Macadamia		y				
Persoonia levis	Broad-leaved Geebung			y		y	y
Persoonia linearis	Narrow-leaved Geebung			y		y	y
Persoonia mollis subsp. *leptophylla*						y	
Petrophile pedunclulata	Conesticks					y	
Petrophile pulchella	Conesticks					y	

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Stenocarpus salignus	Scrub Beefwood		y	y			y
Xylomelum pyriforme	Woody Pear					y	
Ranunculaceae							
Clematis aristata	Traveller's Joy			y	y	y	y
Clematis glycinoides	Headache Vine						
Guwalyari			y			y	
Ranunculus inundatus	River Buttercup	y	y	y			
Rhamnaceae							
Alphitonia excelsa	Red Ash	y	y	y			y
Emmenosperma alphitonioides	Yellow Ash	y	y				
Pomaderris aspera	Hazel Pomaderris					y	
Pomaderris ferruginea	Rusty Pomaderris					y	
Rosaceae							
* *Cydonia oblonga*	Quince		y				
* *Eriobotrya japonica*	Loquat		y				
* *Potentilla indica*	Indian Strawberry	y	y				
* *Malus x domestica*	Apple		y				
* *Prunus cerasifera*	Chinese Plum		y				
* *Prunus persica*	Peach		y				
* *Rubus anglocandicans*	Blackberry	y	y	y	y		y
Rubus moluccanus var. *trilobus*	Molucca Bramble		y				y
Rubus nebulosus	Green-leaf Bramble		y				
Rubus parviflorus	Native Raspberry		y	y			y
Rubus rosifolius var. *rosifolius*	Rose-leaf Bramble			y			
Rousseaceae							
Abrophyllum ornans	Native Hydrangea			y			y
Rubiaceae							
Asperula conferta	Common Woodruff			y		y	y
Cyclophyllum longipetalum	Brush Canthium			y			
Galium gaudichaudii subsp. *gaudichaudii*	Bedstraw			y			y
Morinda jasminoides				y			y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Opercularia aspera	Coarse Stinkweed	y	y				
Pomax umbellata						y	
Psychotria loniceroides	Hairy Psychotria		y	y			y
Rutaceae							
Acronychia oblongifolia	White Aspen		y	y			y
Boronia thujona						y	
** Calodendrum capense*	Cape Chestnut		y				
Correa reflexa var. *reflexa*	Native Fuchsia					y	
Crowea exalata subsp. *exalata*						y	
Melicope elleryana	Pink-flowered Doughwood		y				
Melicope micrococca	White Euodia		y	y			y
Sarcomelicope simplicifolia subsp. *simplicifolia*	Yellow wood		y	y			y
Zieria cytisoides	Downy Zieria				y		
Zieria pilosa	Hairy Zieria				y		
Zieria smithii	Sandfly Zieria			y	y		y
Salicaceae							
** Populus deltoides*	Cottonwood		y				
** Populus nigra 'Italica'*	Lombardy Poplar		y				
** Salix alba*	White Willow		y				
Scolopia braunii	Flintwood		y	y			y
Santalaceae							
Exocarpos cupressiformis	Cherry Ballart					y	
Exocarpos strictus	Dwarf Cherry					y	
Leptomeria acida	Native Currant					y	
Sapindaceae							
Alectryon subcinereus	Native Quince		y	y			
** Cardiospermum grandiflorum*	Balloon Vine	y	y				y
Diploglottis australis	Native Tamarind	y	y		y		
Dodonaea rhombifolia	Broad-leaf Hop-bush				y		
Dodonaea triquetra	Large-leaf Hop-bush	y	y				

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Dodonaea viscosa subsp. *angustifolia*	Sticky Hop-bush			y			
Guioa semiglauca	Guioa		y	y			y
Sapotaceae							
Planchonella australis	Black Apple		y		y		
Scrophulariaceae							
Myoporum floribundum	Slender Myoporum			y			y
* *Verbascum thapsus* subsp. *thapsus*	Aaron's Rod	y	y				
Veronica calycina	Hairy Speedwell			y			
Veronica plebeia	Creeping Speedwell	y	y	y			y
Solanaceae							
* *Cestrum parqui*	Green Cestrum	y	y		y		
Duboisia myoporoides	Corkwood			y			
* *Physalis peruviana*	Cape Gooseberry	y	y				
* *Solanum americanum*	Glossy Nightshade	y	y				
Solanum aviculare	Kangaroo Apple			y	y		y
* *Solanum mauritianum*	Wild Tobacco	y	y		y	y	
* *Solanum nigrum*	Nightshade	y	y			y	y
Solanum opacum	Green Nightshade			y			
Solanum prinophyllum	Forest Nightshade			y			y
* *Solanum pseudocapsicum*	Madeira Winter Cherry	y	y	y			
Solanum pungetium	Eastern Nightshade			y	y		y
Solanum stelligerum	Devil's needles			y			
Solanum prinophyllum,	Forest Nightshade			y			y
Stackhousiaceae							
Stackhousia monogyna	Creamy Candles					y	
Stackhousia viminea	Slender Stackhousia					y	
Stylidiaceae							
Stylidium graminifolium	Grass Trigger-plant					y	
Stylidium laricifolium	Giant Trigger-plant					y	
Theaceae							
* *Camellia japonica*	Camellia		y				

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
* *Camellia sasanqua*	Sasanqua		y				
Thymeliaceae							
Pimelea linifolia subsp. *linifolia*	Slender Riceflower			y	y	y	y
Tremandraceae							
Tetratheca thymifolia	Black-eyed Susan					y	
Ulmaceae							
* *Ulmus procera*	English Elm		y				
Trema tomentosa var. *aspera*	Native Peach						
Urticaceae							
Dendrocnide excelsa	Giant Stinging Tree		y	y	y		y
Urtica incisa	Stinging Nettle			y	y		y
Verbenaceae							
Clerodendrum tomentosum	Hairy Clerodendrum		y	y	y		y
* *Lantana camara*	Lantana	y	y	y	y	y	y
Violaceae							
Hybanthus monopetalus	Slender Violet-bush					y	
Melicytus dentatus	Tree Violet			y			y
Viola hederacea	Ivy-leafed Violet			y			y
* *Viola odorata*	Sweet Violet		y				
Viola sieberiana				y			
Vitaceae							
Cayratia clematidea	Native Grape			y			y
Cissus antarctica	Kangaroo Vine			y	y		
Cissus hypoglauca	Water Vine			y	y		y
Winteraceae							
Tasmannia inspida	Brush Pepperbush		y				
LILLIDAE							
Alismataceae							
Damasonium minus	Starfruit				y		
Amaryllidaceae							
* *Clivia miniata*	Kaffir Lily		y				

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Araceae							
Gymnostachys anceps	Settler's Twine, Boorgay			y	y	y	y
Spirodela polyrhiza	Duckweed			y			y
Wolffia australiana	Tiny Duckweed			y			
Arecaceae							
Livistona australis	Cabbage Palm, daranggara			y	y		y
Asparagaceae							
Arthropodium milleflorum	Pale Vanilla-Lily					y	
** Asparagus aethiopicus*	Asparagus fern	y	y	y	y	y	y
** Asparagus plumosus*	Climbing Asparagus	y	y				
** Beaucarnea recurvata*	Ponytail Palm		y				
Laxmannia gracilis	Slender Wire Lily					y	
Lomandra confertifolia subsp. *rubiginosa*	Mat-rush			y		y	y
Lomandra filiformis subsp. *coriacea*	Wattle Mat-rush					y	y
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush					y	
Lomandra glauca	Pale Mat-rush					y	
Lomandra gracilis	-					y	
Lomandra longifolia	Spiny-headed Mat-rush		y	y	y	y	y
Lomandra multiflora subsp. *multiflora*	Many-flowered mat-rush			y			y
Lomandra obliqua	-					y	
Asphodelaceae							
Caesia parviflora var. *parviflora*	Pale Grass-Lily					y	
Dianella caerulea var. *caerulea*	Blue Flax-lily			y		y	y
Dianella caerulea var. *producta*				y			
Xanthorrhoea concava						y	
Xanthorrhoea resinosa	Grass tree					y	
Cannaceae							
** Canna CV*	Canna lily		y				
Colchicaceae							
Schelhammera undulata						y	
Commelinaceae							

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Aneilema biflorum	-			y			
Commelina cyanea	Scurvy Weed	y	y	y			y
* *Tradescantia fluminensis*	Wandering Jew	y	y	y	y	y	y
Cyperaceae							
Carex appressa	Tall Sedge	y	y	y			y
Carex fascicularis	Drooping Tassel-sedge			y			
Carex inversa	Knob Tassel-sedge			y			
Carex longebrachiata	Pendulous Tassel-sedge	y	y	y		y	y
Caustis flexuosa	Curly Wig					y	
Cyathochaeta diandra	-			y		y	
* *Cyperus brevifolius*	Mullumbimby Couch	y	y	y			y
* *Cyperus eragrostis*	Umbrella Sedge		y	y			
Cyperus gracilis	Slender flat Sedge			y			
Cyperus polystachyos	-		y				
Cyperus sanguinolentus	-			y			y
Gahnia sieberiana	Red-fruited Saw-sedge			y		y	y
Lepidosperma gunnii	Small Rapier-sedge					y	
Lepidosperma laterale	Variable Sword-sedge					y	
Lepidosperma urophorum	Tussock Rapier-sedge					y	
Schoenus melanostachys	Black Bog-rush			y			
Iridaceae							
Patersonia sericea var. *sericea*	Silky Purple-flag					y	
* *Romulea rosea* var. *australis*	Onion Grass	y	y				
* *Sisyrinchium rosulatum*	Scourweed	y	y				
Juncaceae							
* *Juncus bulbosus*	-		y				
Juncus continuus	-			y	y		
Juncus usitatus	Common Rush	y	y	y	y	y	y
Orchidaceae							
Bulbophyllum exiguuim				y			y
Caleana major	Large Duck Orchid					y	

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Cestichis reflexa				y			y
Cryptostylis erecta	Bonnet orchid						y
Cymbidium suave	Snake Orchid			y			y
Dendrobium linguiforme	Tongue Orchid			y			
Dendrobium speciosum var. *speciosum*	Rock Orchid						y
Dendrobium striolatum	Streaked Rock orchid						y
Pterostylis curta	Blunt Greenhood					y	
Sarcochilus hillii						y	
Thelymitra venosa	Large veined sun orchid					y	
Philydraceae			y	y			
Philydrum lanuginosum	Frogsmouth						
Poaceae							
** Andropogon virginicus*	Whisky Grass	y	y				y
Anisopogon avenaceus	Oat Speargrass			y	y		y
Aristida ramosa	Purple Wiregrass			y			y
Aristida vagans	Three-awn Speargrass			y			y
Austrostipa pubescens				y		y	
Austrostipa rudis subsp. *rudis*						y	
** Axonopus fissifolius*	Carpet Grass	y	y				
** Briza minor*	Shivery Grass	y	y				
** Cenchrus clandestinus*	Kikuyu	y	y				
Cymbopogon refractus	Barbed-wire Grass					y	
Cynodon dactylon	Couch	y	y	y			y
Deyeuxia quadriseta				y			
Dichelachne micrantha	Shorthair Plumegrass			y	y		
Digitaria didactyla	Queensland Blue Couch	y	y				
Digitaria parviflora	Small-flowered Finger-grass						
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass		y	y			y
Echinopogon ovatus	Forest Hedgehog Grass			y	y		
Entolasia marginata	Bordered Panic			y	y		y

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Entolasia stricta	Wiry panic			y	y		y
* *Ehrharta erecta*	Panic Veldtgrass	y	y	y			y
Eragrostis benthamii				y			
Eragrostis brownii	Brown's Lovegrass		y	y			y
* *Eragrostis cilianensis*	Stinkgrass	y	y				
Imperata cylindrica	Blady Grass	y	y	y	y	y	y
Microlaena stipoides var. *stipoides*	Weeping Grass	y	y	y	y	y	y
Oplismenus aemulus	Basket Grass			y	y	y	y
Oplismenus imbecillis	Creeping Beard Grass			y	y	y	y
Panicum simile	Two-colour Panic					y	
Paspalidium criniforme						y	
Paspalidium distans				y			
* *Paspalum dilatatum*	Paspalum	y	y	y			y
Paspalum distichum	Water Couch		y	y			
* *Phalaris aquatica*	Phalaris	y	y	y			
* *Phalaris arundinacea* var. *arundinacea*	Reed Canary Grass	y	y				
Phragmites australis	Native Reed	y	y	y			
* *Phyllostachys aurea*	Fishpole Bamboo		y				
* *Poa annua*	Winter Grass	y	y	y			y
Poa affinis	Tussock			y			
Poa labillardieri var. *labillardieri*	Tussock			y			y
Poa tenera	Soft Tussock						y
Rytidosperma caespitosum	Ringed Wallaby Grass			y	y	y	y
Rytidosperma fulvum	Wallaby Grass			y			
Rytidosperma tenuius		y	y	y	y	y	y
* *Sporobolus africanus*	Parramatta Grass		y				
Sporobolus creber	Slender rat's-tail Grass	y	y	y			y
* *Stenotaphrum secundatum*	Buffalo	y	y				
Themeda triandra	Kangaroo Grass	y	y	y	y	y	y
Potamogentonaceae							
Potamogeton sulcatus	Pondweed			y			

SCIENTIFIC NAME	COMMON NAME	1	2	3	4	5	6
Ripogonaceae							
Ripogonum album	White Supplejack			y			y
Smilacaceae							
Smilax australis	Lawyer Vine			y	y	y	y
Smilax glyciphylla	Sweet Sarsparilla			y	y	y	y
Typhaceae							
Typha orientalis	Broad-leaf Cumbungi		y	y	y	y	y
Zygophyllaceae							
** Tribulus terrestris*	Caltrop	y	y	y	y		y

Opposite: Bushland at Bundanon. Photo: Rachel Tagg.