

# Vegetation and floristics of Columbey National Park, lower Hunter Valley, New South Wales

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**Abstract:** A vegetation survey was undertaken within Columbey National Park (32° 35'S, 151° 44'E) near Clarence Town in the lower Hunter Valley of New South Wales. Multivariate cluster analysis and non-metric multi-dimensional scaling were carried out on plot-based data to classify the vegetation into twelve native communities (one plantation), and each compared with a larger regional dataset. A vegetation map was also prepared, based heavily on extensive ground-data supplemented with aerial photographic interpretation.

Although small in size, this reserve conserves good examples of the endangered Lower Hunter Spotted Gum-Ironbark Forest (475 ha) and River-Flat Eucalypt Forest on Coastal Floodplains (124 ha), together with a small parcel of Hunter Lowlands Redgum Forest (3.7 ha). Collectively, these Endangered Ecological Communities occupy approximately 70% of the 870 ha reserve. Small populations of the threatened and previously unreserved orchid, *Pterostylis chaetophora* are present in the reserve, together with the Endangered *Corybas dowlingii* and the regionally significant cycad, *Macrozamia flexuosa*. An historical record of *Eucalyptus glaucina* could not be substantiated during the current survey, and may have been recorded in error. A total of 349 vascular plant taxa were recorded, including 25 weed species.

The vegetation present within Columbey National Park bears strong resemblance to that in the Cessnock region of the Hunter Valley (Bell 2004; DECC 2008), a feature attributed to similar rainfall and soil types. Vegetation communities common between the two areas include Lower Hunter Spotted Gum – Ironbark Forest, Red Ironbark Scrub-Forest, Paperbark Soak Forest, Floodplain Redgum-Box Forest and Gully Rainforest. Unlike the Cessnock area, however, Columbey has not been subject to illegal rubbish dumping to any great degree.

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## Introduction

Columbey National Park (NP) conserves approximately 870 ha of land adjacent to the township of Clarence Town in the lower Hunter Valley. It was proclaimed in July 2007 and occupies the majority of the former Uffington State Forest. Investigations as part of a larger study reviewing the status and distribution of the endangered Lower Hunter Spotted Gum – Ironbark Forest (Bell in prog.) prompted a full floristic survey and classification to be undertaken within the reserve, on behalf of the NSW Department of Environment and Climate Change.

### *Location and environmental Setting*

Columbey National Park (32° 35' S, 151° 44' E) is located immediately west of Clarence Town, on the lower Williams River in the Hunter Valley, within the local government areas of Dungog and Port Stephens (Figure 1). The majority of

the reserve (788 ha) lies between the south-easterly flowing Wallaroo Creek and the Newcastle-Chichester water pipeline, with a smaller separate portion (81 ha) at Stonequarry Hill approximately 2km to the west. Topography in the major portion ranges from approximately 10 m ASL in the south, to 100 m ASL at Tower Hill in the centre of the reserve. At Stonequarry Hill, the more rugged terrain ranges from 40m – 160 m ASL. Columbey Sugarloaf, rising to a height of 218 m, lies approximately 1km west of the reserve, and Wallaroo Nature Reserve occurs 5 km to the south-east. The entire reserve drains via Wallaroo and Tumbledown Creeks into the Williams River.

The geology of the area is predominantly Carboniferous in age, with the sandstone-dominated Wallaringa Formation of the Tamworth fold belt the most widespread lithology. Stonequarry Hill is entirely comprised of the conglomerate-dominated Mount Johnstone Formation (DMR 1999). Major creeklines in the reserve, such as Wallaroo Creek and tributaries of Tumbledown Creek, support often deep

deposits of alluvium. Soil landscapes have been mapped and described by Matthei (1995), and are dominated (~80%) by moderately deep, well-to-imperfectly drained Yellow Soloths, and shallow moderately-drained Lithosols of the Clarence Town soil landscape. Other less common soil types include deep well-drained Yellow and Brown Soloths and rapidly-drained Lithosols and Bleached Loams (~13%); and well-drained and moderately deep alluvium on alluvial plains, and deep well-drained siliceous sands in stream channels (~7%).

The Hunter Valley falls within a warm temperate climatic zone, with a maritime influence near the coast, and experiences warm wet summers and cool dry winters. Rainfall generally peaks in late Summer and early Autumn, although local variations due to topography are evident. Annual average rainfall ranges from 925 mm at Paterson (10km west) to 1152 mm in Wallaroo State Forest (14km east). Temperatures range from a daily average low of 6° C in July, to a high of 29.6° C in January (Bureau of Meteorology 2008).

#### Previous botanical studies

Little previous botanical survey has been carried out within Columbe. Prior to dedication as a National Park, parts of Uffington State Forest were sampled for regional vegetation classification and mapping studies (eg: North Coast CRA, LHCCREMS); however no comprehensive study has been completed. Significant plant species previously recorded from the general area around Columbe include *Angophora*

*inopina*, *Callistemon linearifolius*, *Cynanchum elegans*, *Diuris pedunculata*, *Eucalyptus glaucina*, *Grevillea parviflora* subsp. *parviflora*, *Syzygium paniculatum*, *Tetratheca juncea* (all threatened), and *Macrozamia flexuosa*, *Eucalyptus fergusonii* subsp. *fergusonii* (rare) (NSW Wildlife Atlas, April 2009). *Eucalyptus glaucina* has been previously recorded from the reserve area, although the two records date from 1893 and 1906 and their precise locations are unclear. Vegetation within the nearby Wallaroo Nature Reserve is documented in Bell (2002).

## Methods

### Floristic survey

Vegetation survey was predominantly conducted in Columbe in October and November 2008, with additional sampling in April and May 2009. Sampling plots were surveyed across all parts of the reserve, and locations were selected on the basis of major observed differences in the vegetation so that all variations present could be examined. This entailed an initial reconnaissance of the entire reserve prior to sampling (facilitated by the profusion of fire trails present), followed by allocation of sampling plots in representative locations and with as many replicates as possible. Sampling was also undertaken in previously mapped soil and lithology types. All sample plots were of 0.04 ha (nominally 20 x 20 m, or 40 x 10 m in riparian areas) and located within homogeneous stands of vegetation. Modified (1–6 scale: 1 = few

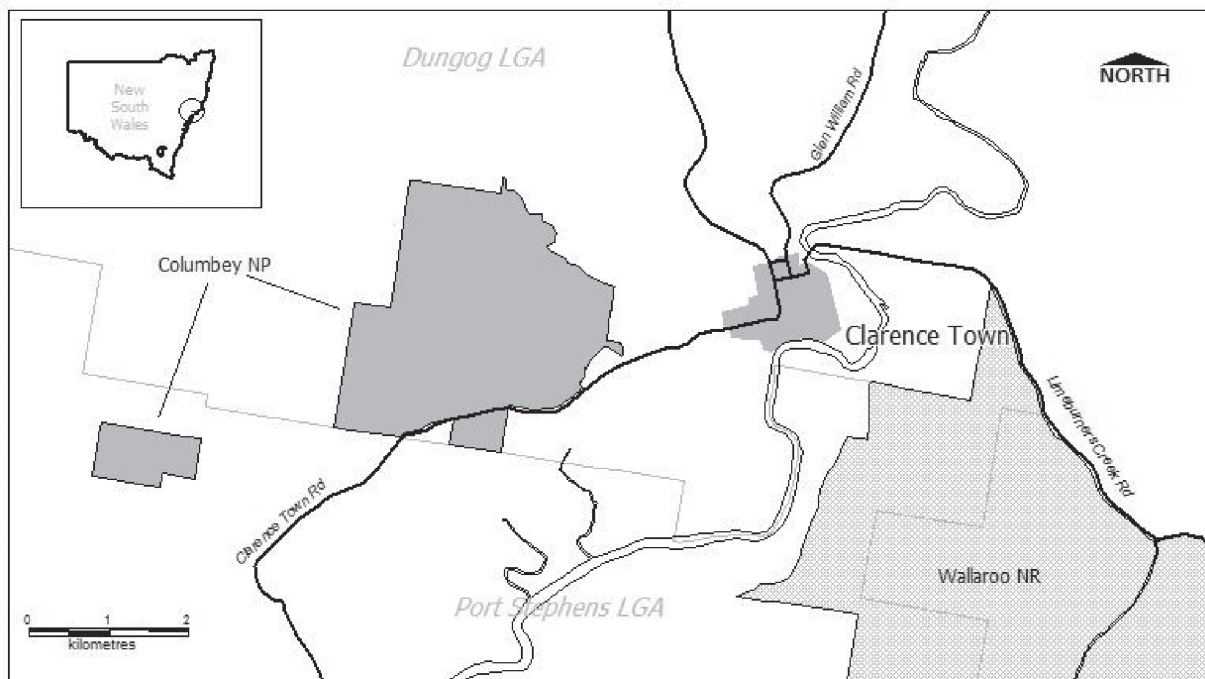


Fig. 1. Location of Columbe National Park.

individuals, <5% cover; 2 = many individuals, <5% cover; 3 = 5–25% cover; 4 = 26–50% cover; 5 = 51–75% cover; 6 = 76–100% cover) Braun-Blanquet cover abundance scores (Braun Blanquet 1928) were applied to all vascular plant species recorded within each quadrat. Plant nomenclature followed Harden (1990–1993) and revisions accepted by the National Herbarium of New South Wales (via the PlantNet web site <http://plantnet.rbgsyd.nsw.gov.au>). Structural data were also collected at each sample plot, including estimated height range, percentage cover and dominant species present in each observable stratum.

#### Data analysis & community definition

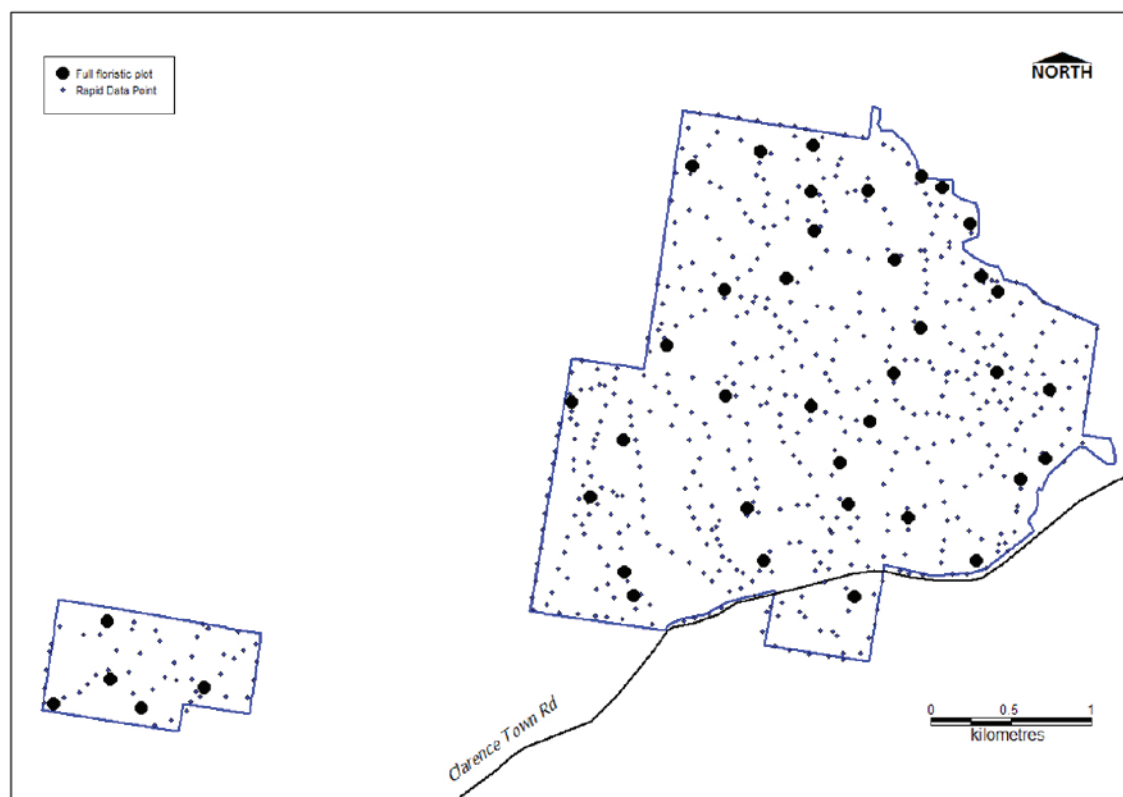
Cluster analysis and non-metric multidimensional scaling (nMDS) were performed on the dataset using *Primer V6* (Clarke & Gorley 2006), utilizing the group averaging strategy, the Bray-Curtis association measure and a Beta value of  $-0.1$ . The SIMPER routine in *Primer* was used to generate diagnostic species lists for each defined floristic group, by decomposing average Bray-Curtis dissimilarities between all pairs of samples (one from each defined group) into percentage contributions from each species. Analysis of similarity within and between pre-defined floristic groups was undertaken with the ANOSIM routine in *Primer*, by testing the null hypothesis that there were no floristic differences between samples within the defined groups.

#### Targeted survey

Threatened species searches were conducted in concert with full floristic plot sampling, as well as through targeted searches in habitats known to support specific species elsewhere. Foot traverses in selected areas were made with a hand-held GPS unit (Garmin GPSmap 60CSx) and significant plant species recorded where encountered. GPS data was downloaded and imported into mapping layers on completion of each field search. Particular searches were made along drainage lines for *Eucalyptus glaucina*, given the pre-existing record near the southern boundary of the reserve. In this case, most drainage lines in the southern half of the reserve were searched, and all redgums encountered in the field were identified through general habit, leaf colour (extent of glaucousness) and fruit/bud morphology. Binoculars were used to assist in examining canopy characteristics.

#### Vegetation Community mapping

Mapping of vegetation communities was accomplished through the collection of dominant species information at numerous locations throughout the reserve. These Rapid Data Points (RDPs) are essentially summaries of floristic information tied to a specific ground location using a Garmin GPSmap 60CSx, and later transferred to the GIS. Information recorded included canopy, shrub and ground



**Fig. 2.** Distribution of Rapid Data Points (RDPs) (small dots) and full floristic plots (large dots) across Columbeby National Park.

dominants, together with miscellaneous notes on condition and a field-applied vegetation community code. Initially, all trafficable paths across the study area were driven in 4WD vehicle recording RDPs. Those areas lacking extensive trail networks, including poorly maintained fire trails, were then traversed on foot with a hand-held GPS unit, recording the same information. A large dataset of summary information was rapidly collected to use in vegetation mapping procedures.

During field reconnaissance 550 Rapid Data Points (RDPs; 1 point per 0.63 ha) were collected in Columbey NP (Figure 2). At each of these points, information on dominant plant species in each stratum was recorded and imported directly into the vegetation mapping process. All points were initially given a draft vegetation community code in the field, which was reviewed after classification analysis of full floristic data.

Within Mapinfo® Geographical Information System (GIS), observable photo-patterns from orthorectified colour aerial photographs (1:25000 scale, supplied by LPI) were scrutinised and cross-referenced to RDP data collected in the field. All RDP data collected and recorded on GPS was attributed a map unit code reflecting the final floristic classification, and overlain on the base map to check and code each polygon accordingly.

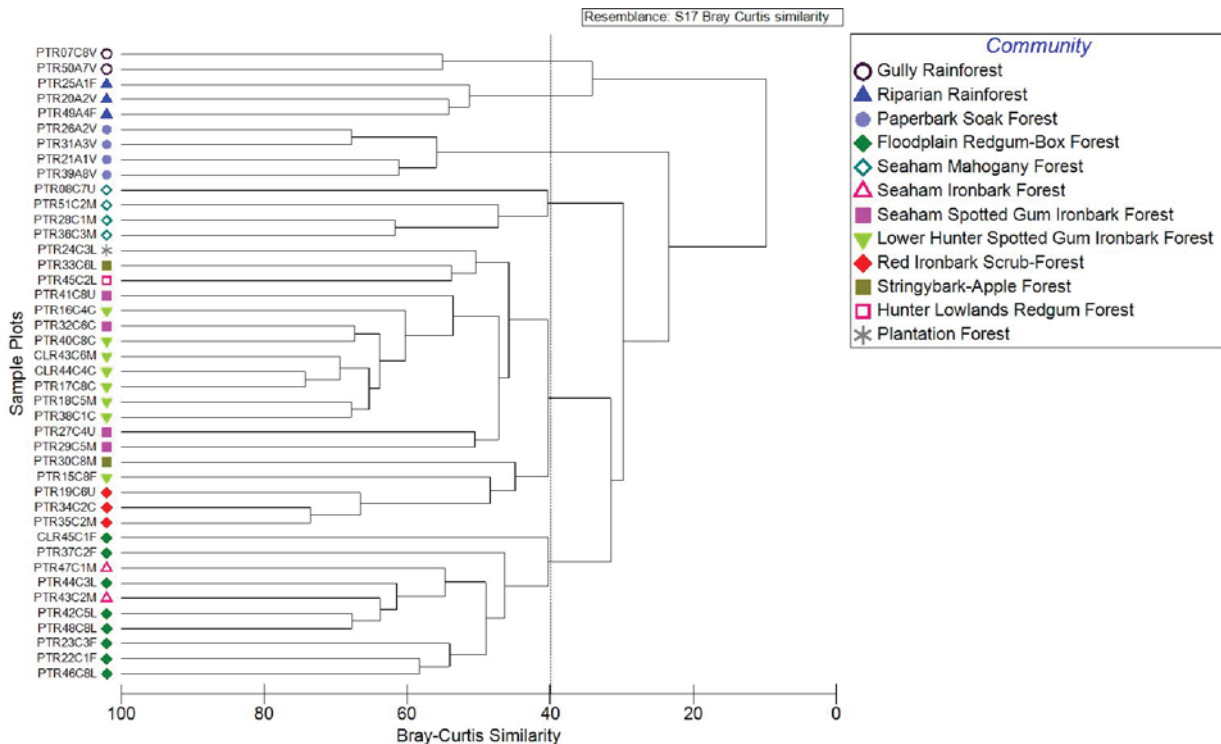
## Results

### *Sampling intensity & species diversity*

A total of 42 full floristic sampling plots were completed as part of this study (see Figure 2 for locations). One sampling plot was located within Crown reserve along Cemetery Road to the east of the reserve, but was included in the analysis due to its close proximity. This intensity of sampling represents approximately one sample per 21 hectares of vegetation. There were 349 taxa were recorded in Columbey NP reserve including 25 weed species. The most common species recorded across all sampling plots were the grasses *Microlaena stipoides* var. *stipoides*, *Entolasia stricta* and *Aristida vagans*, and the herbs *Pratia purpurascens*, *Brunoniella australis* and *Dichondra repens*. *Cheilanthes sieberi* subsp. *sieberi* was the most commonly recorded fern, while *Leucopogon juniperinus*, *Notelaea longifolia* forma *longifolia* and *Bursaria spinosa* were the most frequent shrubs. *Corymbia maculata* was the most frequent canopy species. A full species list for Columbey is given in Appendix 1.

### *Data analysis and vegetation mapping*

Multivariate cluster analysis of 42 sample plots and 325 native plant taxa resulted in the definition of 6 major groups



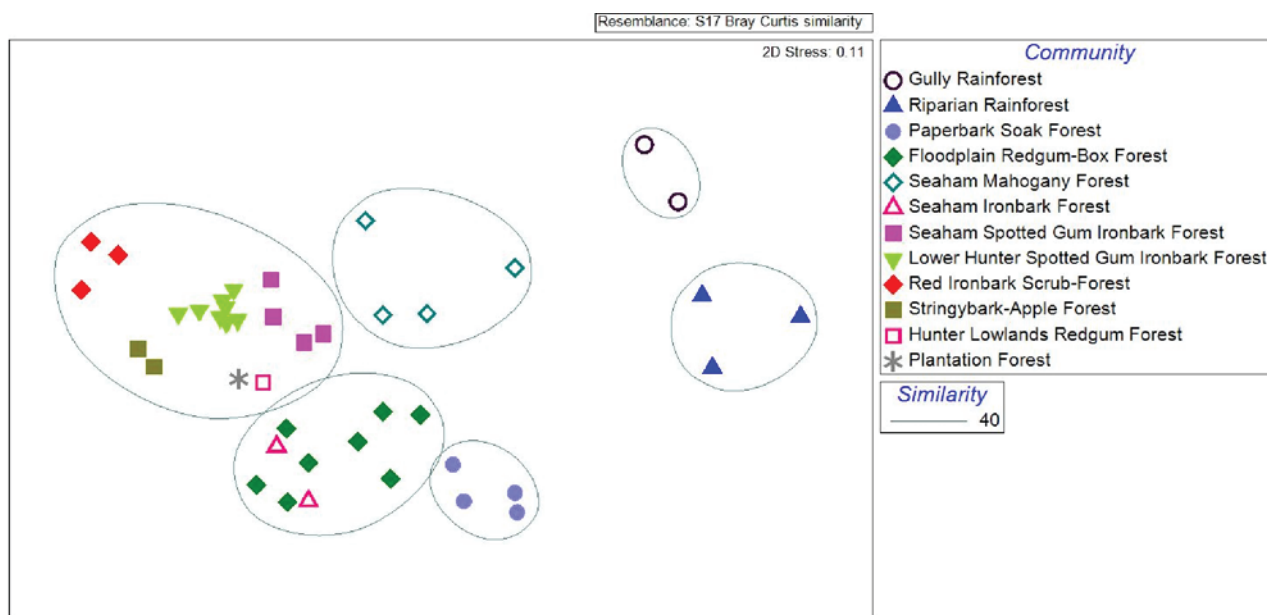
**Fig. 3.** Site dendrogram showing the relationship between all sample plots (Bray-Curtis association measure). Floristic groups defined at 40% similarity (vertical dotted line).

at 40% similarity, or 0.60 dissimilarity (Figure 3). On further interrogation, one of these groups can be further divided into 6 finer-scale groups, although some of these are poorly defined due to lack of sample replication. This represents a fine resolution of observable floristic variation, with other classifications often limited to 20–30% similarity (0.7–0.8 dissimilarity). Five of the 12 ultimate groups have been previously defined in the LHCC regional classification (which excludes Dungog LGA: NPWS 2000), while one represents a former forestry plantation. Sample plot PTR45C2L comprises a small area of regrowing *Eucalyptus tereticornis* forest on a lower slope, which grouped closest to the single plot comprising the Plantation Forest (PTR24C3L) and one of the Stringybark-Apple forest plots, dominated by *Eucalyptus globoidea* (PTR33C6L). Plots comprising the closely related Lower Hunter Spotted Gum-Ironbark Forest, Seaham Spotted Gum-Ironbark Forest, and the Red Ironbark Scrub-Forest were not clearly defined in the cluster analysis, although the nMDS ordination provided better resolution of these communities. The two plots comprising the Seaham Ironbark Forest (PTR43C2M, PTR47C1M) had both been impacted upon by grazing activities in the past, and grouped within the Floodplain Redgum-Box Forest group. This is understandable given the dominance of grasses and herbs in these two communities. Four distinct forms of Floodplain Redgum-Box Forest are recognisable in the field (Cabbage Gum forest, Grey Box forest, Forest Redgum forest, and Ironbark forest); however the history of grazing and other disturbances did not allow a consistent pattern to emerge in the cluster analysis. Non-metric multidimensional scaling strongly supported the groupings evident in the cluster

analysis, with a low stress level of 0.11 and strong congruence with the cluster analysis groups (Figure 4). All defined groups are well separated in 2-dimensional space, with the exception of the closely related Spotted Gum – Ironbark communities, and the Floodplain Redgum-Box Forest group noted above. Note the location of the four Seaham Spotted Gum – Ironbark Forest sample plots compared to their positions in the cluster analysis (Figure 3).

The analysis of similarity of species composition between defined groups of sample plots revealed an overall Global R value of 0.882 ( $p = 0.001$ ). Significant differences were also evident between all defined communities in the pairwise analysis, except for Plantation Forest which had only one sample (Table 2). Comparisons from most groups returned R values at or close to unity, indicating within group similarity to be greater than between group similarity. Low values evident for Seaham Mahogany Forest with Seaham Spotted Gum – Ironbark Forest (0.56), and the latter community with Lower Hunter Spotted Gum-Ironbark Forest (0.58), Floodplain Redgum-Box Forest (0.62), and Plantation Forest (0.67) suggest poorer resolution of these communities when based on floristic differences alone, and low sample replication may have contributed to this result. The R value of  $-0.08$  between Seaham Ironbark Forest and Floodplain Redgum-Box Forest suggests no floristic difference between these two communities, however the two occur in differing environments (slopes vs floodplain) and have been retained as separate communities on this basis.

Vegetation Community profiles of each vegetation community in Columbeby National Park are provided in



**Fig. 4.** nMDS plot showing the relationship between all sample plots, overlain with cluster analysis groups (40% similarity, Bray-Curtis association measure) from Figure 3.

**Table 2. ANOSIM results (Global R values) for pair-wise comparisons of *a priori* vegetation groups.**

	LHSGIF	FRBF	GR	SMF	RIS-F	RR	PSF	PF	SSGIF	SAF	SIF	HLRF
LHSGIF												
FRBF	0.97											
GR	1	1										
SMF	0.97	0.87	0.96									
RIS-F	0.95	1	1	1								
RR	1	1	1	1	1							
PSF	1	0.90	1	0.99	1	1						
PF	0.92	0.88	1	0.75	1	1	1					
SSGIF	0.58	0.62	1	0.56	1	1	1	0.67				
SAF	0.90	0.99	1	1	1	1	1	1	1			
SIF	1	-0.08	1	0.96	1	1	1	1	0.93	1		
HLRF	0.79	0.59	1	0.83	1	1	1	-	0.75	0.00	1	

LHSGIF = Lower Hunter Spotted Gum – Ironbark Forest  
 FRBF = Floodplain Redgum – Box Forest  
 GR = Gully Rainforest  
 SMF = Seaham Mahogany Forest  
 RIS-F = Red Ironbark Scrub-Forest  
 RR = Riparian Rainforest

PSF = Paperbark Soak Forest  
 PF = Plantation Forest  
 SSGIF = Seaham Spotted Gum – Ironbark Forest  
 SAF = Stringybark – Apple Forest  
 SIF = Ironbark Forest  
 HLRF = Hunter Lowlands Redgum Forest

**Table 4 Vegetation community extent, Columbey NP.**

Unit	Community	Extent (ha)	% of total
1	Gully Rainforest	7	0.8
2	Riparian Rainforest	20	2
3	Paperbark Soak Forest	5	0.6
4	Floodplain Redgum – Box Forest	124	15
5	Seaham Mahogany Forest	39	5
6	Seaham Ironbark Forest	8	1
7	Seaham Spotted Gum – Ironbark Forest	107	13
8	Lower Hunter Spotted Gum – Ironbark Forest	419	52
9	Red Ironbark Scrub-Forest	56	7
10	Stringybark – Apple Forest	3	0.3
11	Hunter Lowlands Redgum Forest	4	0.5
12	Plantation Forest	17	2
D	Dam	0.1	0.01
Xr	Disturbed: Canopy only	2	0.2
Total		810	100

Appendix 2. These include lists of those species contributing the top 90% in diversity for each, as obtained through the SIMPER procedure in *Primer*. Community profiles provide information to enable identification of that community in the field including a summary map showing the distribution of each community within the reserve. For each vegetation community, a summary of the basic structural makeup of that unit is given. The accuracy of structural information presented with each profile is governed by the sample size of each community (shown as “n” in the structural tables).

Where possible, the equivalent vegetation classification within other regional assessments have been provided under the community name, to assist in regional comparisons and significance assessments.

A vegetation map for Columbey National Park (Figure 5), based on aerial photo interpretation, floristic classification and detailed ground reconnaissance shows the distribution of vegetation communities. The areal extent of each community within the reserve is shown in Table 4. Brief descriptions of the communities defined for Columbey are given below.

1. Gully Rainforest: noted only in the more rugged topography of the Stonequarry Hill section, this community is dominated by *Backhousia myrtifolia*, *Scolopia braunii*, *Melaleuca styphelioides*, *Syzygium australe* and *Streblus brunonianus* in the canopy, over a range of rainforest-affiliated species such as *Hibiscus heterophyllous*, *Dioscorea transversa*, *Myrsine variabilis*, *Podocarpus elatus*, *Elaeodendron australis*, *Lomandra longifolia* and *Pellaea falcata*. Emergent eucalypts from the surrounding landscape are also evident, including *Corymbia maculata*, *Eucalyptus acmenoides*, *Eucalyptus canaliculata* and *Eucalyptus moluccana*.
2. Riparian Rainforest: narrowly occurring along major creeklines such as Wallaroo Creek, on deep sandy alluvium. Dominated by *Tristaniopsis laurina*, *Backhousia myrtifolia*, *Melicope micrococca*, *Acronychia wilcoxianum*, *Acmena smithii*, and *Cryptocarya microneura*. Emergent eucalypts (eg: *Eucalyptus acmenoides*, *Eucalyptus tereticornis*) are also present, as are the occasional *Casuarina cunninghamiana* and *\*Grevillea robusta*. The latter species does not naturally occur south of Coffs Harbour on the far North Coast (Hill 2002), and hence the presence in Columbey is likely to have dispersed from the nearby Clarence Town village where it has been widely planted.
3. Paperbark Soak Forest: occurs along drainage lines and is dominated by *Melaleuca linariifolia*, occasionally with *Melaleuca styphelioides*, over a dense ground layer of *Carex longebrachiata*, *Carex appressa* and other sedge species. Emergent eucalypts (*Eucalyptus tereticornis*, *Eucalyptus amplifolia* subsp. *amplifolia*, *Eucalyptus siderophloia*) are also present in many locations. Many small examples of this community occur within the Floodplain Redgum-Box Forest.
4. Floodplain Redgum – Box Forest: restricted to major creeklines and their associated flood-outs. It can be dominated by any of *Eucalyptus amplifolia* subsp. *amplifolia*, *Eucalyptus siderophloia*, *Eucalyptus tereticornis* or *Eucalyptus moluccana*. Examples dominated by each are present within the reserve, which are readily recognised in the field. *Angophora floribunda* also occurs as a canopy dominant in limited areas. Some locations have been previously cleared and now support regrowth vegetation, while others show few signs of disturbance. This community is consistent with the River-Flat Eucalypt Forest on Coastal Floodplains EEC (NSW Scientific Committee 2005a).
5. Seaham Mahogany Forest: dominated by *Eucalyptus acmenoides*, *Eucalyptus siderophloia* and *Allocasuarina torulosa*, this community occurs on well sheltered slopes such as the southern side of Tower Hill. The understorey is dominated by *Notelaea longifolia* forma *longifolia* and includes a high diversity of grasses and herbs such as *Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillus*, *Desmodium gunnii*, *Pratia purpurascens*, *Veronica plebeia* and *Scutellaria humilis*.
6. Seaham Ironbark Forest: located in two areas of the reserve, both of which have been disturbed by previous clearing and grazing, and both are dominated by even-aged stands of *Eucalyptus crebra* and/ or *Eucalyptus siderophloia*. Shrubs are generally sparse or absent, but a diverse ground layer of grasses and herbs is present. It is probable that this community is an artifact of past clearing, and has been recolonised by nearby standing remnant trees, particularly *Eucalyptus crebra*.
7. Seaham Spotted Gum – Ironbark Forest: dominated by *Eucalyptus siderophloia*, *Eucalyptus crebra*, *Corymbia maculata* and *Eucalyptus moluccana*, often with *Eucalyptus tereticornis*. Occurs on the higher ridges and hills, such as Tower Hill. Understorey species include *Bursaria spinosa*, *Acacia falcata*, *Lissanthe strigosa*, *Jacksonia scoparia*, *Cymbopogon refractus*, *Themeda australis*, *Aristida vagans*, and a high diversity of herbs.
8. Lower Hunter Spotted Gum – Ironbark Forest: dominated by *Eucalyptus fibrosa*, *Corymbia maculata* and *Eucalyptus umbra*. In places, *Eucalyptus moluccana* can also be present. Tends to occur on the lower undulating slopes at low elevation, with typical understorey species including *Daviesia ulicifolia* subsp. *ulicifolia*, *Bursaria spinosa*, *Pultenaea villosa*, *Entolasia stricta*, *Aristida vagans*, *Macrozamia flexuosa*, and *Lomandra confertifolia* subsp. *pallida*. This community is consistent with the Final Determination for the EEC of the same name (NSW Scientific Committee 2005b), and was supported in the data analysis.
9. Red Ironbark Scrub-Forest: dominated by *Eucalyptus fibrosa* over a dense understorey of *Melaleuca nodosa*. *Corymbia maculata* may also be present but in very low abundance. This community occurs toward the north of the reserve, and supports a number of species such as *Phyllota phyllicoides*, *Lomandra glauca*, *Gompholobium pinnatum*, *Patersonia sericea*, *Dillwynia retorta*, *Xanthorrhoea latifolia* subsp. *latifolia* and *Banksia spinulosa* var. *collina*, which in the lower Hunter Valley occur more commonly on sandstone substrates.
10. Stringybark – Apple Forest: occurs in two locations within the wider LHSGIF landscape. Dominated by *Eucalyptus globoidea*, but with *Angophora costata* or *Eucalyptus fibrosa* present in one area. This community is typified by the presence of more typical sandstone species, such as *Banksia spinulosa*

var. *collina*, *Xanthorrhoea latifolia*, *Podolobium scandens*, *Laxmannia gracilis*, *Gompholobium pinnatum* and *Aristida warburgii*. Given the small size of both locations present, it is not surprising that their floristic composition is heavily influenced by the surrounding LHSGIF, hence their close ties to that community in the data analysis.

11. Hunter Lowlands Redgum Forest: a single location of this community occurs in a previously cleared and grazed landscape. Dominated by *Eucalyptus tereticornis* over a grassy ground layer of *Themeda australis*, *Aristida warburgii*, *Aristida vagans* and *Ptilothrix deusta*. Shrubs such as *Acacia falcata*, *Acacia irrorata*, *Pultenaea villosa* and *Bursaria spinosa* are also present. The floristic composition present at this site is consistent with the Final Determination for the EEC of the same name (NSW Scientific Committee 2003).
12. Plantation Forest: between Plantation Road and Clarencetown Road, areas of plantation eucalypt forest occur, in mostly well-defined rows. For all intents and purposes these areas possess a native understorey of species typical of elsewhere in the

reserve. Planted eucalypts noted include all locally occurring species, such as *Eucalyptus siderophloia* (dominant), *Eucalyptus fibrosa*, *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Corymbia maculata*. An area of *Callitris endlicheri* (not locally endemic) is also present adjacent to Clarencetown Road. Other areas of plantation include *Eucalyptus resinifera*, particularly towards the middle of the reserve.

## Discussion

### *Conservation significance of vegetation communities*

For Columbe National Park 12 vegetation communities have been delineated using multivariate clustering and nMDS techniques, including one plantation forest type. For a small reserve this shows surprising diversity, ranging from riparian rainforest on deep alluvial soils to dryer open forests on hard-setting clays. There were 349 native plant species including 25 weed species recorded for the reserve.

Three Endangered Ecological Communities are present within Columbe NP. Collectively these occupy just over

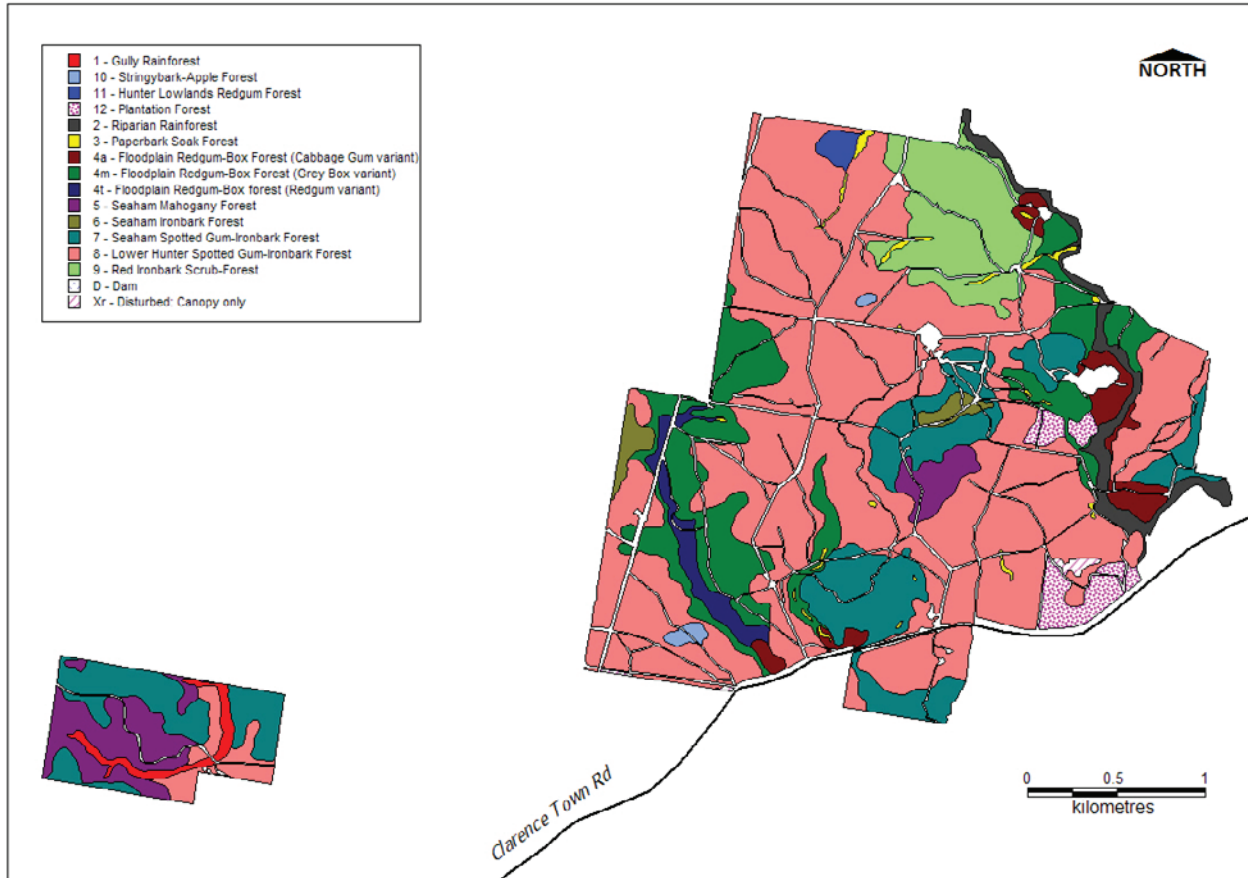


Fig. 5. Vegetation map of Columbe National Park.



600 ha or 69% of the entire reserve (Table 6, Figure 6). Sizeable areas of Lower Hunter Spotted Gum – Ironbark Forest (including the Red Ironbark Scrub-Forest) occur across the reserve area and are significant for conserving this EEC near its northern limit of distribution. Only Werakata National Park and State Conservation Area near Cessnock support this EEC elsewhere (Bell 2004; DECC 2008).

The various forms of Floodplain Redgum-Box Forest occurring along major creek lines and flood-outs support vegetation broadly ascribable to the River-Flat Forest on Coastal Floodplains EEC. While broad in nature, this EEC encapsulates vegetation associated with major drainage lines and which traditionally have been cleared or disturbed for agriculture. The presence of *Eucalyptus*

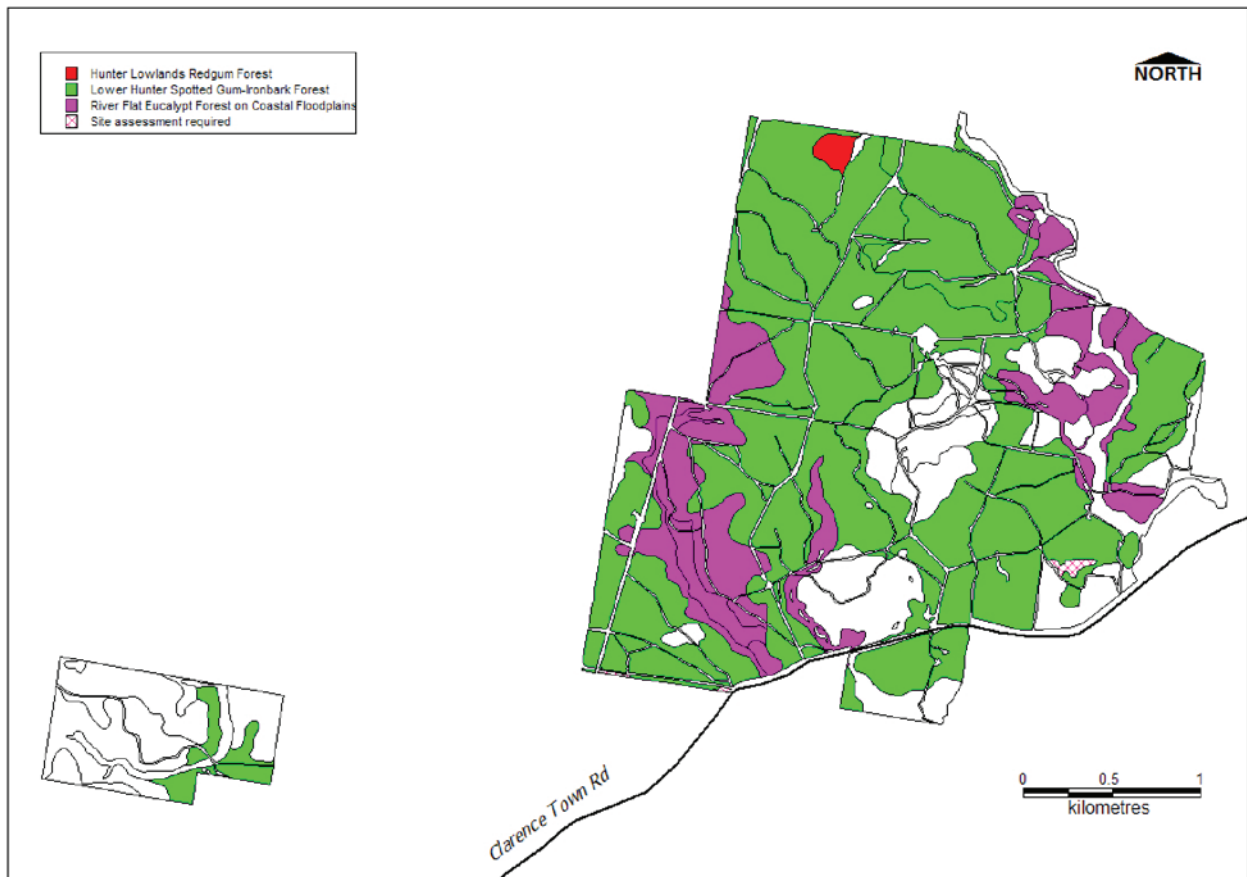
*amplifolia*, *Angophora floribunda*, *Eucalyptus tereticornis* and *Eucalyptus moluccana* in these environments within the reserve typifies this community.

Hunter Lowlands Redgum Forest represents the third EEC present, typified by *Eucalyptus tereticornis* on gentle rises, which like Werakata National Park (Bell 2004) is represented in Columbeby only by a small stand. Some heavily disturbed lands within Columbeby may also potentially be included within listed EECs, but require more detailed site assessment (shown on Figure 6).

The vegetation present within Columbeby National Park bears strong resemblance to that in the Cessnock region of the Hunter Valley (Bell 2004; DECC 2008). This is perhaps

**Table 6. Extent of Endangered Ecological Communities, Columbeby National Park.**

Endangered Ecological Community	Extent (ha)
Lower Hunter Spotted Gum – Ironbark Forest	475
River Flat Eucalypt Forest on Coastal Floodplains	124
Hunter Lowlands Redgum Forest	3.7
Total	603



**Fig. 6.** Endangered Ecological Communities mapped for Columbeby NP.

not surprising given the two locations lie in the same rainfall band (900–1000 mm/yr) and occur on similar geologies. Vegetation communities common between the two areas include Lower Hunter Spotted Gum – Ironbark Forest, Red Ironbark Scrub-Forest, Paperbark Soak Forest, Floodplain Redgum-Box Forest and Gully Rainforest. Unlike the Cessnock area, however, Columbey has not been subject to illegal rubbish dumping to any great degree.

#### Significant plant species

One small population (~5 plants) of the terrestrial orchid *Pterostylis chaetophora* was recorded in Columbey NP during the survey. *Pterostylis chaetophora* (nominated as Endangered to the NSW *Threatened Species Conservation Act 1995: TSC Act 1995*) was recorded in Columbey National Park during the survey. This species was present in regrowth *Eucalyptus amplifolia* subsp. *amplifolia* forest, and is part of a known population in the Seaham-Clarence Town district. Several other populations, ranging in size from 2–20 plants, are also known from the reserve. The total NSW population of this species is estimated at 500–600 plants, with few populations exceeding 30 plants (A. Paget, pers. comm.).

A single population of *Corybas dowlingii* (Orchidaceae) (Endangered, *TSC Act 1995*) has been recorded in Columbey NP (B. Abbott, pers. comm.). No other populations are known from any other dedicated conservation reserve.

Many plants of the rare cycad *Macrozamia flexuosa* (Zamiaceae) (ROTAP 2K) were recorded in Columbey during the survey. *Macrozamia flexuosa* was scattered mostly within open forest of *Corymbia maculata*, *Eucalyptus fibrosa* and *Eucalyptus umbra*, and is present across most forest habitats.

Despite targeted searches, no specimens of *Eucalyptus glaucina* (Myrtaceae) were located: leaf morphology and colour in all redgums inspected identified them as either *Eucalyptus tereticornis* or *Eucalyptus amplifolia*. At the time of survey (late October – November 2008), most trees has a flush of new growth which were easily viewed through binoculars for colour assessment. The drainage line where the pre-existing record of this species was recorded was also searched but no *Eucalyptus glaucina* could be located. The NSW Department of Environment, Climate Change and Water (DECCW) Wildlife Atlas shows many records of *Eucalyptus glaucina* to the west and north-west of Columbey NP, in the area around Vacy, Paterson and Dungog (see Jupp 2001). These areas are higher in the Williams River catchment than Columbey, and it is possible that the reserve does not support ideal habitat for this species.

Other plant taxa of significance recorded from Columbey include *Sannantha crassa* (prev. *Babingtonia*) (family Myrtaceae) recorded along creeklines (previous southern limit at Barrington Tops, with a risk category of ‘priority for investigation’: Bean 1999); *Lomandra hystrix* (Lomandraceae) in riparian rainforest along Wallaroo Creek (southerly range extension from Taree: Quirico 1993);

and *Gompholobium inconspicuum* (Fabaceae) within Red Ironbark Scrub-Forest (northern extension of range from Singleton-Cessnock: Chappill et. al. 2008, DECC 2008).

#### Weed Management

Weed species within the reserve are relatively few, although some areas would benefit from some rehabilitation effort. \**Lantana camara* is the most extensive woody weed present, occurring along some drainage lines (eg: near the Newcastle-Chichester pipeline) and on sheltered slopes in greater relief areas. The numerous herbaceous and grassy weeds will only ever become problematic after heavy ground disturbance, and should be monitored and controlled whenever major earthworks are undertaken. The Black Cypress Pine (\**Callitris endlicheri*) plantation along Clarence Town Road, although showing signs of limited spread around the edges, is unlikely to pose a serious threat to native communities. This species is sensitive to fire and will be adequately controlled through wildfire events or via strategic burns. Several large trees of \**Grevillea robusta*, native to riparian rainforests north from Coffs Harbour, may potentially cause management issues in the future. However their current location within the riparian rainforest makes removal difficult.

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## Appendix 1. List of vascular plant species recorded in Columbey National Park, 2008–2009

(\* = exotic or non-indigenous species)

### Family, Genus & Species

#### Filicopsida (Ferns)

##### Adiantaceae

*Adiantum aethiopicum*  
*Adiantum hispidulum*  
*Cheilanthes austrotenuifolia*  
*Cheilanthes distans*  
*Cheilanthes sieberi* subsp. *sieberi*  
*Pellaea falcata*  
*Pellaea paradoxa*

##### Blechnaceae

*Doodia aspera*

##### Polypodiaceae

*Platyserium bifurcatum*  
*Pyrrosia rupestris*

Cycadopsida (Cycads)

##### Zamiaceae

*Macrozamia flexuosa*  
*Macrozamia reducta*

Coniferopsida (Conifers)

##### Araucariaceae

*Araucaria bidwillii* \*

##### Cupressaceae

*Callitris endlicheri* \*

Podocarpaceae

*Podocarpus elatus*

#### Magnoliopsida (Flowering plants)

##### Dicotyledons

##### Acanthaceae

*Brunoniella australis*  
*Pseuderanthemum variabile*

##### Apiaceae

*Centella asiatica*  
*Daucus glochidiatus* f. *A*  
*Hydrocotyle laxiflora*  
*Hydrocotyle peduncularis*

##### Aphanopetalaceae

*Aphanopetalum resinum*

##### Apocynaceae

*Gomphocarpus fruticosus* \*  
*Parsonsia straminea*

##### Araliaceae

*Polyscias sambucifolia* subsp. *sambucifolia*

##### Asteraceae

*Brachyscome multifida* var. *multifida*  
*Cassinia uncata*  
*Chrysocephalum apiculatum*  
*Cirsium vulgare* \*  
*Conyza bonariensis* \*  
*Epaltes australis*  
*Euchiton involucratus*  
*Euchiton sphaericus*  
*Facelis retusa* \*  
*Lagenophora stipitata*  
*Ozothamnus diosmifolius*  
*Senecio madagascariensis* \*  
*Sigesbeckia orientalis* subsp. *orientalis*  
*Taraxacum officinale* \*  
*Vernonia cinerea* var. *cinerea*

**Family, Genus & Species**

*Vittadinia cuneata* var. *cuneata*  
*Vittadinia sulcata*

**Bignoniaceae**

*Pandorea pandorana*

**Boraginaceae**

*Cynoglossum australe*

**Cactaceae**

*Opuntia stricta* var. *stricta* \*

**Campanulaceae**

*Wahlenbergia communis*  
*Wahlenbergia gracilis*  
*Wahlenbergia stricta* subsp. *stricta*

**Casuarinaceae**

*Allocasuarina torulosa*  
*Casuarina cunninghamiana* subsp. *cunninghamiana*  
*Casuarina glauca*

**Celastraceae**

*Elaeodendron australe* var. *australe*  
*Maytenus silvestris*

**Clusiaceae**

*Hypericum gramineum*

## Convolvulaceae

*Dichondra repens*  
*Polymeria calycina*

**Cunoniaceae**

*Aphanopetalum resinosum*

**Dilleniaceae**

*Hibbertia aspera* subsp. *aspera*  
*Hibbertia diffusa*  
*Hibbertia scandens*

**Droseraceae**

*Drosera auriculata*

**Ebenaceae**

*Diospyros australis*

**Elaeocarpaceae**

*Elaeocarpus obovatus*

**Ericaceae**

*Acrotriche divaricata*  
*Leucopogon juniperinus*  
*Lissanthe strigosa* subsp. *subulata*  
*Monotoca scoparia*

**Euphorbiaceae**

*Claoxylon australe*  
*Homalanthus populifolius*

**Fabaceae (Faboideae)**

*Daviesia ulicifolia* subsp. *ulicifolia*  
*Desmodium brachypodium*  
*Desmodium gunnii*  
*Desmodium rhytidophyllum*  
*Desmodium varians*  
*Dillwynia retorta* species complex  
*Glycine clandestina*  
*Glycine microphylla*  
*Glycine tabacina*  
*Glycine tomentella*  
*Gompholobium inconspicuum*  
*Gompholobium pinnatum*  
*Hardenbergia violacea*  
*Hovea linearis*  
*Indigofera australis*  
*Jacksonia scoparia*  
*Kennedia rubicunda*  
*Mirbelia rubifolia*  
*Phyllota phyllicoides*

*Podolobium scandens*  
*Pultenaea euchila*  
*Pultenaea myrtoidea*  
*Pultenaea villosa*  
*Swainsona galegifolia*  
*Zornia dyctiocarpa* var. *dyctiocarpa*

**Fabaceae (Mimosoideae)**

*Acacia falcata*  
*Acacia implexa*  
*Acacia irrorata* subsp. *irrorata*  
*Acacia leiocalyx* subsp. *leiocalyx*  
*Acacia longifolia* subsp. *longifolia*  
*Acacia maidenii*  
*Acacia ulicifolia*

**Flacourtiaceae**

*Scolopia braunii*

**Gentianaceae**

*Centaurium tenuiflorum* \*

**Geraniaceae**

*Geranium homeanum*

**Goodeniaceae**

*Goodenia bellidifolia* subsp. *bellidifolia*  
*Goodenia hederacea* subsp. *hederacea*  
*Goodenia heterophylla* subsp. *heterophylla*

**Haloragaceae**

*Gonocarpus tetragynus*  
*Haloragis heterophylla*

**Lamiaceae**

*Clerodendrum tomentosum*  
*Mentha diemenica*  
*Mentha satuireioides*  
*Plectranthus parviflorus*  
*Scutellaria humilis*

**Lauraceae**

*Cassitha glabella* f. *glabella*  
*Cryptocarya microneura*

**Lobeliaceae**

*Pratia purpurascens*

**Loganiaceae**

*Logania albiflora*  
*Logania pusilla*

**Loranthaceae**

*Dendrophthoe vitellina*

**Malvaceae**

*Hibiscus heterophyllus* subsp. *heterophyllus*  
*Pavonia hastata* \*  
*Sida rhombifolia* \*

**Meliaceae**

*Melia azedarach*  
*Synoum glandulosum* subsp. *glandulosum*

**Menispermaceae**

*Sarcopetalum harveyanum*  
*Stephania japonica* var. *discolor*

**Moraceae**

*Ficus coronata*  
*Streblus brunonianus*

**Myoporaceae**

*Eremophila debilis*

**Myrsinaceae**

*Anagallis arvensis* \*  
*Myrsine variabilis*

**Myrtaceae**

*Acmena smithii*

**Family, Genus & Species**

*Angophora costata*  
*Angophora floribunda*

*Backhousia myrtifolia*  
*Callistemon linearis*  
*Callistemon rigidus*  
*Callistemon salignus*  
*Calytrix tetragona*  
*Corymbia maculata*  
*Eucalyptus acmenoides*  
*Eucalyptus amplifolia* subsp. *amplifolia*  
*Eucalyptus canaliculata*  
*Eucalyptus crebra*  
*Eucalyptus fibrosa*  
*Eucalyptus globoidea*  
*Eucalyptus moluccana*  
*Eucalyptus placita*  
*Eucalyptus punctata*  
*Eucalyptus saligna*  
*Eucalyptus siderophloia*  
*Eucalyptus tereticornis*  
*Eucalyptus umbra*  
*Leptospermum polygalifolium* subsp. *cismontanum*  
*Leptospermum polygalifolium* subsp. *polygalifolium*  
*Leptospermum trinervium*  
*Melaleuca decora*  
*Melaleuca linariifolia*  
*Melaleuca nodosa*  
*Melaleuca quinquenervia* \*  
*Melaleuca styphelioides*  
*Melaleuca thymifolia*  
*Sannantha* (prev. *Babingtonia*) *crassa*  
*Syncarpia glomulifera* subsp. *glomulifera*  
*Syzygium australe*  
*Tristaniopsis laurina*

**Oleaceae**

*Notelaea longifolia* f. *intermedia*  
*Notelaea longifolia* f. *longifolia*

**Oxalidaceae**

*Oxalis perennans*

**Peperomiaceae**

*Peperomia blanda* var. *floribunda*

**Phyllanthaceae**

*Breynia oblongifolia*  
*Glochidion ferdinandi* var. *ferdinandi*  
*Phyllanthus hirtellus*  
*Phyllanthus similis*  
*Phyllanthus virgatus*  
*Poranthera microphylla*

**Pittosporaceae**

*Billardiera scandens*  
*Bursaria longisepala*  
*Bursaria spinosa*  
*Hymenosporum flavum*  
*Pittosporum multiflorum*  
*Pittosporum revolutum*

**Plantaginaceae**

*Plantago debilis*  
*Plantago lanceolata* \*

**Polygalaceae**

*Polygala japonica*

**Polygonaceae**

*Persicaria strigosa*

**Proteaceae**

*Banksia spinulosa* var. *collina*  
*Grevillea robusta* \*  
*Hakea sericea*  
*Persoonia linearis*

**Putranjivaceae**

*Drypetes deplanchei*

**Ranunculaceae**

*Clematis aristata*  
*Clematis glycinoides* var. *glycinoides*  
*Ranunculus inundatus*  
*Ranunculus plebeius*

**Rosaceae**

*Rubus parvifolius*

**Rubiaceae**

*Canthium coprosmoides*  
*Galium binifolium*  
*Galium gaudichaudii*  
*Galium propinquum*  
*Morinda jasminoides*  
*Opercularia aspera*  
*Opercularia diphylla*  
*Opercularia varia*  
*Pomax umbellata*  
*Richardia humistrata* \*  
*Richardia stellaris* \*

**Rutaceae**

*Acronychia wilcoxiana*  
*Melicope micrococca*  
*Zieria smithii*

**Santalaceae**

*Exocarpos cupressiformis*

**Sapindaceae**

*Dodonaea triquetra*  
*Guioa semiglaucula*

**Scrophulariaceae**

*Veronica plebeia*

**Solanaceae**

*Duboisia myoporoides*  
*Solanum prinophyllum*  
*Solanum stelligerum*

**Stackhousiaceae**

*Stackhousia viminea*

**Sterculiaceae**

*Brachychiton populneus* subsp. *populneus*  
*Commersonia fraseri*

**Stylidiaceae**

*Stylidium graminifolium*

**Thymelaeaceae**

*Pimelea linifolia* subsp. *linifolia*

**Ulmaceae**

*Trema tomentosa* var. *viridis*

**Verbenaceae**

*Lantana camara* \*  
*Verbena rigida* var. *rigida* \*

**Violaceae**

*Hybanthus stellarioides*  
*Viola banksii*  
*Viola hederacea*

**Vitaceae**

*Cayratia clematidea*  
*Cissus antarctica*  
*Cissus hypoglaucula*  
*Cissus opaca*  
*Tetrastigma nitens*

**Magnoliopsida (Flowering plants)****Monocotyledons****Anthericaceae**

*Arthropodium milleflorum*  
*Arthropodium minus*

**Family, Genus & Species**

*Arthropodium* sp. B  
*Caesia parviflora* var. *parviflora*  
*Caesia parviflora* var. *vittata*  
*Laxmannia gracilis*  
*Thysanotus tuberosus* subsp. *tuberosus*  
*Tricoryne elatior*

**Araceae**

*Gymnostachys anceps*

**Commelinaceae**

*Commelina cyanea*  
*Murdannia graminea*

**Cyperaceae**

*Carex appressa*  
*Carex inversa*  
*Carex longebrachiata*  
*Carex maculata*  
*Chorizandra cymbaria*  
*Cyperus enervis*  
*Cyperus imbecillis*  
*Cyperus laevis*  
*Cyperus lucidus*  
*Cyperus sesquiflorus* \*  
*Eleocharis dietrichiana*  
*Fimbristylis dichotoma*  
*Gahnia aspera*  
*Gahnia clarkei*  
*Gahnia melanocarpa*  
*Isolepis inundata*  
*Lepidosperma elatius*  
*Lepidosperma laterale*  
*Ptilothrix deusta*  
*Schoenus apogon*  
*Tetraria capillaris*

**Dioscoreaceae**

*Dioscorea transversa*

**Hypoxidaceae**

*Hypoxis hygrometrica* var. *hygrometrica*  
*Hypoxis hygrometrica* var. *villosisepala*

**Iridaceae**

*Patersonia sericea*  
*Sisyrinchium* sp. A \*

**Juncaceae**

*Juncus continuus*  
*Juncus planifolius*  
*Juncus usitatus*

**Juncaginaceae**

*Triglochin procerum*

**Lomandraceae**

*Lomandra confertifolia* subsp. *pallida*  
*Lomandra filiformis* subsp. *coriacea*  
*Lomandra filiformis* subsp. *filiformis*  
*Lomandra glauca*  
*Lomandra hystrix*  
*Lomandra longifolia*  
*Lomandra multiflora* subsp. *multiflora*

**Luzuriagaceae**

*Eustrephus latifolius*  
*Geitonoplesium cymosum*

**Orchidaceae**

*Acianthus fornicatus*  
*Caladenia catenata*  
*Calochilus* sp.  
*Chiloglottis diphylla*  
*Dipodium punctatum*

*Eriochilus cucullatus* spp. agg.

*Genoplesium* sp.  
*Microtis unifolia*  
*Pterostylis chaetophora*  
*Pterostylis collina*  
*Pterostylis longifolia*  
*Spiranthes australis*

**Philydraceae**

*Philydrum lanuginosum*

**Phormiaceae**

*Dianella caerulea* var. *asserta*  
*Dianella caerulea* var. *caerulea*  
*Dianella caerulea* var. *cinerascens*  
*Dianella revoluta* var. *revoluta*  
*Dianella tasmanica*

**Poaceae**

*Anisopogon avenaceus*  
*Aristida ramosa*  
*Aristida vagans*  
*Aristida warburgii*  
*Austrodanthonia setacea*  
*Austrodanthonia tenuior*  
*Axonopus fissifolius* \*  
*Bothriochloa decipiens* var. *decipiens*  
*Chloris truncata* \*  
*Cymbopogon refractus*  
*Cynodon dactylon*  
*Dichelachne micrantha*  
*Digitaria diffusa*  
*Digitaria ramularis*  
*Echinopogon caespitosus* var. *caespitosus*  
*Echinopogon intermedius*  
*Echinopogon ovatus*  
*Entolasia marginata*  
*Entolasia stricta*  
*Eragrostis brownii*  
*Eragrostis cilianensis* \*  
*Eragrostis leptostachya*  
*Imperata cylindrica* var. *major*  
*Joycea pallida*  
*Lachnagrostis aemula*  
*Microlaena stipoides* var. *stipoides*  
*Notodanthonia longifolia*  
*Oplismenus aemulus*  
*Oplismenus imbecillis*  
*Panicum effusum*  
*Panicum simile*  
*Paspalidium albovillosum*  
*Paspalidium aversum*  
*Paspalidium distans*  
*Paspalum dilatatum* \*  
*Poa labillardierei* var. *labillardierei*  
*Sarga leiocladum*  
*Sporobolus creber*  
*Sporobolus pyramidalis* \*  
*Themeda australis*

**Smilacaceae**

*Smilax australis*  
*Smilax glycyphylla*

**Uvulariaceae**

*Tripladenia cunninghamii*

**Xanthorrhoeaceae**

*Xanthorrhoea glauca* subsp. *glauca*  
*Xanthorrhoea latifolia* subsp. *latifolia*  
*Xanthorrhoea macronema*

## Appendix 2. Vegetation Community Profiles for Columbe National Park

Vegetation Community profiles provide information to enable identification of that community in the field. A summary map showing the distribution of each community within the reserve is included with each profile. For each vegetation community, a summary of the basic structural makeup of that unit is given. The accuracy of structural information presented with each profile is governed by the sample size of each community (shown as “n” in the structural tables). Where possible, the equivalent vegetation classification within other regional assessments have been provided under the community name, to assist in regional comparisons and significance assessments.

The derivation of diagnostic species for each community has been defined using the SIMPER routine in *Primer*. SIMPER analysis provides the relative contributions of each species to the Bray-Curtis similarity within each of the defined vegetation communities. Only those species contributing to a total cumulative contribution of 90% of the average similarity (ie: the value shown at the top of each table) for each community are listed. These species can be described of as *typical* of that community, and have a consistently large presence within the data as reflected in the ratio of their contribution to the standard deviation (the Sim/SD field in

each table) across the within-group similarities (the average similarity). Community groups with less than two samples (ie: Hunter Lowlands Redgum Forest, Plantation Forest) cannot be analysed in this way. Instead, the full species list from the single plot in each community is shown, in decreasing cover abundance value.

In the *Key Diagnostic Species* tables in each profile:

- **Average similarity** is the within-group similarity for all pairs of sample plots comprising the community. Higher average similarity indicates a better defined community.
- **Av.Abund** is the average cover abundance of that species within sample plots comprising the community
- **Av.Sim** is the average similarity (contribution) made by each species to the within-group similarity (the overall average similarity).
- **Sim/SD** is the ratio of average similarity to standard deviation for each species across all pairs of samples. A high ratio represents a good discriminating species. At least three samples are required for this ratio to be calculated.
- **Contrib %** is the percentage contribution of each species to the overall average similarity for the community.

### Unit 1

#### Gully Rainforest

NSW Vegetation class (Keith 2004):

North East CRA

LHCCREMS 3:

Dry Rainforests

No equivalent

Hunter Valley Dry Rainforest



#### General Description:

Gully Rainforest occurs only in the more rugged topography of the Stonequarry Hill section of the reserve, and is dominated by *Backhousia myrtifolia*, *Scolopia braunii*, *Melaleuca styphelioides*, *Syzygium australe* and *Streblus brunonianus* in the canopy, over a range of

rainforest-affiliated species such as *Hibiscus heterophyllous*, *Dioscorea transversa*, *Myrsine variabilis*, *Podocarpus elatus*, *Cassine australis*, *Lomandra longifolia* and *Pellaea falcata*. Emergent eucalypts from the surrounding landscape are also evident, including *Corymbia maculata*, *Eucalyptus acmenoides*, *Eucalyptus canaliculata* and *Eucalyptus moluccana*.

**Characteristic Features:**

- narrow strips of rainforest along often rocky gully lines
- canopy dominated by *Backhousia myrtifolia* with several other rainforest tree species
- ground layer of ferns and scattered grasses

**Known Floristic/ Structural Variations:**

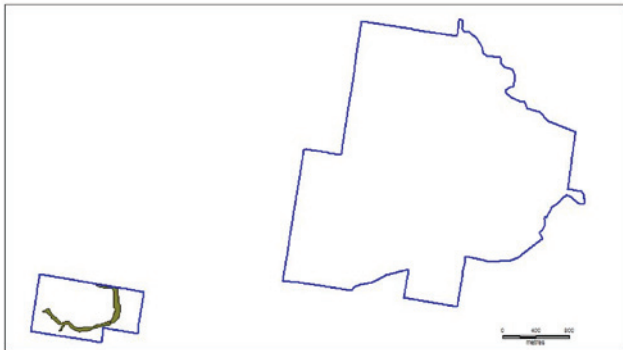
No known floristic or structural variations noted, as this community occurs only in the one drainage line within the reserve.

**Relationship to Other Communities:**

Gully Rainforest is most similar to Riparian Rainforest (Unit 2), but supports a higher diversity of rainforest trees and shrubs. *Backhousia myrtifolia* is clearly dominant in Gully Rainforest, but commonly occurs with other dry rainforests species such as *Scolopia braunii*, *Podocarpus elatus*, *Syzygium australe* and *Streblus brunonianus*. Gully Rainforest also occurs in rocky gullies on steeper terrain, rather than the deep alluvial sands of the Riparian Rainforest.

**Community Conservation Status:**

- Reserve Representation* – unknown from other reserves but likely to occur on the Lower North Coast
- EPBC Act (1999) Status* – not currently listed.
- TSC Act (1995) Status* – not currently listed.



**Distribution:**

- Columbey NP (main portion)* not present
- Columbey NP (Stonequarry Hill)* 6.75 ha
- Total 6.75 ha

**Significant Species:**

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (TSC Act) – *none recorded*
- Rare (ROTAP) – *none recorded*

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	24.5	21.5	27.5	22.5	3.5	2
Middle 1	9.8	6.0	13.5	77.5	3.5	2
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	1.5	0.6	2.5	35.0	21.2	2

**Species Richness:**

- Number of plots:* 2
- Total native species:* 70
- Mean species / plot (+/- SD):* 50.5 (+/- 7.78)

**Key Diagnostic Species [based on 2 plots]:**

**Gully Rainforest**

**Average similarity: 55.09**

Habit	Species	Av. Abund	Av. Sim	Sim/ SD	Contrib%
Tree	<i>Backhousia myrtifolia</i>	5.00	5.99	-	10.87
	<i>Melaleuca styphelioides</i>	3.00	3.59	-	6.52
	<i>Eucalyptus acmenoides</i>	2.00	2.40	-	4.35
	<i>Drypetes deplanchei</i>	1.00	1.20	-	2.17
	<i>Elaeodendron australe</i> var. <i>australe</i>	1.50	1.20	-	2.17
	<i>Melicope micrococca</i>	1.50	1.20	-	2.17
Shrub	<i>Hibiscus heterophyllus</i> subsp. <i>heterophyllus</i>	2.00	2.40	-	4.35
	<i>Scolopia braunii</i>	2.50	2.40	-	4.35
	<i>Streblus brunonianus</i>	2.50	2.40	-	4.35
	<i>Breynia oblongifolia</i>	1.00	1.20	-	2.17
	<i>Clerodendrum tomentosum</i>	1.00	1.20	-	2.17
	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	1.50	1.20	-	2.17
	<i>Notelaea longifolia</i> forma <i>longifolia</i>	1.50	1.20	-	2.17
	<i>Oplismenus imbecillis</i>	2.50	2.40	-	4.35
Herb/ Forb	<i>Desmodium gunnii</i>	2.00	2.40	-	4.35
	<i>Pseuderanthemum variabile</i>	2.00	2.40	-	4.35
Fern	<i>Adiantum hispidulum</i>	1.50	1.20	-	2.17
	<i>Pellaea falcata</i>	1.00	1.20	-	2.17
Sedge	<i>Carex maculata</i>	2.50	2.40	-	4.35
	<i>Gahnia melanocarpa</i>	1.00	1.20	-	2.17
Vine	<i>Pandorea pandorana</i>	2.00	2.40	-	4.35
	<i>Aphanopetalum resinosum</i>	1.50	1.20	-	2.17
	<i>Cissus antarctica</i>	1.00	1.20	-	2.17
	<i>Dioscorea transversa</i>	1.50	1.20	-	2.17
	<i>Geitonoplesium cymosum</i>	1.50	1.20	-	2.17
	<i>Morinda jasminoides</i>	1.50	1.20	-	2.17
	<i>Parsonsia straminea</i>	1.00	1.20	-	2.17



## Unit 2

### Riparian Rainforest

NSW Vegetation class (Keith 2004):

North East CRA

LHCCREMS1:

Dry Rainforests  
No equivalent  
Coastal Wet Gully Forest (?)



### General Description:

Riparian Rainforest occurs along major creeklines such as Wallaroo Creek, on deep sandy alluvium, and is characterised by *Tristaniopsis laurina*, *Backhousia myrtifolia*, *Melicope micrococca*, *Acronychia wilcoxianum*, *Acmena smithii*, and *Cryptocarya microneura*. Emergent eucalypts (eg: *E. acmenoides*, *E. tereticornis*) are also present, as are the occasional *Casuarina cunninghamiana* and *\*Grevillea robusta*. The latter species does not naturally occur south of Coffs Harbour on the far North Coast (Harden 1991), but has naturalised probably from plantings in nearby Clarence Town.

### Characteristic Features:

- narrow strips of rainforest on deep sandy soils adjacent to larger creeks
- canopy dominated by *Acmena smithii*, *Backhousia myrtifolia* and several other species, with *Tristaniopsis laurina* and *Ficus coronata*
- common along watercourses
- ground layer of ferns

### Known Floristic/ Structural Variations:

Depending on the history of flooding within creeklines supporting this vegetation type, ground layer ferns and herbs may be variable in both composition and abundance. In some areas, emergent Cabbage Gum (*Eucalyptus amplifolia*) occur with rainforest species, particularly where in close proximity to Floodplain Redgum – Box Forest.

### Relationship to Other Communities:

Riparian Rainforest is most similar to Gully Rainforest (Unit 1), but supports fewer rainforest species and tends to be dominated by *Acmena smithii*, *Melicope micrococca*, *Tristaniopsis laurina* and *Backhousia myrtifolia*. Gully Rainforest also occurs in rocky gullies on steeper terrain, rather than the deep alluvial sands of the Riparian Rainforest. *\*Grevillea robusta* (not locally indigenous) occurs only in Riparian Rainforest, where it has attained true canopy status in some areas.

### Community Conservation Status:

Reserve Representation –

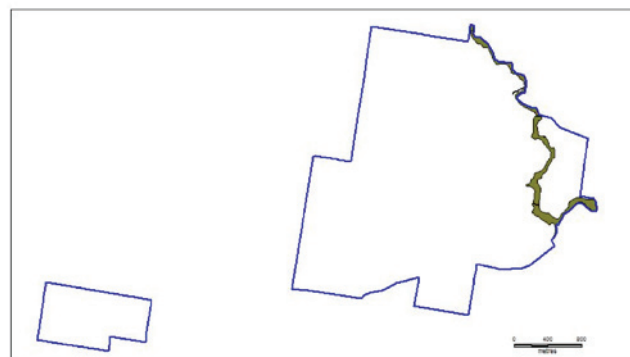
unknown from other reserves but likely to occur on the Lower North Coast

EPBC Act (1999) Status –

not currently listed.

TSC Act (1995) Status –

not currently listed.



### Distribution:

<i>Columbe NP (main portion)</i>	20.16 ha
<i>Columbe NP (Stonequarry Hill)</i>	not present
Total	20.16 ha

### Significant Species:

Undescribed species – none recorded  
Threatened (EPBC Act) – none recorded  
Threatened (TSC Act) – none recorded  
Rare (ROTAP) – none recorded

### Species Richness:

<i>Number of plots:</i>	3
<i>Total native species:</i>	55
<i>Mean species / plot (+/- SD):</i>	34.3 (+/- 7.37)

**Key Diagnostic Species [based on 3 plots]:**

**Riparian Rainforest**

Average similarity: 52.33

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib %
Tree	<i>Backhousia myrtifolia</i>	3.67	4.94	8.31	9.43
	<i>Melicope micrococca</i>	3.00	3.82	4.37	7.29
	<i>Tristaniopsis laurina</i>	2.67	3.79	5.69	7.24
	<i>Acronychia wilcoxiana</i>	2.33	2.70	1.53	5.15
	<i>Acmena smithii</i>	2.67	2.17	2.50	4.15
	<i>Acacia maidenii</i>	2.00	1.87	0.58	3.57
	<i>Angophora floribunda</i>	1.67	1.25	0.58	2.38
	<i>Eucalyptus acmenoides</i>	1.67	1.25	0.58	2.38
	<i>Grevillea robusta</i> *	1.67	1.05	0.58	2.01
	<i>Cryptocarya microneura</i>	1.67	1.00	0.58	1.90
Shrub	<i>Breynia oblongifolia</i>	1.00	1.65	8.31	3.14
	<i>Ficus coronata</i>	1.00	1.65	8.31	3.14

	<i>Notelaea longifolia</i> forma <i>longifolia</i>	1.00	1.65	8.31	3.14
	<i>Pittosporum multiflorum</i>	1.33	1.05	0.58	2.01
	<i>Maytenus silvestris</i>	0.67	0.62	0.58	1.19
Grass	<i>Oplismenus imbecillis</i>	2.67	3.29	8.31	6.29
Herb/ Forb	<i>Pseuderanthemum</i> <i>variabile</i>	1.33	1.00	0.58	1.90
Fern	<i>Adiantum aethiopicum</i>	2.00	3.29	8.31	6.29
	<i>Doodia aspera</i>	2.00	1.57	0.58	3.01
Sedge	<i>Gymnostachys anceps</i>	0.67	0.62	0.58	1.19
Vine	<i>Morinda jasminoides</i>	2.00	2.14	2.88	4.09
	<i>Geitonoplesium cymosum</i>	1.33	1.65	8.31	3.14
	<i>Pandorea pandorana</i>	1.33	1.65	8.31	3.14
	<i>Parsonsia straminea</i>	1.33	1.65	8.31	3.14

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	21.0	18.7	23.3	26.7	5.8	3
Middle 1	10.5	6.0	15.0	78.3	7.6	3
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	0.2	0.1	0.4	11.7	11.6	3

**Unit 3**

**Paperbark Soak Forest**

NSW Vegetation class (Keith 2004):

North East CRA

LHCCREMS 42:

Coastal Floodplain Wetlands

No equivalent

Riparian Melaleuca Swamp Woodland (?)



**General Description:**

Paperbark Soak Forest occurs sporadically along shallow drainage lines and is dominated by *Melaleuca linariifolia*, occasionally with *Melaleuca styphelioides*, over a dense ground layer of *Carex*

*longebrachiata*, *Carex appressa* and other sedge species. Emergent eucalypts (*Eucalyptus tereticornis*, *E. amplifolia* subsp. *amplifolia*, *E. siderophloia*) are also present in many locations. Many small examples of this community occur within the Floodplain Redgum-Box Forest, to which they are strongly linked.

**Characteristic Features:**

- Low, dense canopy dominated by *Melaleuca linariifolia* and *Melaleuca styphelioides*
- standing pools of water, billabongs etc often present
- ground layer of *Carex longibrachiata*, *Carex appressa* and other sedges, grasses and herbs

**Known Floristic/ Structural Variations:**

No known floristic or structural variations noted.

**Relationship to Other Communities:**

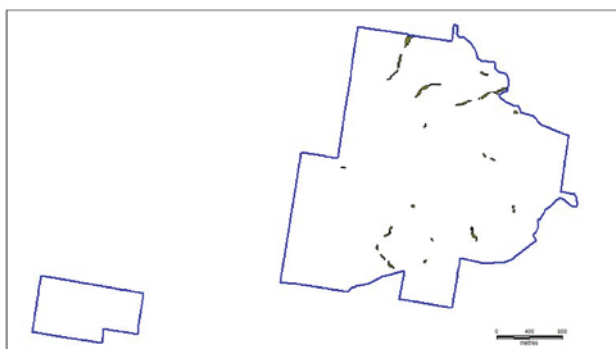
Paperbark Soak Forest is floristically and structurally distinct from all other defined communities in the reserve. The low, dense canopy of *Melaleuca linariifolia*, ground layer of sedges and grasses, and presence of standing water in billabongs are not replicated elsewhere. Small stands of *Melaleuca* may occur within the Floodplain Redgum – Box Forest (Unit 4), but these tend to highly localised.

**Community Conservation Status:**

Reserve Representation – known Werakata NP (DECC 2008)

EPBC Act (1999) Status – not currently listed.

TSC Act (1995) Status – not currently listed.

**Distribution:**

Columbeby NP (main portion) 4.87 ha  
Columbeby NP (Stonequarry Hill) not present  
Total 4.87 ha

**Significant Species:**

Undescribed species – none recorded

Threatened (EPBC Act) – none recorded

Threatened (TSC Act) – none recorded

Rare (ROTAP) – none recorded

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	16.6	15.3	18.0	28.8	41.1	4
Middle 1	6.1	4.8	7.5	57.5	35.7	4
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	91.3	2.5	4

**Species Richness:**

Number of plots: 4  
Total native species: 69  
Mean species / plot (+/- SD): 35.5 (+/- 1.92)

**Key Diagnostic Species [based on 4 plots]:****Paperbark Soak Forest  
Average similarity: 58.77**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%
Tree	<i>Melaleuca linariifolia</i>	5.50	8.20	18.35	13.95
Shrub	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	1.50	1.86	2.81	3.16
	<i>Leucopogon juniperinus</i>	1.00	1.59	23.09	2.71
	<i>Notelaea longifolia</i> forma <i>longifolia</i>	1.00	1.59	23.09	2.71
	<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>	1.25	1.03	0.83	1.75
Grass	<i>Callistemon linearis</i>	0.75	0.77	0.91	1.32
	<i>Oplismenus imbecillis</i>	3.00	3.95	5.16	6.73
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	2.00	3.18	23.09	5.41
	<i>Entolasia marginata</i>	1.50	1.85	2.99	3.14
	<i>Imperata cylindrica</i> var. <i>major</i>	1.75	1.61	0.91	2.73
Gram-inoid	<i>Dianella caerulea</i> var. <i>assera</i>	1.00	1.59	23.09	2.71
Herb/Forb	<i>Dichondra repens</i>	2.00	3.18	23.09	5.41
	<i>Hydrocotyle laxiflora</i>	2.00	3.18	23.09	5.41
	<i>Pratia purpurascens</i>	2.00	3.18	23.09	5.41
	<i>Centella asiatica</i>	1.50	1.61	0.91	2.73
	<i>Oxalis perennans</i>	1.00	0.82	0.91	1.40
	<i>Hydrocotyle peduncularis</i>	1.00	0.80	0.91	1.37
	<i>Polymeria calycina</i>	1.00	0.78	0.91	1.33
	<i>Veronica plebeia</i>	1.00	0.78	0.91	1.33
Sedge	<i>Carex longibrachiata</i>	5.25	7.95	23.09	13.53
Vine	<i>Parsonsia straminea</i>	1.50	1.87	2.51	3.19
	<i>Glycine clandestina</i>	1.25	1.59	23.09	2.71

**General Description:**

**Unit 4**

**Floodplain Redgum – Box Forest**  
**NSW Vegetation class (Keith 2004):**  
**North East CRA E54:**  
**LHCCREMS**

**Coastal Floodplain Wetlands**  
**Grey Box – Redgum- Grey Ironbark (?)**  
**No equivalent**



Floodplain Redgum – Box Forest is restricted to major creeklines and their associated flood-outs. It can be dominated by any of *Eucalyptus amplifolia* subsp. *amplifolia*, *Eucalyptus siderophloia*, *Eucalyptus tereticornis* or *Eucalyptus moluccana*. Examples dominated by each are present within the reserve, which are readily recognised in the field. *Angophora floribunda* also occurs as a canopy dominant in limited areas. Some locations have been previously cleared and now support regrowth vegetation, while others appear not to have been overly disturbed. This community equates to the River-Flat Eucalypt Forest on Coastal Floodplains EEC (NSW Scientific Committee 2005a).

**Characteristic Features:**

- \* canopy dominated by any of *Eucalyptus amplifolia* subsp. *amplifolia*, *Eucalyptus moluccana*, *Angophora floribunda* or *Eucalyptus siderophloia*
- ground layer dominated by grasses and herbs
- occurs on low-lying flats adjacent to major drainage lines, commonly regrowth following past grazing activities

**Known Floristic/ Structural Variations:**

Five main variants have been noted in the field for this community, all characterised by different canopy dominants. Any of Cabbage Gum (*Eucalyptus amplifolia* subsp. *amplifolia*), Grey Box (*Eucalyptus moluccana*), Rough-barked Apple (*Angophora floribunda*), Forest Redgum (*Eucalyptus tereticornis*), or Northern Grey Ironbark (*Eucalyptus siderophloia*) can dominate an area, however targeted sampling and analysis could not sufficiently differentiate between them. Areas where *Eucalyptus tereticornis* is characteristic are invariably along creeks and are heavily invaded by *Lantana camara*, making sampling difficult. It is likely that analysis incorporating data from further afield (outside of Columbey NP) would justify elevating these variants to community status.

**Relationship to Other Communities:**

The often mono-specific stands of *Eucalyptus amplifolia*, *Eucalyptus moluccana*, *Angophora floribunda* or *Eucalyptus siderophloia* characterise this community, and cannot be confused with any other vegetation type. They also occur in low lying terrain in close proximity to drainage lines. Stands of *Eucalyptus siderophloia* may be confused

with Plantation Forest (Unit 12), but canopy species in that community are planted in rows and should be easily distinguished.

**Distribution:**

<i>Columbey NP (main portion)</i>	124.4 ha
<i>Columbey NP (Stonequarry Hill)</i>	not present
Total	124.4 ha

**Community Conservation Status:**

<i>Reserve Representation</i> –	known Werakata NP (DECC 2008)
<i>EPBC Act (1999) Status</i> –	not currently listed.
<i>TSC Act (1995) Status</i> –	forms a component of <i>River flat Eucalypt Forest on Coastal Floodplains</i> EEC.

**Significant Species:**

Undescribed species –	<i>none recorded</i>
Threatened (EPBC Act) –	<i>none recorded</i>
Threatened (TSC Act) –	<i>none recorded</i>
Rare (ROTAP) –	<i>none recorded</i>

**Species Richness:**

Number of plots:	8
Total native species:	137
Mean species / plot (+/- SD):	51.1 (+/- 6.20)

**Key Diagnostic Species [based on 8 plots]:**

**Floodplain Redgum – Box Forest  
Average similarity: 48.96**

Habit	Species	Av. Abund	Av. Sim	Sim/ SD	Contrib%
Tree	<i>Eucalyptus moluccana</i>	2.38	1.38	0.72	2.83
	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	1.50	0.49	0.34	1.01
	<i>Eucalyptus siderophloia</i>	1.00	0.24	0.34	0.49
Shrub	<i>Leucopogon juniperinus</i>	1.50	1.33	3.21	2.71
	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	1.88	0.99	0.78	2.02
	<i>Bursaria spinosa</i>	1.25	0.84	1.56	1.71
	<i>Breynia oblongifolia</i>	0.88	0.57	1.05	1.16
	<i>Maytenus silvestris</i>	0.63	0.40	0.73	0.83
	<i>Notelaea longifolia</i> forma <i>longifolia</i>	0.75	0.39	0.73	0.79
	Grass	<i>Microlaena stipoides</i> var. <i>stipoides</i>	3.63	3.56	5.97
	<i>Aristida vagans</i>	2.38	1.83	1.59	3.73
	<i>Cymbopogon refractus</i>	2.38	1.83	1.59	3.73
	<i>Panicum simile</i>	1.50	1.18	1.05	2.41
	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	1.38	0.94	0.97	1.92
	<i>Paspalidium distans</i>	1.63	0.89	0.72	1.82
	<i>Eragrostis brownii</i>	1.38	0.75	0.73	1.53
	<i>Entolasia marginata</i>	1.13	0.71	0.97	1.44
	<i>Oplismenus imbecillis</i>	1.25	0.65	0.68	1.34
	<i>Themeda australis</i>	1.25	0.38	0.46	0.78
	<i>Echinopogon ovatus</i>	1.00	0.34	0.48	0.70
	<i>Eragrostis leptostachya</i>	0.88	0.25	0.34	0.52

**Floodplain Redgum – Box Forest  
Average similarity: 48.96**

Habit	Species	Av. Abund	Av. Sim	Sim/ SD	Contrib%
Gram- inoid	<i>Dianella revoluta</i> var. <i>revoluta</i>	1.38	1.21	3.90	2.48
	<i>Dianella caerulea</i> var. <i>assera</i>	1.25	1.14	5.70	2.33
	<i>Lomandra confertifolia</i> subsp. <i>pallida</i>	1.25	0.77	0.73	1.57
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	0.88	0.41	0.69	0.85
Herb / Forb	<i>Dichondra repens</i>	2.25	2.24	10.04	4.58
	<i>Brunoniella australis</i>	1.88	1.93	3.75	3.95
	<i>Vernonia cinerea</i> var. <i>cinerea</i>	1.75	1.70	2.92	3.47
	<i>Pratia purpurascens</i>	1.75	1.65	1.69	3.37
	<i>Plantago debilis</i>	1.50	1.20	1.05	2.46
	<i>Oxalis perennans</i>	1.50	1.15	1.05	2.35
	<i>Lagenophora stipitata</i>	1.50	1.13	1.05	2.30
	<i>Centella asiatica</i>	1.13	0.64	0.68	1.30
	<i>Euchiton involucratus</i>	1.00	0.50	0.67	1.03
	<i>Hydrocotyle laxiflora</i>	1.00	0.49	0.51	1.00
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	1.75	1.60	1.70	3.27
Sedge	<i>Gahnia aspera</i>	2.13	1.98	3.45	4.04
	<i>Fimbristylis dichotoma</i>	1.63	1.42	1.50	2.90
	<i>Carex longibrachiata</i>	1.50	0.80	0.72	1.63
Vine	<i>Glycine tabacina</i>	1.88	1.94	3.68	3.96
	<i>Glycine clandestina</i>	0.75	0.29	0.48	0.59

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	19.1	17.3	21.0	32.5	7.1	8
Middle 1	8.4	5.4	11.3	19.4	7.3	8
Middle 2	2.3	1.3	3.3	37.9	38.1	8
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	87.5	8.2	6

**Unit 5**

**Seaham Mahogany Forest**

**NSW Vegetation class (Keith 2004):**

**North East CRA E89:**

**LHCCREMS 12:**

**North Coast Wet Sclerophyll Forests**

**Moist Foothills Spotted Gum (?)**

**Hunter Valley Moist Forest (?)**



**General Description:**

Seaham Mahogany Forest is dominated by *Eucalyptus acmenoides*, *Eucalyptus siderophloia*, *Eucalyptus placita* and *Allocasuarina torulosa*, and occurs on well sheltered slopes such as the southern side of Tower Hill in the main portion of the reserve. The understorey is dominated by *Notelaea longifolia* forma *longifolia* and includes a high diversity of grasses and herbs such as *Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillus*, *Desmodium gunnii*, *Pratia purpurascens*, *Veronica plebeia* and *Scutellaria humilis*.

**Characteristic Features:**

- canopy dominated by *Eucalyptus acmenoides*, *Allocasuarina torulosa* and *Eucalyptus siderophloia*
- occurs on sheltered slopes of higher relief areas
- herbs and grasses dominate the ground layer

**Known Floristic/ Structural Variations:**

No known floristic or structural variations noted.

**Relationship to Other Communities:**

The dominance of *Eucalyptus acmenoides* and *Allocasuarina torulosa* in the canopy of this community distinguish it from all others in the reserve. This community also only occurs on sheltered slopes of the higher relief areas, and supports a rich ground layer of herbs and grasses. Some areas may be difficult to distinguish between this community and the adjacent Seaham Spotted Gum – Ironbark Forest (Unit 7), but the co-dominance of Spotted Gum in the latter can be used as a rule of thumb in this case.

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	20.9	18.5	23.3	41.3	6.3	4
Middle 1	6.3	4.7	7.9	11.3	2.5	4
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	38.8	22.1	4

**Community Conservation Status:**

*Reserve Representation* –

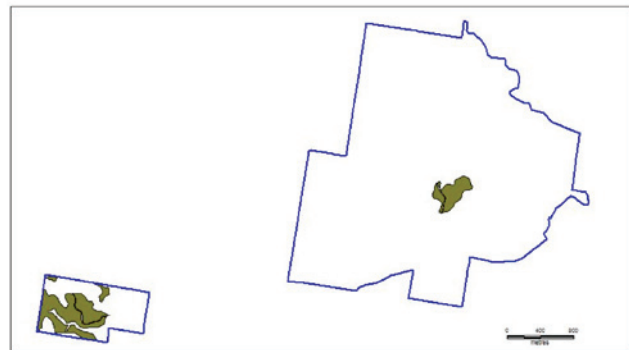
unknown from other reserves but likely to occur on the Lower North Coast

*EPBC Act (1999) Status* –

not currently listed.

*TSC Act (1995) Status* –

not currently listed.



**Distribution:**

<i>Columbey NP (main portion)</i>	10.37 ha
<i>Columbey NP (Stonequarry Hill)</i>	28.86 ha
<b>Total</b>	<b>39.23 ha</b>

**Significant Species:**

Undescribed species – none recorded

Threatened (EPBC Act) – none recorded

Threatened (TSC Act) – none recorded

Rare (ROTAP) – *Macrozamia flexuosa*

**Species Richness:**

Number of plots: 4  
 Total native species: 125  
 Mean species / plot (+/- SD): 59.3(+/- 4.86)

**Key Diagnostic Species [based on 4 plots]:**

**Seaham Mahogany Forest  
 Average similarity: 46.28**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%							
Tree	<i>Eucalyptus acmenoides</i>	3.50	3.18	8.06	6.88	Herb/ Forb	Grass	<i>Panicum simile</i>	2.25	2.01	54.75	4.34
	<i>Allocasuarina torulosa</i>	2.50	2.18	5.12	4.71		<i>Imperata cylindrica</i> var. <i>major</i>	2.50	1.68	2.04	3.63	
	<i>Corymbia maculata</i>	2.50	2.02	1.80	4.36		<i>Oplismenus imbecillis</i>	1.75	0.99	0.91	2.14	
	<i>Eucalyptus siderophloia</i>	2.25	1.17	0.88	2.52		<i>Poa labillardierei</i> var. <i>labillardierei</i>	1.75	0.99	0.91	2.14	
							<i>Microlaena stipoides</i> var. <i>stipoides</i>	1.50	0.49	0.41	1.06	
Shrub	<i>Acacia implexa</i>	1.50	1.17	2.92	2.53	Vine	Gram-inoid	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	1.25	0.67	0.81	1.45
	<i>Leucopogon juniperinus</i>	1.75	1.17	3.01	2.53		<i>Dianella caerulea</i> var. <i>assera</i>	1.25	0.66	0.82	1.42	
	<i>Notelaea longifolia</i> forma <i>longifolia</i>	1.75	1.17	3.01	2.53		<i>Lomandra longifolia</i>	1.00	0.50	0.91	1.07	
	<i>Breynia oblongifolia</i>	1.25	1.01	54.75	2.17		Herb/ Forb	<i>Desmodium gunnii</i>	2.00	2.01	54.75	4.34
	<i>Clerodendrum tomentosum</i>	0.75	0.50	0.91	1.08		<i>Dichondra repens</i>	2.00	2.01	54.75	4.34	
	<i>Maytenus silvestris</i>	0.75	0.50	0.91	1.07		<i>Pratia purpurascens</i>	2.00	2.01	54.75	4.34	
	<i>Myrsine variabilis</i>	1.00	0.50	0.91	1.07		<i>Pseuderanthemum variabile</i>	1.75	1.51	2.68	3.27	
							<i>Brunoniella australis</i>	1.50	0.99	0.91	2.14	
Subshrub	<i>Hibbertia diffusa</i>	1.00	0.50	0.91	1.08	<i>Oxalis perennans</i>	1.25	0.66	0.81	1.43		
	<i>Pomax umbellata</i>	1.00	0.50	0.91	1.08	<i>Plectranthus parviflorus</i>	1.00	0.51	0.91	1.10		
						<i>Vernonia cinerea</i> var. <i>cinerea</i>	1.00	0.51	0.91	1.10		
						Vine	<i>Glycine clandestina</i>	2.00	2.01	54.75	4.34	
						<i>Pandorea pandorana</i>	2.00	2.01	54.75	4.34		
						<i>Desmodium rhytidophyllum</i>	1.25	1.01	54.75	2.17		
						<i>Eustrephus latifolius</i>	1.25	1.01	54.75	2.17		
						<i>Desmodium brachypodum</i>	1.25	0.68	0.82	1.46		
						<i>Hardenbergia violacea</i>	1.00	0.50	0.91	1.08		
						<i>Cissus opaca</i>	0.75	0.50	0.91	1.07		

**Unit 6****Seaham Ironbark Forest**

NSW Vegetation class (Keith 2004):

North East CRA E33:

LHCCREMS 16:

Coastal Valley Grassy Woodlands  
Dry Foothills Spotted Gum (?)  
Seaham Spotted Gum-Ironbark Forest**General Description:**

Seaham Ironbark Forest occurs in two areas of the reserve, both of which have been disturbed by previous clearing and grazing, and both are dominated by even-aged stands of *Eucalyptus crebra* and/ or *Eucalyptus siderophloia*. Shrubs are generally sparse or absent, but a diverse ground layer of grasses and herbs is present. It is probable that this community is an artefact of past clearing, and has been recolonised by nearby standing remnant trees, particularly *Eucalyptus crebra*.

**Characteristic Features:**

- canopy dominated by *Eucalyptus crebra* and, in some places, *Eucalyptus siderophloia*
- even-aged stands of eucalypts following previous clearing and grazing
- ground layer of numerous grasses and herbs

**Known Floristic/ Structural Variations:**

Northern Grey Ironbark (*Eucalyptus siderophloia*) may co-occur with the more characteristic Narrow-leaved Ironbark (*Eucalyptus crebra*) in some areas.

**Relationship to Other Communities:**

Almost mono-specific stands of *Eucalyptus crebra* (+/- *E. siderophloia*) over a grassy understorey distinguish this community from all others. There may be some confusion with Seaham Spotted Gum – Ironbark Forest (Unit 7) due to the presence of *Eucalyptus crebra* also in that community, however the co-dominance of *Corymbia maculata* in the latter can be used to split the two.

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	15.8	13.5	18.0	35.0	0.0	2
Middle 1	1.9	1.3	2.5	16.5	19.1	2
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	87.5	10.6	2

**Community Conservation Status:**

Reserve Representation –

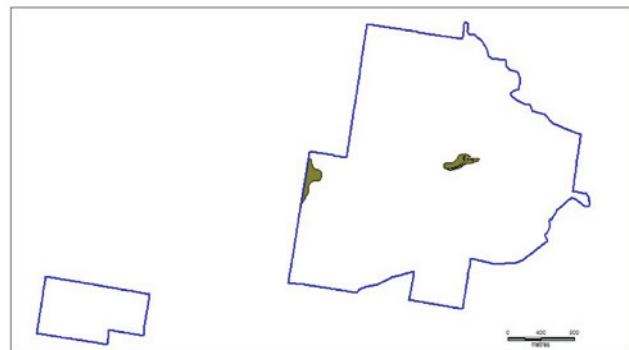
unknown from other reserves but likely to occur on the Lower North Coast

EPBC Act (1999) Status –

not currently listed.

TSC Act (1995) Status –

not currently listed.

**Distribution:**

Columbe NP (main portion)	8.19 ha
Columbe NP (Stonequarry Hill)	not present
Total	8.19 ha



**Significant Species:**Undescribed species – *none recorded*Threatened (EPBC Act) – *none recorded*Threatened (TSC Act) – *none recorded*Rare (ROTAP) – *none recorded***Species Richness:**

Number of plots: 2  
 Total native species: 68  
 Mean species / plot (+/- SD): 49.5 (+/- 3.54)

**Key Diagnostic Species [based on 2 plots]:****Seaham Ironbark Forest**  
Average similarity: 56.67

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib %
Tree	<i>Eucalyptus crebra</i>	3.50	3.33	-	5.88
Shrub	<i>Acacia implexa</i>	1.50	1.11	-	1.96
	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	1.50	1.11	-	1.96
	<i>Breynia oblongifolia</i>	1.50	1.11	-	1.96
Grass	<i>Cymbopogon refractus</i>	2.50	2.22	-	3.92
	<i>Echinopogon ovatus</i>	2.00	2.22	-	3.92
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	3.00	2.22	-	3.92

	<i>Panicum effusum</i>	2.50	2.22	-	3.92
	<i>Paspalidium distans</i>	2.50	2.22	-	3.92
	<i>Themeda australis</i>	3.50	2.22	-	3.92
	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	1.50	1.11	-	1.96
Gram- inoid	<i>Dianella caerulea</i> var. <i>assera</i>	1.00	1.11	-	1.96
Herb/ Forb	<i>Brunoniella australis</i>	2.00	2.22	-	3.92
	<i>Dichondra repens</i>	2.00	2.22	-	3.92
	<i>Hypericum gramineum</i>	2.00	2.22	-	3.92
	<i>Hypoxis hygrometrica</i> var. <i>villosisepala</i>	2.00	2.22	-	3.92
	<i>Lagenophora stipitata</i>	2.00	2.22	-	3.92
	<i>Oxalis perennans</i>	2.00	2.22	-	3.92
	<i>Pratia purpurascens</i>	2.00	2.22	-	3.92
	<i>Vernonia cinerea</i> var. <i>cinerea</i>	2.00	2.22	-	3.92
	<i>Centella asiatica</i>	1.50	1.11	-	1.96
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	2.00	2.22	-	3.92
	<i>Fimbristylis dichotoma</i>	2.00	2.22	-	3.92
Sedge	<i>Carex longibrachiata</i>	1.50	1.11	-	1.96
	<i>Glycine clandestina</i>	2.00	2.22	-	3.92
Vine	<i>Glycine tabacina</i>	2.00	2.22	-	3.92

**Unit 7****Seaham Spotted Gum – Ironbark Forest**

NSW Vegetation class (Keith 2004):

North East CRA E33:

LHCCREMS 16:

Hunter-Macleay Dry Sclerophyll Forests

Dry Foothills Spotted Gum (?)

Seaham Spotted Gum-Ironbark Forest

**General Description:**

Seaham Spotted Gum – Ironbark Forest is dominated by *Eucalyptus siderophloia*, *Eucalyptus crebra*, *Corymbia maculata* and *Eucalyptus moluccana*, often with *Eucalyptus tereticornis*. It occurs on the higher ridges and hills, such as Tower Hill, and understory species include *Bursaria spinosa*, *Acacia falcata*, *Lissanthe strigosa*, *Jacksonia scoparia*, *Cymbopogon refractus*, *Themeda australis*, *Aristida vagans*, and a high diversity of herbs.

**Characteristic Features:**

- canopy dominated by *Eucalyptus siderophloia*, *Eucalyptus crebra*, *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Corymbia maculata*
- occurs on the higher elevation areas, on ridgetops and at exposed aspects
- shrubs such as *Jacksonia scoparia* and *Bursaria spinosa* characteristic

**Known Floristic/ Structural Variations:**

No known floristic or structural variations noted.

**Relationship to Other Communities:**

The presence of *Eucalyptus siderophloia*, *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Eucalyptus moluccana*, with *Corymbia maculata* distinguish this community from all others. Lower Hunter Spotted Gum – Ironbark Forest (Unit 8) is superficially similar, but in that community the dominant ironbark species is *Eucalyptus fibrosa* and it occurs at lower elevations on the more gentle slopes and ridges.

**Community Conservation Status:**

Reserve Representation – known from Wallaroo and Karuah NRs

EPBC Act (1999) Status – not currently listed.

TSC Act (1995) Status – not currently listed.



**Distribution:**

<i>Columbeby NP (main portion)</i>	74.7 ha
<i>Columbeby NP (Stonequarry Hill)</i>	32.0 ha
<b>Total</b>	<b>106.7 ha</b>

**Significant Species:**

- Undescribed species – none recorded
- Threatened (EPBC Act) – none recorded
- Threatened (TSC Act) – none recorded
- Rare (ROTAP) – *Macrozamia flexuosa*

**Species Richness:**

<i>Number of plots:</i>	4
<i>Total native species:</i>	109
<i>Mean species / plot (+/- SD):</i>	57.2 (+/- 8.10)

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	18.5	17.0	20.0	33.8	2.5	4
Middle 1	3.5	2.2	4.8	26.3	27.2	4
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	75.0	19.2	4

**Key Diagnostic Species [based on 4 plots]:**

**Seaham Spotted Gum – Ironbark Forest**  
Average similarity: 51.15

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib %	
Tree	<i>Corymbia maculata</i>	2.75	2.51	4.43	4.90	
	<i>Eucalyptus umbra</i>	2.00	1.32	1.81	2.57	
	<i>Eucalyptus tereticornis</i>	1.25	0.50	0.91	0.97	
	<i>Eucalyptus crebra</i>	1.75	0.44	0.41	0.86	
Shrub	<i>Bursaria spinosa</i>	2.75	2.17	5.19	4.25	
	<i>Acacia falcata</i>	2.00	1.50	2.74	2.94	
	<i>Acacia implexa</i>	1.75	1.47	3.42	2.87	
	<i>Pultenaea villosa</i>	1.50	1.20	2.18	2.34	
	<i>Acacia ulicifolia</i>	1.50	1.16	3.27	2.27	
	<i>Leucopogon juniperinus</i>	1.50	1.16	3.27	2.27	
	<i>Breynia oblongifolia</i>	1.00	1.01	9.98	1.97	
	<i>Persoonia linearis</i>	0.75	0.46	0.91	0.91	
Subshrub	<i>Pomax umbellata</i>	1.00	0.46	0.91	0.91	
Grass	<i>Aristida vagans</i>	2.50	2.19	4.05	4.28	
	<i>Cymbopogon refractus</i>	2.75	2.16	7.70	4.22	
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	2.25	2.01	9.98	3.93	
	<i>Dichelachne micrantha</i>	1.75	1.47	3.42	2.87	
	<i>Entolasia stricta</i>	2.00	1.47	3.42	2.87	
	<i>Panicum simile</i>	1.50	0.93	0.91	1.81	
	Gram-inoid	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	1.75	1.54	2.31	3.01
<i>Lomandra confertifolia</i> subsp. <i>pallida</i>		1.75	1.20	2.18	2.34	
<i>Lomandra longifolia</i>		1.25	1.01	9.98	1.97	
<i>Dianella caerulea</i> var. <i>assera</i>		1.50	0.93	0.91	1.81	
<i>Dianella revoluta</i> var. <i>revoluta</i>		0.75	0.50	0.91	0.97	
<i>Pratia purpurascens</i>		2.00	2.01	9.98	3.93	
<i>Brunoniella australis</i>		1.75	1.50	2.74	2.94	
<i>Lagenophora stipitata</i>		1.50	1.04	0.91	2.02	
<i>Phyllanthus hirtellus</i>		1.50	1.04	0.91	2.02	
<i>Dichondra repens</i>		1.50	0.93	0.91	1.81	
Fern	<i>Desmodium gunnii</i>	1.25	0.70	0.85	1.36	
	<i>Vernonia cinerea</i> var. <i>cinerea</i>	1.25	0.62	0.81	1.21	
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	2.00	2.01	9.98	3.93	
	<i>Lepidosperma laterale</i>	2.00	1.52	2.46	2.98	
	<i>Gahnia aspera</i>	1.00	0.46	0.91	0.91	
	Vine	<i>Glycine clandestina</i>	1.75	1.47	3.42	2.87
		<i>Glycine tabacina</i>	1.50	1.17	2.95	2.28
<i>Desmodium rhytidophyllum</i>		1.25	0.62	0.81	1.21	
	<i>Eustrephus latifolius</i>	1.00	0.53	0.91	1.05	

## Unit 8

### Lower Hunter Spotted Gum – Ironbark Forest

NSW Vegetation class (Keith 2004):

North East CRA E75:

LHCCREMS 17:

Hunter-Macleay Dry Sclerophyll Forests

Lowlands Spotted Gum-Box (?)

Lower Hunter Spotted Gum-Ironbark Forest



#### General Description:

Lower Hunter Spotted Gum – Ironbark Forest is dominated by *Eucalyptus fibrosa*, *Corymbia maculata* and *Eucalyptus umbra*. In places, *Eucalyptus moluccana* can also be present. This community occupies the lower undulating slopes at low elevation, with typical understorey species including *Daviesia ulicifolia* subsp. *ulicifolia*, *Bursaria spinosa*, *Pultenaea villosa*, *Entolasia stricta*, *Aristida vagans*, *Macrozamia flexuosa*, and *Lomandra confertifolia* subsp. *pallida*. This community is consistent with the Final Determination for the EEC of the same name (NSW Scientific Committee 2005b).

#### Characteristic Features:

- canopy dominated by *Eucalyptus fibrosa* and *Corymbia maculata*, with *Eucalyptus umbra* also present in some areas
- shrub layer of *Daviesia ulicifolia* subsp. *ulicifolia*, *Bursaria spinosa* and *Pultenaea villosa*
- ground layer dominated by grasses such as *Entolasia stricta*, *Aristida vagans* and *Microlaena stipoides* var. *stipoides*

#### Known Floristic/ Structural Variations:

In some locations, small stands of *Melaleuca nodosa* may occasionally occur, which superficially resemble the Red Ironbark – Paperbark Scrub-Forest. However, these stands are always highly localised.

#### Relationship to Other Communities:

The co-dominance of *Corymbia maculata* and *Eucalyptus fibrosa*, often with *Eucalyptus umbra*, distinguish this community from all others. The closely related Red Ironbark Scrub-Forest (Unit 9) can be confused with this community, but *Corymbia maculata* is very sparse or absent in that community, and *Melaleuca nodosa* forms characteristic dense stands in the mid-storey.

#### Community Conservation Status:

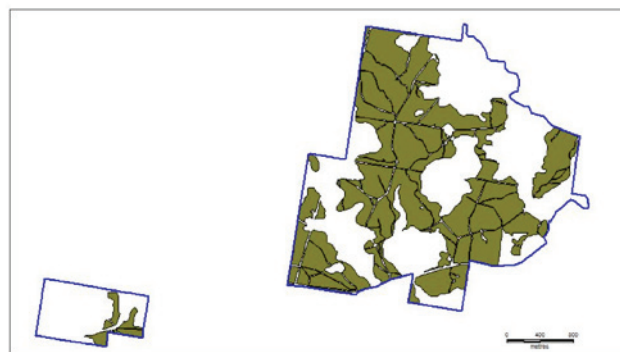
Reserve Representation – known from Werakata NP & SCA (DECC 2008) and Sugarloaf SCA (Bell & Driscoll 2009)

EPBC Act (1999) Status –

not currently listed.

TSC Act (1995) Status –

consistent with *Lower Hunter Spotted Gum – Ironbark Forest* EEC



#### Distribution:

<i>Columbe NP (main portion)</i>	407.09 ha
<i>Columbe NP (Stonequarry Hill)</i>	12.11 ha
Total	419.2 ha

#### Significant Species:

Undescribed species – none recorded  
 Threatened (EPBC Act) – none recorded  
 Threatened (TSC Act) – none recorded  
 Rare (ROTAP) – *Macrozamia flexuosa*

#### Species Richness:

<i>Number of plots:</i>	8
<i>Total native species:</i>	109
<i>Mean species / plot (+/- SD):</i>	48.6 (+/- 3.50)

**Key Diagnostic Species [based on 8 plots]:****Lower Hunter Spotted Gum Ironbark Forest**  
**Average similarity: 61.69**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%						
							<i>Panicum simile</i>	1.88	2.10	3.76	3.41
							<i>Paspalidium distans</i>	1.50	1.26	1.05	2.05
							<i>Themeda australis</i>	1.38	1.12	1.41	1.82
							<i>Cymbopogon refractus</i>	1.25	1.01	1.48	1.64
							<i>Eragrostis brownii</i>	1.13	0.77	0.95	1.25
Tree	<i>Eucalyptus fibrosa</i>	3.50	3.85	7.17	6.24						
	<i>Corymbia maculata</i>	3.25	3.63	15.31	5.89	Gram-inoid	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	1.63	1.61	2.91	2.62
	<i>Eucalyptus umbra</i>	1.75	1.17	0.93	1.89		<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	1.63	1.52	1.50	2.47
Shrub	<i>Bursaria spinosa</i>	2.50	2.65	5.03	4.30		<i>Dianella revoluta</i> var. <i>revoluta</i>	1.50	1.47	2.63	2.38
	<i>Pultenaea villosa</i>	2.13	1.51	1.18	2.45		<i>Dianella caerulea</i> var. <i>assera</i>	1.25	1.02	1.45	1.65
	<i>Leucopogon juniperinus</i>	1.38	1.33	3.46	2.15		<i>Lomandra longifolia</i>	1.25	0.78	0.96	1.26
	<i>Acacia falcata</i>	1.25	1.24	4.70	2.02						
	<i>Persoonia linearis</i>	1.38	1.14	1.41	1.86						
	<i>Acacia ulicifolia</i>	2.00	1.14	0.75	1.85	Herb/Forb	<i>Pratia purpurascens</i>	2.00	2.40	17.07	3.88
	<i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i>	1.50	1.04	0.98	1.69		<i>Phyllanthus hirtellus</i>	1.88	2.09	4.03	3.38
	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>	1.00	0.66	1.01	1.07		<i>Goodenia heterophylla</i> subsp. <i>heterophylla</i>	1.25	0.81	0.73	1.32
Subshrub	<i>Pomax umbellata</i>	1.63	1.55	1.47	2.51		<i>Brunoniella australis</i>	1.13	0.80	0.94	1.29
	<i>Brachyscome multifida</i> var. <i>multifida</i>	1.50	1.30	1.40	2.11	Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	2.00	2.40	17.07	3.88
	<i>Hibbertia diffusa</i>	0.88	0.64	1.05	1.03						
Grass	<i>Entolasia stricta</i>	3.50	3.52	4.70	5.71						
	<i>Aristida vagans</i>	2.75	2.69	4.29	4.36						
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	2.00	2.40	17.07	3.88	Sedge	<i>Lepidosperma laterale</i>	1.38	1.07	0.96	1.73
						Vine	<i>Glycine clandestina</i>	1.50	1.31	1.40	2.13
							<i>Hardenbergia violacea</i>	0.88	0.90	1.69	1.47

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	17.3	15.8	18.8	32.5	3.8	8
Middle 1	5.2	3.0	7.5	30.6	29.6	8
Middle 2	1.4	0.7	2.1	42.1	26.1	8
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	60.0	25.5	5

**Unit 9**

**Red Ironbark Scrub-Forest**

NSW Vegetation class (Keith 2004):

North East CRA

LHCCREMS

Hunter-Macleay Dry Sclerophyll Forests

No equivalent

17: Lower Hunter Spotted Gum-Ironbark Forest



**General Description:**

Red Ironbark Scrub-Forest is dominated by *Eucalyptus fibrosa* under a dense understorey of *Melaleuca nodosa*. *Corymbia maculata* may also be present but in low abundance. This community occurs toward the north of the reserve, and supports a number of more typically sandstone-based species such as *Phyllota phyllicoides*, *Lomandra glauca*, *Gompholobium pinnatum*, *Patersonia sericea*, *Dillwynia retorta*, *Xanthorrhoea latifolia* subsp. *latifolia* and *Banksia spinulosa* var. *collina*. It is similar to vegetation in the Cessnock LGA which forms a component of the Lower Hunter Spotted Gum – Ironbark Forest EEC (DECC 2008).

**Characteristic Features:**

- canopy dominated by *Eucalyptus fibrosa* and (very occasionally) *Corymbia maculata*
- mid layer of dense stands of *Melaleuca nodosa*, *Hakea sericea* and *Callistemon linearis*
- occurs on erodible clay soils

**Known Floristic/ Structural Variations:**

No known floristic or structural variations noted.

**Relationship to Other Communities:**

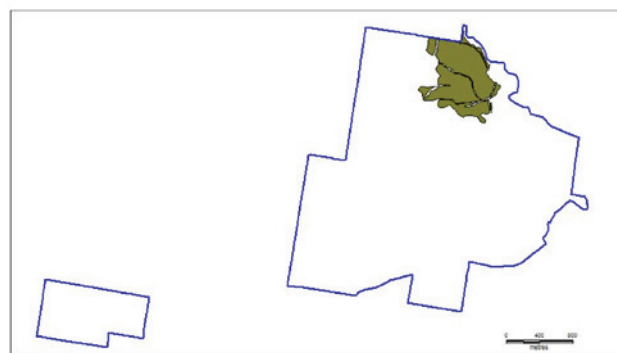
Dense stands of *Melaleuca nodosa* under a canopy of mostly *Eucalyptus fibrosa* distinguish this community from the closely related Lower Hunter Spotted Gum – Ironbark Forest (Unit 8). No other community within the reserve is characterised by *Melaleuca nodosa* in the understorey.

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	15.3	12.7	18.0	20.0	0.0	3
Middle 1	5.6	3.8	7.3	61.7	40.4	3
Middle 2	-	1.5	4.0	85.0	-	1
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.7	46.7	34.0	3

**Community Conservation Status:**

*Reserve Representation* – known from Werakata NP & SCA (DECC 2008)  
*EPBC Act (1999) Status* – not currently listed.  
*TSC Act (1995) Status* – forms a component of Lower Hunter Spotted Gum – Ironbark Forest EEC



**Distribution:**

<i>Columbey NP (main portion)</i>	56.21 ha
<i>Columbey NP (Stonequarry Hill)</i>	not present
<b>Total</b>	<b>56.21 ha</b>

**Significant Species:**

Undescribed species – *none recorded*  
 Threatened (EPBC Act) – *none recorded*  
 Threatened (TSC Act) – *none recorded*  
 Rare (ROTAP) – *Macrozamia flexuosa*

**Species Richness:**

Number of plots: 3  
 Total native species: 70  
 Mean species / plot (+/- SD): 47.7 (+/- 6.11)

**Key Diagnostic Species [based on 3 plots]:**

**Red Ironbark Scrub–Forest**  
 Average similarity: **68.96**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%
Tree	<i>Eucalyptus fibrosa</i>	3.67	3.98	11.00	5.77
	<i>Corymbia maculata</i>	2.00	1.62	2.15	2.35
Shrub	<i>Melaleuca nodosa</i>	6.00	7.23	12.92	10.48
	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>	2.00	2.41	12.92	3.49
	<i>Pultenaea myrtilloides</i>	2.00	2.41	12.92	3.49
	<i>Phyllota phylloides</i>	1.67	1.57	2.89	2.28
	<i>Dendrophthoe vitellina</i>	1.00	1.21	12.92	1.75
	<i>Pultenaea villosa</i>	1.00	1.21	12.92	1.75
	<i>Callistemon rigidus</i>	1.33	0.83	0.58	1.20
	<i>Callistemon linearis</i>	1.33	0.73	0.58	1.06
	<i>Hakea sericea</i>	1.67	0.73	0.58	1.06
Subshrub	<i>Gonocarpus tetragynus</i>	2.00	2.41	12.92	3.49

Grass	<i>Entolasia stricta</i>	2.67	2.83	3.27	4.11
	<i>Aristida vagans</i>	2.00	2.41	12.92	3.49
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	2.00	2.41	12.92	3.49
	<i>Joycea pallida</i>	1.67	1.57	2.89	2.28
	<i>Aristida warburgii</i>	1.33	0.73	0.58	1.06
Gram-inoid	<i>Dianella revoluta</i> var. <i>revoluta</i>	2.00	2.41	12.92	3.49
	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	2.33	2.41	12.92	3.49
	<i>Lomandra glauca</i>	2.00	2.41	12.92	3.49
Herb/Forb	<i>Goodenia bellidifolia</i> subsp. <i>bellidifolia</i>	2.00	2.41	12.92	3.49
	<i>Phyllanthus hirtellus</i>	2.00	2.41	12.92	3.49
	<i>Pratia purpurascens</i>	1.67	1.57	2.89	2.28
	<i>Lagenophora stipitata</i>	1.00	1.21	12.92	1.75
	<i>Thysanotus tuberosus</i> subsp. <i>tuberosus</i>	1.00	1.21	12.92	1.75
	<i>Drosera auriculata</i>	1.33	0.73	0.58	1.06
	<i>Goodenia heterophylla</i> subsp. <i>heterophylla</i>	1.33	0.73	0.58	1.06
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	2.00	2.41	12.92	3.49
Sedge	<i>Philothrix deusta</i>	2.33	2.41	12.92	3.49
Vine	<i>Cassytha glabella</i> forma <i>glabella</i>	2.00	2.41	12.92	3.49
	<i>Hardenbergia violacea</i>	1.00	1.21	12.92	1.75

**Unit 10**

**Stringybark - Apple Forest**

NSW Vegetation class (Keith 2004):

North East CRA

LHCCREMS 30:

Hunter-Macleay Dry Sclerophyll Forests

No equivalent

Coastal Plains Smooth-barked Apple Woodland (?)



**General Description:**

Stringybark – Apple Forest occurs in two locations within the wider Lower Hunter Spotted Gum – Ironbark Forest landscape. It is dominated by *Eucalyptus globoidea*, but with *Angophora costata* or *Eucalyptus fibrosa* present in one area. This community is typified by the presence of more typical sandstone species, such as *Banksia spinulosa* var. *collina*, *Xanthorrhoea latifolia*, *Podolobium scandens*, *Laxmannia gracilis*, *Gompholobium pinnatum* and *Aristida warburgii*. Given the small size of both locations present, it is not surprising that their floristic composition is heavily influenced by the surrounding Lower Hunter Spotted Gum – Ironbark Forest.

**Characteristic Features:**

- canopy dominated by *Eucalyptus globoidea*, and in some areas *Angophora costata*
- *Xanthorrhoea latifolia* often present, together with *Banksia spinulosa* var. *collina*
- ground layer of grasses and sandstone-based subshrubs such as *Gompholobium pinnatum*

**Known Floristic/ Structural Variations:**

Smooth-barked Apple (*Angophora costata*) is prominent in one location, however White Stringybark (*Eucalyptus globoidea*) clearly characterises this community.

**Relationship to Other Communities:**

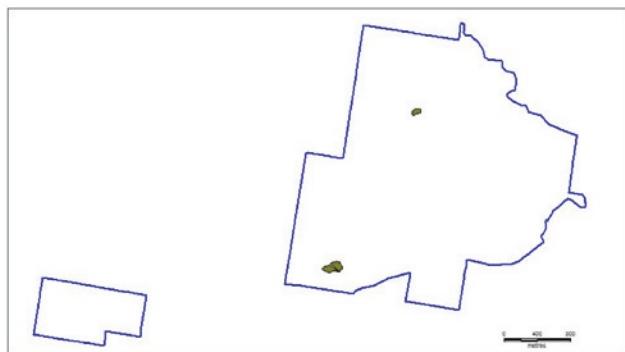
The dominance of *Eucalyptus globoidea* in the canopy distinguish this community from all others. *Angophora costata* may also be present in some areas, and neither species occurs to any great extent in other communities. The presence of ground layer species such as *Banksia spinulosa* var. *collina*, *Xanthorrhoea latifolia*, *Podolobium scandens*, *Laxmannia gracilis*, *Gompholobium pinnatum* and *Aristida warburgii* may also aid identification, but these species are present in some other communities, particularly Red Ironbark Scrub-Forest (Unit 9).

**Community Conservation Status:**

*Reserve Representation* – unknown from other reserves but likely to occur on the Lower North Coast

*EPBC Act (1999) Status* – not currently listed.

*TSC Act (1995) Status* – not currently listed.

**Distribution:**

*Columbey NP (main portion)* 2.67 ha

*Columbey NP (Stonequarry Hill)* not present

**Total** 2.67 ha

**Significant Species:**

Undescribed species – *none recorded*

Threatened (EPBC Act) – *none recorded*

Threatened (TSC Act) – *none recorded*

Rare (ROTAP) – *none recorded*

**Species Richness:**

*Number of plots:* 2

*Total native species:* 78

*Mean species / plot (+/- SD):* 53.5 (+/- 9.19)

**Key Diagnostic Species [based on 2 plots]:****Stringybark – Apple Forest**  
**Average similarity: 51.06**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%	
Tree	<i>Eucalyptus globoidea</i>	4.00	4.26	-	8.33	
	Shrub	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>	2.00	2.13	-	4.17
		<i>Acacia ulicifolia</i>	2.00	1.06	-	2.08
		<i>Callistemon linearis</i>	1.00	1.06	-	2.08
	<i>Persoonia linearis</i>	1.50	1.06	-	2.08	
	Grass	<i>Entolasia stricta</i>	3.00	3.19	-	6.25
<i>Aristida vagans</i>		2.50	2.13	-	4.17	
<i>Microlaena stipoides</i> var. <i>stipoides</i>		2.00	2.13	-	4.17	
<i>Panicum simile</i>		2.00	2.13	-	4.17	
<i>Paspalidium distans</i>		2.00	2.13	-	4.17	
<i>Themeda australis</i>		3.00	2.13	-	4.17	
Gram-inoid	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2.00	2.13	-	4.17	
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	2.00	2.13	-	4.17	
	<i>Lomandra longifolia</i>	1.50	1.06	-	2.08	
Herb/Forb	<i>Brunoniella australis</i>	2.00	2.13	-	4.17	
	<i>Phyllanthus hirtellus</i>	2.00	2.13	-	4.17	
	<i>Pratia purpurascens</i>	2.00	2.13	-	4.17	
	<i>Drosera auriculata</i>	1.00	1.06	-	2.08	
	<i>Microtis unifolia</i>	1.00	1.06	-	2.08	
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	2.00	2.13	-	4.17	
Sedge	<i>Philothrix deusta</i>	2.50	2.13	-	4.17	
	<i>Lepidosperma laterale</i>	1.50	1.06	-	2.08	
Vine	<i>Glycine clandestina</i>	2.00	2.13	-	4.17	
	<i>Billardiera scandens</i>	1.50	1.06	-	2.08	
	<i>Cassytha glabella</i> forma <i>glabella</i>	1.50	1.06	-	2.08	

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	19.8	18.0	21.5	32.5	3.5	2
Middle 1	7.5	5.0	10.0	5.0	0.0	2
Middle 2	1.3	0.8	1.8	19.0	22.6	2
Middle 3	-	-	-	-	-	-
Lowest	0.4	0.1	0.8	82.5	3.5	2

**Hunter Lowlands Redgum Forest**

**Unit 11**

NSW Vegetation class (Keith 2004):  
 North East CRA  
 LHCCREMS 19:

Coastal Valley Grassy Woodlands  
 No equivalent  
 Hunter Lowlands Redgum Forest



**General Description:**

Hunter Lowlands Redgum Forest occurs at a single location in a previously cleared and grazed landscape, where it is dominated by *Eucalyptus tereticornis* over a grassy ground layer of *Themeda australis*, *Aristida warburgii*, *Aristida vagans* and *Ptilothrix deusta*. Shrubs such as *Acacia falcata*, *Acacia irrorata* subsp. *irrorata*, *Pultenaea villosa* and *Bursaria spinosa* are also present. The floristic composition present at this site is consistent with the Final Determination for the EEC of the same name (NSW Scientific Committee 2003).

**Characteristic Features:**

- canopy dominated almost exclusively by *Eucalyptus tereticornis*
- occurs on low relief slopes near creeklines
- ground layer of grasses such as *Themeda australis*, *Aristida warburgii* and *Eragrostis brownii*

**Known Floristic/ Structural Variations:**

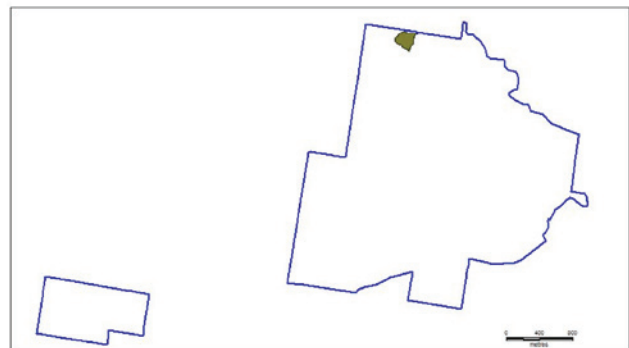
No known floristic or structural variations noted.

**Relationship to Other Communities:**

Dominant stands of *Eucalyptus tereticornis* characterise this community, which is not repeated elsewhere in the reserve. This species is occasionally present in the Floodplain Redgum – Box Forest (Unit 4), but that community is dominated by *Eucalyptus amplifolia*, *Eucalyptus moluccana* or *Eucalyptus siderophloia*.

**Community Conservation Status:**

Reserve Representation – known from Werakata NP (DECC 2008)  
 EPBC Act (1999) Status – not currently listed.  
 TSC Act (1995) Status – forms a component of Hunter Lowlands Redgum Forest EEC.



**Distribution:**

Columbey NP (main portion)	3.68 ha
Columbey NP (Stonequarry Hill)	not present
Total	3.68 ha



**Significant Species:**

Undescribed species – none recorded  
 Threatened (EPBC Act) – none recorded  
 Threatened (TSC Act) – none recorded  
 Rare (ROTAP) – none recorded

**Species Richness:**

Number of plots: 1  
 Total native species: 49  
 Mean species / plot (+/- SD): 49 (+/- n/a)

**Key Diagnostic Species [based on 1 plot]:**

**Hunter Lowlands Redgum Forest  
 Less than 2 samples in group**

Habit	Species	Av. Abund	Av. Sim	Sim/SD	Contrib%
Tree	<i>Eucalyptus tereticornis</i>	-	-	-	-
Shrub	<i>Acacia falcata</i>	-	-	-	-
	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	-	-	-	-
	<i>Breynia oblongifolia</i>	-	-	-	-
	<i>Bursaria spinosa</i>	-	-	-	-
	<i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i>	-	-	-	-
	<i>Hibbertia aspera</i> subsp. <i>aspera</i>	-	-	-	-
	<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>	-	-	-	-
	<i>Leucopogon juniperinus</i>	-	-	-	-
	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>	-	-	-	-
	<i>Logania albiflora</i>	-	-	-	-
	<i>Persoonia linearis</i>	-	-	-	-
	<i>Pultenaea villosa</i>	-	-	-	-
	Grass	<i>Aristida vagans</i>	-	-	-
<i>Aristida warburgii</i>		-	-	-	-
<i>Austroanthonia setacea</i>		-	-	-	-
<i>Cymbopogon refractus</i>		-	-	-	-
<i>Echinopogon ovatus</i>		-	-	-	-
<i>Entolasia stricta</i>		-	-	-	-

	<i>Eragrostis brownii</i>	-	-	-	-
	<i>Imperata cylindrica</i> var. <i>major</i>	-	-	-	-
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	-	-	-	-
	<i>Oplismenus imbecillis</i>	-	-	-	-
	<i>Panicum simile</i>	-	-	-	-
	<i>Paspalidium distans</i>	-	-	-	-
	<i>Themeda australis</i>	-	-	-	-
Gram- inoid	<i>Dianella revoluta</i> var. <i>revoluta</i>	-	-	-	-
	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	-	-	-	-
	<i>Lomandra longifolia</i>	-	-	-	-
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	-	-	-	-
Herb/ Forb	<i>Chrysocephalum apiculatum</i>	-	-	-	-
	<i>Dichondra repens</i>	-	-	-	-
	<i>Eriochilus cucullatus</i>	-	-	-	-
	<i>Goodenia bellidifolia</i> subsp. <i>bellidifolia</i>	-	-	-	-
	<i>Hypoxis hygrometrica</i> var. <i>villosisepala</i>	-	-	-	-
	<i>Lagenophora stipitata</i>	-	-	-	-
	<i>Opercularia diphylla</i>	-	-	-	-
	<i>Oxalis perennans</i>	-	-	-	-
	<i>Phyllanthus hirtellus</i>	-	-	-	-
	<i>Pomax umbellata</i>	-	-	-	-
<i>Pratia purpurascens</i>	-	-	-	-	
Sedge	<i>Gahnia aspera</i>	-	-	-	-
	<i>Lepidosperma laterale</i>	-	-	-	-
	<i>Ptilothrix deusta</i>	-	-	-	-
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	-	-	-	-
Vine	<i>Billardiera scandens</i>	-	-	-	-
	<i>Glycine clandestina</i>	-	-	-	-
	<i>Glycine tabacina</i>	-	-	-	-
	<i>Parsonsia straminea</i>	-	-	-	-

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	-	18.0	20.0	25.0	-	1
Middle 1	-	6.0	15.0	10.0	-	1
Middle 2	-	1.5	4.0	20.0	-	1
Middle 3	-	-	-	-	-	-
Lowest	-	0.1	0.7	85.0	-	1

**Unit 12**

**Plantation Forest**

**NSW Vegetation class (Keith 2004):**  
**North East CRA**  
**LHCCREMS**

**No equivalent**  
**No equivalent**  
**No equivalent**



**General Description:**

Between Plantation Road and Clarendetown Road, areas of plantation eucalypt forest occur, in mostly well-defined rows. For all intents and purposes these areas possess a native understorey of species typical of elsewhere in the reserve. Planted eucalypts noted include all locally occurring species, such as *Eucalyptus siderophloia* (dominant), *Eucalyptus fibrosa*, *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Corymbia maculata*. An area of *Callitris endlicheri* (not locally indigenous) is also present adjacent to Clarendetown Road. Other areas of plantation include *Eucalyptus resinifera*, particularly towards the middle of the reserve adjacent to Wallaroo Ck.

**Characteristic Features:**

- canopy dominated by any of *Eucalyptus siderophloia*, *Eucalyptus fibrosa*, *Eucalyptus tereticornis*, *Eucalyptus moluccana*, *Corymbia maculata*, *Eucalyptus resinifera*, or *Callitris endlicheri*, all planted in rows
- shrub layer poorly developed or absent
- ground layer of grasses and herbs

**Known Floristic/ Structural Variations:**

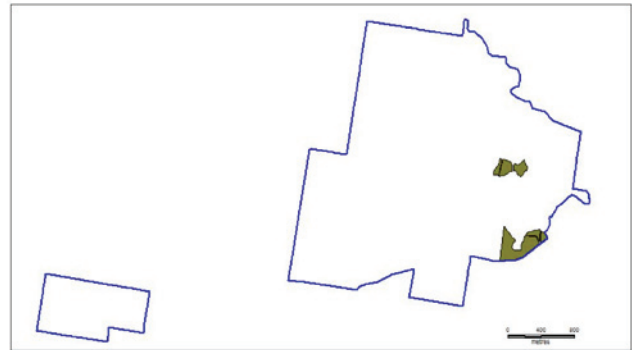
Planted canopy species varies throughout the mapped areas of this community. Northern Grey Ironbark (*Eucalyptus siderophloia*) tends to dominate most areas, and Red Mahogany (*Eucalyptus resinifera*) is most common in the more northern plantation area.

**Relationship to Other Communities:**

Although the majority of species present within this community are represented elsewhere in the reserve in several other communities, the linear rows of canopy species clearly separates this community from all others. In addition, Black Cypress Pine is not present in any other community, either within the reserve or locally elsewhere.

**Community Conservation Status:**

Reserve Representation – not applicable  
 EPBC Act (1999) Status – not applicable  
 TSC Act (1995) Status – not applicable



**Distribution:**

<i>Columbey NP (main portion)</i>	16.65 ha
<i>Columbey NP (Stonequarry Hill)</i>	not present
<b>Total</b>	<b>16.65 ha</b>

**Significant Species:**

Undescribed species – none recorded  
 Threatened (EPBC Act) – none recorded  
 Threatened (TSC Act) – none recorded  
 Rare (ROTAP) – none recorded

**Species Richness:**

<i>Number of plots:</i>	1
<i>Total native species:</i>	45
<i>Mean species / plot (+/- SD):</i>	45 (+/- n/a)

**Key Diagnostic Species [based on 1 plot]:****Plantation Forest  
Less than 2 samples in group**

Habit	Species	Av. Abund	Av. Sim	Sim/ SD	Contrib %
Tree	<i>Eucalyptus siderophloia</i>	-	-	-	-
	<i>Eucalyptus tereticornis</i>	-	-	-	-
Shrub	<i>Acacia ulicifolia</i>	-	-	-	-
	<i>Acrotriche divaricata</i>	-	-	-	-
	<i>Breynia oblongifolia</i>	-	-	-	-
	<i>Bursaria spinosa</i>	-	-	-	-
	<i>Cassinia uncata</i>	-	-	-	-
	<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	-	-	-	-
	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>	-	-	-	-
	<i>Notelaea longifolia</i> f. <i>longifolia</i>	-	-	-	-
	<i>Persoonia linearis</i>	-	-	-	-
	<i>Pultenaea villosa</i>	-	-	-	-
Subshrub	<i>Chrysocephalum apiculatum</i>	-	-	-	-
Grass	<i>Aristida vagans</i>	-	-	-	-
	<i>Cymbopogon refractus</i>	-	-	-	-
	<i>Dichelachne micrantha</i>	-	-	-	-
	<i>Echinopogon ovatus</i>	-	-	-	-
	<i>Entolasia stricta</i>	-	-	-	-
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	-	-	-	-
	<i>Notodanthonia longifolia</i>	-	-	-	-
	<i>Panicum simile</i>	-	-	-	-
	<i>Poa labillardierei</i> var. <i>labillardierei</i>	-	-	-	-
	<i>Themeda australis</i>	-	-	-	-

**Plantation Forest  
Less than 2 samples in group**

Habit	Species	Av. Abund	Av. Sim	Sim/ SD	Contrib %
Gram- inoid	<i>Dianella caerulea</i> var. <i>assera</i>	-	-	-	-
	<i>Dianella revoluta</i> var. <i>revoluta</i>	-	-	-	-
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	-	-	-	-
Herb/Forb	<i>Brunoniella australis</i>	-	-	-	-
	<i>Dichondra repens</i>	-	-	-	-
	<i>Euchiton sphaericus</i>	-	-	-	-
	<i>Goodenia bellidifolia</i> subsp. <i>bellidifolia</i>	-	-	-	-
	<i>Hibbertia diffusa</i>	-	-	-	-
	<i>Hydrocotyle laxiflora</i>	-	-	-	-
	<i>Microtis unifolia</i>	-	-	-	-
	<i>Opercularia diphylla</i>	-	-	-	-
	<i>Phyllanthus hirtellus</i>	-	-	-	-
	<i>Poranthera microphylla</i>	-	-	-	-
	<i>Pratia purpurascens</i>	-	-	-	-
Sedge	<i>Lepidosperma laterale</i>	-	-	-	-
	<i>Ptilothrix deusta</i>	-	-	-	-
	<i>Schoenus apogon</i>	-	-	-	-
Fern	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	-	-	-	-
Vine	<i>Eustrephus latifolius</i>	-	-	-	-
	<i>Glycine clandestina</i>	-	-	-	-
	<i>Parsonsia straminea</i>	-	-	-	-
	<i>Polymeria calycina</i>	-	-	-	-

**Vegetation Structure:**

Stratum	Mean height (m)	Min height (m)	Max height (m)	Mean cover (%)	Sdev	n
Emergent	-	-	-	-	-	-
Tallest	-	18.0	22.0	35.0	-	1
Middle 1	-	1.0	2.5	50.0	-	1
Middle 2	-	-	-	-	-	-
Middle 3	-	-	-	-	-	-
Lowest	-	0.1	0.7	75.0	-	1

