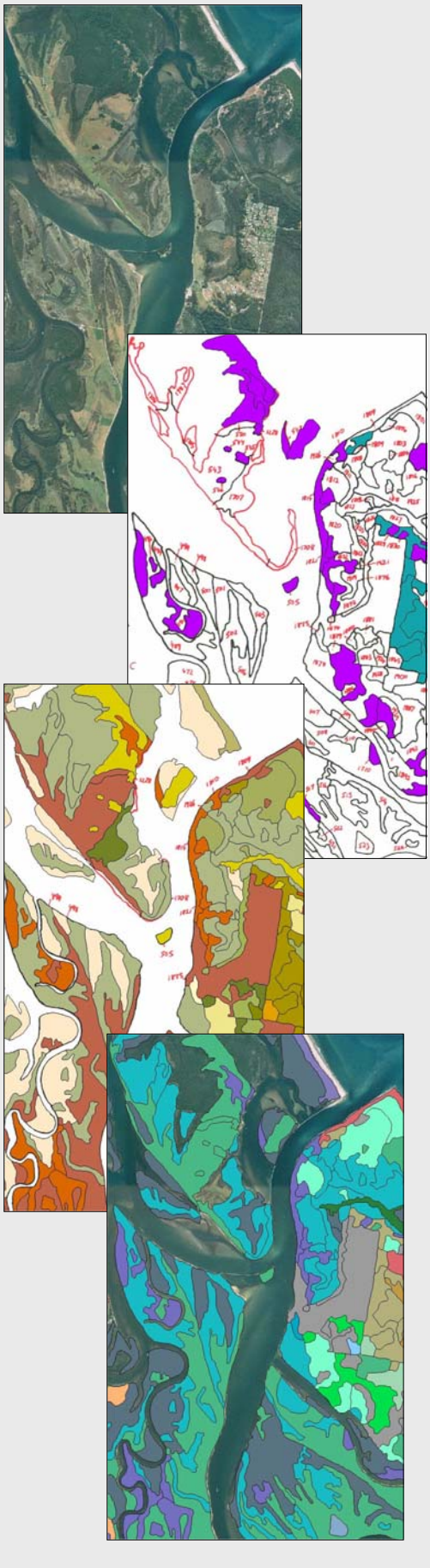

Native Vegetation and Candidate Endangered Ecological Community Mapping Report.

Kempsey LGA East

July 2006

Report to Kempsey Shire Council

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Penny Kendall (*Kendall & Kendall Ecological Consultants Pty Ltd*)

Disclaimer

This project is a rapid survey based primarily on remote sensing and is intended to provide an overview of the vegetation communities throughout the study area.

This study does not comply with the DEC regional survey guidelines as outlined in the *DEC, 2004, Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW* or the *Draft Regional Biodiversity Survey & assessment Guidelines Draft 2001*

In natural environments the composition and distribution of the various vegetation communities are complex and variable with often in-discrete boundaries. Mapping of vegetation communities, particularly by remote techniques, involves a large degree of professional judgment in both locating polygon boundaries and assigning appropriate floristic and structural classes. Even though considerable effort has been applied to this project to ensure the accuracy and objectivity of the mapping, errors will occur, especially when applying the mapping to small areas or parts of polygons.

This project also attempts to derive Candidate EECs from a vegetation dataset which is the combination of previous mapping (CRAFTI) and mapping undertaken for this project (Forest Ecosystems). **It must be emphasised that the actual determination of an ecological community as an Endangered Ecological Community requires considerably more detailed investigation than that undertaken for this study.**

When using the Candidate EEC dataset it must be remembered that the derivation of Candidate EECs is problematic as many of the Candidate EECs adjoin or intergrade with other Candidate EECs and the boundaries between vegetation communities are dynamic and may shift over time in response to climatic changes, hydrological regimes, or other factors. **For this reason the Candidate EEC dataset should be considered indicative only and is not guaranteed to be free of errors or omissions**.

Acknowledgements

Aerial photograph interpretation and mapping of vegetation polygons was undertaken by Penny Kendall (Principal Botanist, Flora Ecologist and Aerial Photograph Interpreter, *Kendall & Kendall Ecological Services Pty Ltd*).

Compilation of mapping into a GIS framework was undertaken by Damon Telfer (*GECO Environmental*).

Derivation of Candidate Endangered Ecological Communities was undertaken jointly by Penny Kendall and Damon Telfer.

The authors would also like to thank Roger Dwyer of Roger Dwyer & Associates Mapping Consultants for assistance with scanning and vectorisation of the mapped vegetation polygons.

Data was provided to the project under licence from the NSW Department of Environment and Conservation and NSW Department of Natural Resources.

Table of Contents

Introduction

GECO Environmental was commissioned by Kempsey Shire Council to prepare a vegetation map for the eastern portion of the Local Government Area (see map below) and to derive Candidate Endangered Ecological Communities within the study area. Penny Kendall from *Kendall & Kendall Ecological Services Pty Ltd* was subcontracted by *GECO Environmental* to assist the project with the air photo interpretation and flora assessment elements of the project.

The mapping project included an area of proposed future industrial land south of Kempsey study area. A more thorough assessment of this area was undertaken by Penny Kendall as part of the overall vegetation mapping project, with additional ground truthing and field survey undertaken within this area. A separate report on the South Kempsey Proposed Future Industrial Area is provided as ***Appendix A*** at the back of this report.

Study Area

The study area covers an eastern portion of the Kempsey LGA, defined as the area of the LGA east of the Pacific Highway plus areas west of the Highway but within the Macleay Coastal subcatchment (as defined by the Department of Natural Resources). The total area is approximately 990 km^2, however approximately 140 km^2 of National Park and 69 km^2 State Forest were excluded from the study area.

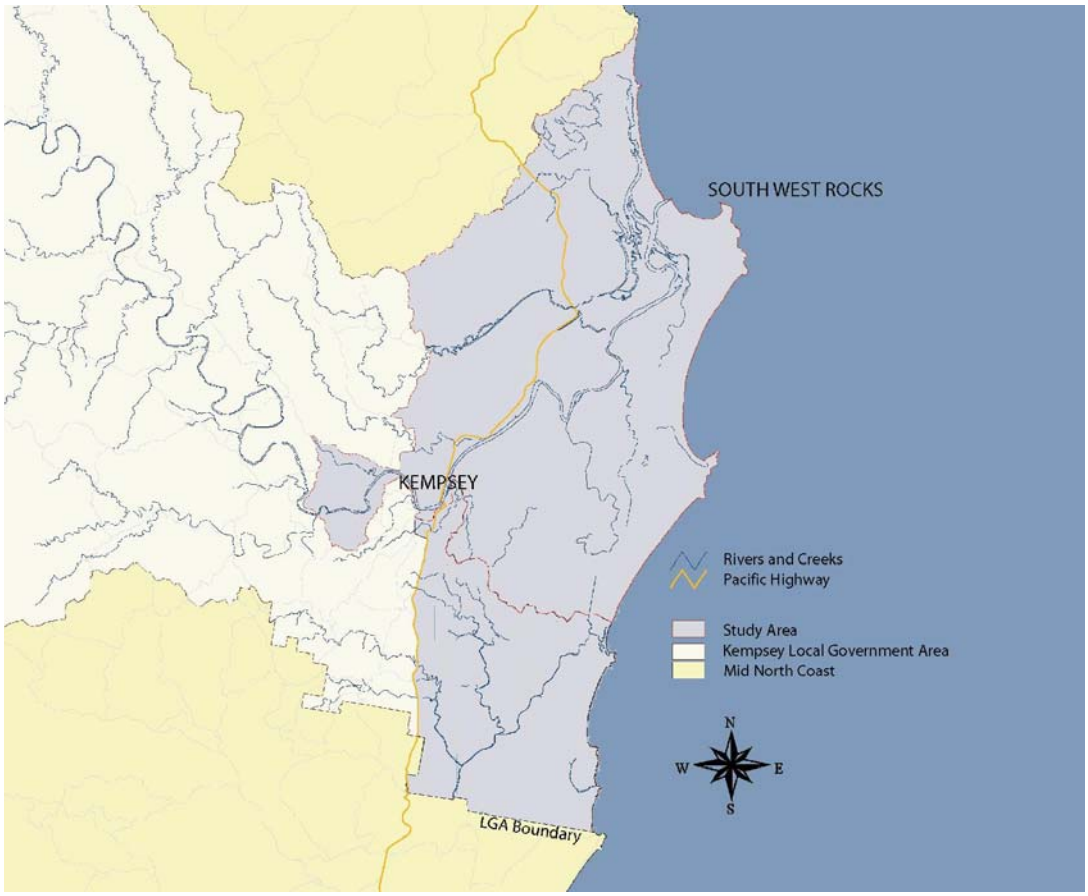

Figure 1 *Kempsey LGA East Vegetation mapping Study Area*

Objectives

The objectives of this Study were to:

- Compile existing vegetation mapping datasets including CRAFTI and location specific studies (eg. South West Rocks Vegetation Study)
- Analyse existing mapping to determine data gaps or areas requiring updating.
- In areas requiring more detailed mapping or where data gaps exist, use API to map vegetation communities using the Forest Ecosystem classification (DEC 2004), to a minimum polygon size of 0.5Ha;
- Compile into a GIS format a single Kempsey Shire Council East Vegetation dataset for the study area from the existing mapping plus additional Forest Ecosystem mapping undertaken for this project.
- Derive into a GIS format a Candidate Endangered Ecological Community dataset using the Kempsey Shire Council East Vegetation dataset, soil landscape mapping, and relevant NSW Scientific Committee EEC Determinations
- Indicate the Likelihood of occurrence of individual Candidate EECs within the Study Area
- Document the methodology for Vegetation Mapping and Candidate EEC mapping and Report to Kempsey Shire Council.

Methodology

Review of previous studies

Regional studies

- *Comprehensive Regional Assessment Air Photo Interpretation Project (CRAFTI)*

  Comprehensive mapping of the Northern CRA area is documented in the Lower North East NSW CRAFTI report (DUAP, 1998). This study, which was based on API assessment of forested lands, resulted in structural-based mapping related to growth stage, which was assigned broad floristic type classes.

- *Forest Ecosystem Classification & Mapping for Lower North East CRA Regions. Resource & Conservation Division, (RACD) Dept of Urban Affairs & Planning (1999).*

  This study analysed plot data to derive a forest ecosystem classification system and it provides the most current benchmark for the distribution and conservation of forest ecosystems in northeastern NSW. The system was developed from the analysis of 4,730 vegetation plots and various vegetation mapping projects. The RACD modelling and mapping provides an indication of the regional extent and conservation status of the forest ecosystems. A recent publication using the data from this study is the *Field Key to Forest Ecosystems North East New South Wales* DEC 2004 provides a guide to the forest ecosystem classification system.

- *Soil Landscapes of the Macksville - Nambucca 1:100,000 Map Sheet. Eddie, M.W. (2000), and*
- *Soil Landscapes of the Kempsey - Korogoro Point 1:100,000 Map Sheet. Atkinson, G (1999)*

  The soil landscape mapping undertaken by NSW Department of Land and water conservation (DLWC) was used as for the stratification and to assist in defining vegetation communities and the possible locations of floodplain endangered ecological communities.

Local Studies

The following local studies were also used to assist the mapping process and to provide a cross-check on the aerial photograph interpretation undertaken for this study.

- *Environmental Overview (Flora And Fauna Issues): Proposed Master Plan for the Spencerville to New Entrance Area of South West Rocks*
  Kendall & Kendall Pty Ltd (2005)

- *Saltwater Creek Catchment Flora and Fauna Study South West Rocks*
  Kendall & Kendall Pty Ltd (2003)

Forest Ecosystem Mapping undertaken under this Study

Mapping methodology

Penny Kendall of *Kendall & Kendall Ecological Consultants* was subcontracted to undertake the Forest Ecosystem mapping for this Study. Forest Ecosystem mapping was undertaken wherever it was evident that vegetation areas in excess of 0.5Ha were not mapped, where post CRAFTI clearing had occurred, or where errors in the CRAFTI mapping were identified. Areas of National Park and State Forest were excluded from review.

The mapping methodology used to improve the existing vegetation mapping dataset (as described above) and to map gaps in the existing dataset was as follows.

Air photo interpretation (API)

Stereoscopic interpretation of aerial photographs was undertaken across the study area. The photography used was 1:25 000 colour flown in August 2003. Clear overlays attached to the photos were marked using a fine (0.18mm) mapping pen. The line work was stereoscopically transferred onto A1 sized plastic overlays, scanned, and vectorised to produce a GIS coverage of the mapped polygons. Polygons were individually labelled and then attributed using ArcView GIS. The API Pathway is outlined in *Figure 2*.

Floristic mapping

The floristic mapping was the primary attribute used to define the polygon location and extent. The forest ecosystem vegetation classification developed by RACD 1999 and refined by DEC 2004 was used.

Structural mapping

Although the floristic composition of the polygons was the primary determinate for polygon location and extent, each polygon was also assigned a structural code based on several structural attributes. Structural mapping is important in determining the habitat and conservation values of vegetation communities. The structural attributes recorded include upper strata density and age, mid strata type and relative disturbance. A description of the methodology used to map the structural attributes is provided in ***Appendix B***.

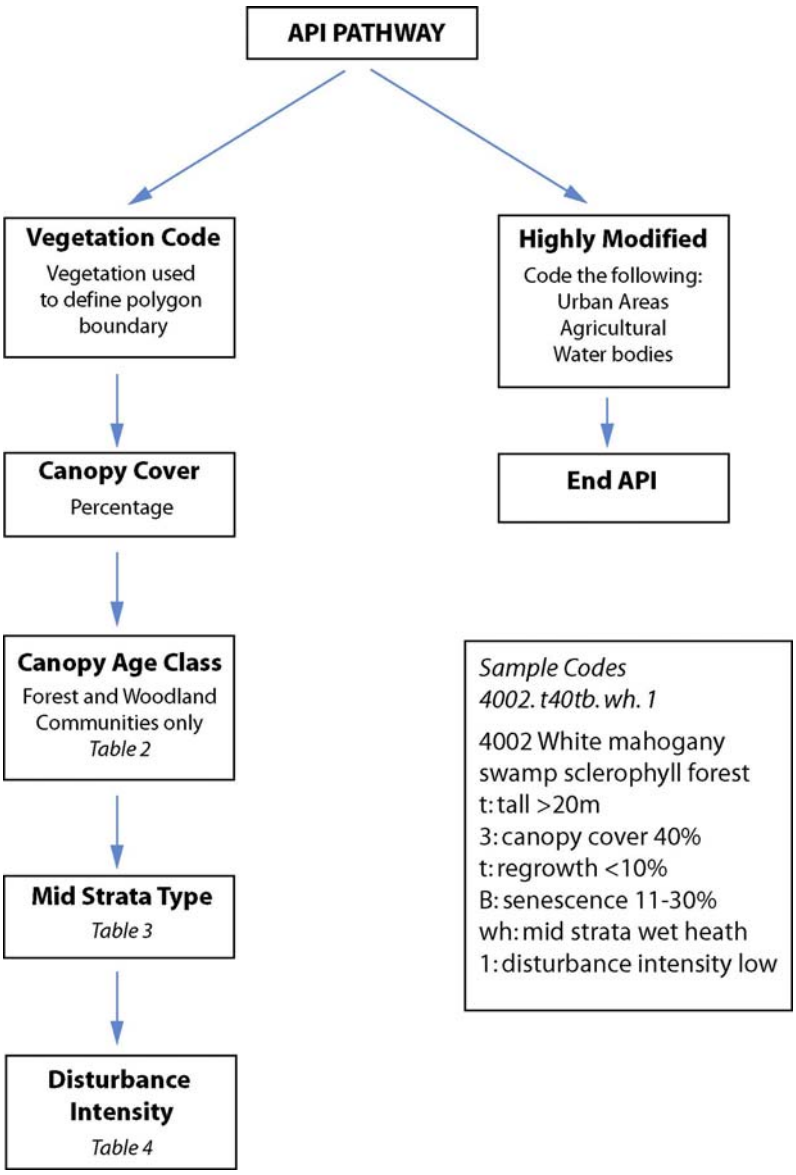

Figure 2 *API Pathway for Forest Ecosystem mapping*

Ground truthing field survey

A preliminary over view was undertaken in January 2006. This involved an orientation drive around the study area to determine the broad vegetation and land use patterns and access constraints. Following API and polygon coding limited ground truthing was conducted along roads providing access to the study area.

No systematic flora survey was undertaken and this study does not comply with the recommended survey effort as outlined in *Threatened Species Survey &Assessment Guidelines for Developments and Activities Working Draft NSW NPWS* and SMEC Australia (2003) guidelines.

Integration of Existing Datasets

The integration of existing datasets with the new Forest Ecosystem mapping was undertaken using the GIS editing capabilities of ArcView 3.2a. The following steps were undertaken;

1. The existing CRAFTI dataset was reprojected to MGA94, clipped to the study area, and overlaid onto the August 2003 1:25,000 orthorectified aerial photographs.
2. The new Forest Ecosystem mapping was added to the GIS and areas of redundancy in the CRAFTI layer were deleted. Where the new mapping resulted in only a part of the existing CRAFTI mapping being redundant, the boundary of the CRAFTI data was adjusted. The two datasets were then joined and cleaned resulting in a single vegetation dataset for the Study Area.
3. Where an existing CRAFTI code for a vegetation type was directly transferable to the Forest Ecosystem classification, then the CRAFTI polygon was relabeled with the Forest Ecosystem code and label (eg. Areas of rainforest mapped under CRAFTI as "R" are directly transferable to FE 168: Rainforest)
4. Where an existing CRAFTI code was **not** directly transferable to the Forest Ecosystem classification, the CRAFTI code and Description label was retained (eg. Areas of wet sclerophyll forest mapped as "E7" under CRAFTI could, depending on canopy dominance as other community associations, be classified as either FE26 Coastal Flooded Gum, FE106 Open Coastal Brushbox, or FE154 Wet Flooded Gum Tallowwood)
5. The full vegetation layer was then labeled with either the FE label or the CRAFTI label. The "Label" field of the vegetation dataset identifies all CRAFTI labels through the use of the suffix "(c)". Two hundred and eight (208) vegetation types were identified.

   The "Label 2" field contains a simplified set of vegetation labels which amalgamates some vegetation and non-vegetation descriptors to facilitate ease of display on desktop GIS systems. For full information on mapped vegetation polygons reference should be made to the full attribute table.

The use of this process has allowed the effective integration of the older CRAFTI dataset with the new Forest Ecosystem mapping undertaken during this project. This purpose of this exercise was to;

1. Allow the display of all vegetation data as a single layer in a GIS system with clearly identified labels and data source.
2. Allow the interrogation of the single dataset to derive Candidate EECs for the study area by using the FE codes and labels and CRAFTI codes and labels.[1]

[1] Polygons included in the CRAFTI dataset supplied by DEC but mapped under NPWS or State Forest mapping were not generally converted to the Forest Ecosystem classification as they were outside this project's scope (ie. Areas of National Park and State Forest were not remapped or reclassified).

Forest Ecosystem Vegetation Communities

As described above in *Integration of Existing Datasets*, Forest Ecosystems (FE) were used as the mapping units in all areas where either no mapping or inadequate mapping existed in the Study Area.

Descriptions of the Forty-one Forest Ecosystems identified and mapped in the Study Area.are provided below. The descriptions of Forest Ecosystems are from the *Field key to Forest Ecosystems North East New South Wales* Dept of Environment & Conservation (DEC) 2004. The descriptions include both natural and modified ecosystems.

An assessment of the Conservation Status of each of the mapped FE is also provided.

Natural Forest Ecosystem Mapping Units

FE 5: Banksia

Generally low to mid-high woodland or open forest with the overstorey clearly dominated by White Banksia (*Banksia integrifolia*) or less commonly Saw Banksia (*B. serrata*). There are two variants of this ecosystem. One occurs on coastal sands and rainforest species such as Lilly Pilly (*Acmena smithii*) and Tuckeroo (*Cupaniopsis anacardioides*) as well as Broad-leaved Paperbark *(Melaleuca quinquenervia)* are sometimes present in the overstorey. The shrubby understorey includes species such as Sydney Golden Wattle *(Acacia longifolia),* Bitou Bush (*Chrysanthemoides monilifera*) and Lantana (*Lantana camara*), while the ground layer includes species such as Spiny-headed Mat-rush (*Lomandra longifolia*), Bracken (*Pteridium esculentum*), and Tall Saw-sedge (*Gahnia clarkei*). The other variant occurs at high elevation along the escarpment edge, and emergent or associated tree species include Pink Bloodwood (*Corymbia intermedia*), Silver-top Stringybark (*Eucalyptus laevopinea*), Mountain Ribbon Gum (*E. nobilis*) and Messmate (*E. obliqua*). Understorey shrub and small tree species include Blackwood (*Acacia melanoxylon*), Blackthorn (*Bursaria spinosa*) and *Leucopogon hookeri,* while the ground layer is dominated by Snow Grass (*Poa sieberiana)*

.

The coastal variant of this ecosystem is well developed on coastal sands in both CRA Regions (e.g. Richmond River and Moonee Beach Nature Reserves, Broadwater, Hat Head and Crowdy Bay National Parks), while the escarpment variant is scattered at higher elevations.

Upper strata species	Mid strata species	Lower strata species
Banksia integrifolia *Banksia serrata* *Cupaniopsis anacardioides* *Acmena smithii* *Corymbia intermedia* *Eucalyptus laevopinea* *Eucalyptus nobilis* *Eucalyptus obliqua*	*Acacia longifolia* *Chrysanthemoides monilifera* *Smilax australis* *Acacia melanoxylon* *Bursaria spinosa* *Leucopogon hookeri*	*Lomandra longifolia* *Pteridium esculentum* *Gahnia clarkei* *Poa sieberiana*

FE 22: Coast Cypress Pine

Mid-high to tall dry forest in which Coast Cypress Pine (*Callitris columellaris*) clearly dominates the overstorey, and associates include Smooth-barked Apple (*Angophora costata*),

Narrow-leaved Apple (*Angophora paludosa*), Saw Banksia (*Banksia serrata*), White Banksia (*B. integrifolia*) and Pink Bloodwood (*Corymbia intermedia*). Understorey species include wattles (e.g. *Acacia suaveolens*, *A. ulicifolia*), banksias (*Banksia aemula*, *B. serrata*) and Black Oak (*Allocasuarina littoralis*). The ground layer is often sparse due to heavy shading, but Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda australis*) and Spiny-headed Mat-rush (*Lomandra longifolia*) are often present.

This ecosystem occurs on coastal sand masses in the Upper CRA Region (e.g. Broadwater and Yuraygir National Parks).

Upper strata species	Mid strata species	Lower strata species
Callitris columellaris *Angophora costata* *Angophora paludosa* *Banksia serrata* *Banksia integrifolia* *Corymbia intermedia*	*Acacia suaveolens* *Acacia ulicifolia* *Banksia aemula* *Banksia serrata* *Allocasuarina littoralis*	*Imperata cylindrical* *Themeda australis* *Lomandra longifolia*

FE 26: Coastal Flooded Gum

Very tall to extremely tall wet forest which is dominated by Flooded Gum (*Eucalyptus grandis)*, Brush Box (*Lophostemon confertus)* and Tallowwood (*E. microcorys)*. The ecosystem has a subtropical rainforest understorey which includes species such as Bangalow Palm (*Archontophoenix cunninghamii)* and Celery Wood (*Polyscias elegans*), along with a great diversity of other rainforest species. Vines such as Water Vine (*Cissus antarctica*) and Native Yam (*Dioscorea transversa*) are common, and the ground layer is dominated by Rasp Fern (*Doodia aspera*), *Oplismenus aemulus* and Giant Maidenhair (*Adiantum formosum*).

This ecosystem is distributed extensively on the Richmond and Tweed Ranges with scattered occurrences on other near coastal ranges south to Bulahdelah. Major occurrences are protected in Mebbin and Toonumbar National Parks.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus grandis (75) *Lophostemon confertus (75)*	*Neolitsea dealbata (75)* *Polyscias elegans (75)* *Smilax australis (75)* *Cissus antarctica (75)* *Dioscorea transversa (67)* *Synoum glandulosum (67)* *Archontophoenix cunninghamiana (67)* *Citriobatus pauciflorus (67)* *Guioa semiglauca (67)* *Alpinia caerulea (58)* *Linospadix monostachya (58)* *Mallotus philippensis (58)* *Ripogonum elseyanum (58)* *Sarcopteryx stipata (58)*	*Doodia aspera (75)* *Oplismenus imbecillis (58)*

FE 27: Coastal Sands Blackbutt

Tall to very tall forest dominated by Blackbutt (*Eucalyptus pilularis)* which often includes Needlebark Stringybark (*E. planchoniana*) and/or Smooth-barked Apple (*Angophora costata*) as sub-dominants. The ecosystem contains a relatively dense heathy shrub layer which includes various wattles (*Acacia* spp.), Wallum Banksia (*Banksia aemula*), Lance Beard Heath (*Leucopogon lanceolatus*) and grass trees (*Xanthorrhoea* spp.). The ground layer is dominated by the small shrub *Hibbertia vestita*, Bracken (*Pteridium esculentum*) and Feather Plant (*Baloskion tetraphyllum*).

This ecosystem is mapped and predicted on coastal sands from the Esk River south to the Hunter River. Significant stands are reserved in Yuraygir and Myall Lakes National Parks.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus pilularis (64) *Eucalyptus planchoniana (57)* *Angophora costata (57)*	*Persoonia virgata (79)* *Leucopogon lanceolatus (64)* *Banksia aemula (50)* *Xanthorrhoea latifolia (43)*	*Hibbertia vestita (71)* *Pteridium esculentum (64)* *Baloskion tetraphyllum (64)*

FE 32: Dry Foothills Blackbutt-Turpentine

Tall to very tall forest dominated by Blackbutt (*Eucalyptus pilularis)* and Turpentine (*Syncarpia glomulifera*) with Tallowwood (*E. microcorys*) sometimes an associate. There is usually a midstorey of Forest Oak (*Allocasuarina torulosa)* and a sparse, patchy shrub layer which usually includes Elderberry Panax (*Polyscias sambucifolia)* and Tree Heath (*Trochocarpa laurina).* The ground layer is dominated by Blue Flax Lily (*Dianella caerulea*), Climbing Guinea Flower (*Hibbertia scandens*), Bracken (*Pteridium esculentum*), Blady Grass (*Imperata cyclindrica*) and Spiny-headed Mat-rush (*Lomandra longifolia*).

This ecosystem is patchily distributed in coastal foothills and escarpment ranges from Dingo Tops north the Corindi River. It is reserved in Ulidarra, Willi Willi and Kumbatine National Parks.

Upper strata species	Mid strata species	Lower strata species
Syncarpia glomulifera *Eucalyptus pilularis* *Eucalyptus microcorys*	*Allocasuarina torulosa* *Polyscias sambucifolia* *Smilax australis* *Cissus hypoglauca* *Trochocarpa laurina*	*Dianella caerulea* *Hibbertia scandens* *Lomandra longifolia* *Pteridium esculentum* *Imperata cylindrica* *Pandorea pandorana*

FE 34: Dry Grassy Blackbutt-Tallowwood

Tall to very tall forest dominated by Blackbutt (*Eucalyptus pilularis*) with Tallowwood (*E.*

microcorys) occurring as a sub-dominant. There is a midstorey of Forest Oak (*Allocasuarina torulosa*) and there is often an open shrub layer of species such as Coffee Bush (*Breynia oblongifolia*), Hopbush (*Dodonea triquetra*) and White Dogwood (*Ozothamnus diosmifolius*). The ground layer is dominated by Blady Grass (*Imperata cyclindrica*), Bracken (*Pteridium esculentum*), Kangaroo Grass (*Themeda australis*) and Spiny-headed Mat-rush (*Lomandra longifolia*).

This ecosystem is concentrated on coastal lowlands and foothills of the Nambucca and Macleay Valleys, although it is also scattered more patchily from the Myall Lakes north to the Wooli River. It is reserved in Wallingat National Park, and Khappingat and Ngambaa Nature Reserves.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus pilularis *Eucalyptus microcorys*	*Allocasuarina torulosa,* *Breynia oblongifolia* *Ozothamnus diosmifolius*	*Imperata cylindrica* *Lomandra longifolia* *Pteridium esculentum* *Vernonia cinerea* *Glycine clandestina* *Lepidosperma laterale* *Themeda australis* *Hardenbergia violacea*

FE 36: Dry Grassy Tallowwood-Grey Gum

Tall to very tall forest which generally includes a mixed canopy of species such as Tallowwood (*Eucalyptus microcorys*), Small-fruited Grey Gum (*E. propinqua*), Grey Ironbark (*E. siderophloia*), Broad-leaved White Mahogany (*E. carnea*) and Turpentine (*Syncarpia glomulifera*). This ecosystem has a midstorey of Forest Oak (*Allocasuarina torulosa*) and a scattered shrub layer of species such as Coffee Bush (*Breynia oblongifolia*) and Lantana (*Lantana camara*). The ground layer is a mixture of forbs and grasses with species such as Blue Flax Lily (*Dianella caerulea*), Spiny-headed Mat-rush (*Lomandra longifolia)*, Climbing Guinea Flower (*Hibbertia scandens*), Kangaroo Grass (*Themeda australis*) and Blady Grass (*Imperata cylindrica*) common.

This ecosystem is distributed throughout the coastal lowlands and foothills of the mid-north coast from the Manning Valley north to the Corindi River. Extensive stands are protected in Kumbatine and Bago Bluff National Parks and Ngambaa Nature Reserve.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus microcorys *Eucalyptus proprinqua* *Eucalyptus siderophloia* *Syncarpia glomulifera* *Eucalyptus carnea* *Corymbia intermedia*	*Allocasuarina torulosa* *Breynia oblongifolia* *Lantana camara* *Smilax australis* *Solanum densevestitum*	*Dianella caerulea* *Lomandra longifolia* *Imperata cylindrica* *Glycine clandestina* *Hibbertia scandens* *Vernonia cinerea* *Desmodium rhytidophyllum* *Pseuderantherum variabile* *Themeda australis*

		Desmodium varians

FE 46: Eastern Red Gums

Tall to very tall forest usually with a red gum species as the dominant tree. Canopy species include Cabbage Gum (*Eucalyptus amplifolia*), Bancroft's Red Gum (*E. bancrofti*), Narrow-leaved Red Gum (*E. seeana*), Broad-leaved Apple (*Angophora subvelutina*) and Grey Box (*E. moluccana*). The midstorey often includes Green Wattle (*Acacia irrorata*) and Black Oak (*Allocasuarina littoralis*) and the ground layer is dominated by Kangaroo Grass (*Themeda australis*), Blady Grass (*Imperata cylindrica)* and Spiny-headed Mat-rush (*Lomandra longifolia*).

This unit includes at least two ecosystems. The one described above occurs mainly on the coastal lowlands in both CRA regions. It also includes tall to very tall forest in which the overstorey consists of Cabbage Gum (*E. amplifolia)*, Round-leaved Gum (*E. brunnea*), Dorrigo White Gum (*E. dorrigoensis*) and Broad-leaved Stringybark (*E. caliginosa*). The understorey and ground layer may also differ and Snow Grass (*Poa sieberiana*) or Tussock Grass (*Poa labillardieri*) are often common species. This variant occurs on plateau areas in the gorge systems of the UNE, for example Guy Fawkes National Park.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus amplifolia, *Eucalyptus bancrofti* *Eucalyptus seeana* *Angophora subvelutina* *Eucalyptus moluccana* *Eucalyptus brunnea* *Eucalyptus dorrigoensis* *Eucalyptus caliginosa*	*Acacia irrorata* *Allocasuarina littoralis*	*Themeda australis* *Imperata cylindrical* *Lomandra longifolia* *Pratia purpurascens* *Desmodium varians* *Poa sieberiana* *Poa labillardieri*

FE 47: Escarpment Red Gum

Tall to very tall forest which is similar to Ecosystem 44 but occurs at lower altitudes with coastal rather than tablelands associates. The canopy is dominated by Forest Red Gum (*Eucalyptus tereticornis*) with associated species including Broad-leaved Apple (*Angophora subvelutina*), Grey Ironbark (*E. siderophloia*) and Pink Bloodwood (*Corymbia intermedia*). There is no shrub layer apart from a few scattered shrubs of Coffee Bush (*Breynia oblongifolia*) and occasional other species and the ground layer is dominated by Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda australis*) and various forbs.

This ecosystem is distributed on escarpment ranges from Chandlers Creek north to the MacPherson Range. It is reserved in Chaelundi National Park.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus tereticornis (83) *Angophora subvelutina (50)* *Corymbia intermedia (43)* *Eucalyptus siderophloia (33)*	*Breynia oblonglofilia (53)*	*Imperata cylindrica (90)* *Themeda australis (83)* *Pratia purpurascens (73)* *Dichondra repens (63)* *Vernonia cinerea (63)* *Lomandra longifolia (60)* *Desmodium rhytidophyllum (60)* *Hardenbergia violacea (60)* *Dianella caerulea (60)* *Oplismenus aemulus (57)*

FE 64: Heath

Typically low to tall heathland less than 2 m high. Species richness is generally high, and composition varies with locality (low altitude to high altitude) and habitat (e.g. coastal sand masses or hills, ranges, escarpment, tableland). Representative heath shrub families include Proteaceae (e.g. *Banksia* and *Hakea* spp.), Myrtaceae (e.g. *Leptospermum*, *Melaleuca* and *Kunzea* spp.), Epacridaceae (e.g. *Leucopogon* and *Epacris* spp.), Fabaceae (e.g. *Dillwynia*, *Pultenaea* and *Acacia* spp.), Rutaceae (e.g. *Boronia* and *Eriostemon* spp.), Xanthorrhoeaceae (*Xanthorrhoea* spp.) and Casuarinaceae (*Allocasuarina* spp.). Many grass, sedge and forb species are generally continuous in height with the heath shrubs.

This ecosystem is an aggregation of many different plant communities. It is concentrated along the coast of both CRA Regions (e.g. Broadwater, Yuraygir, Crowdy Bay and Booti Booti National Parks), and scattered at higher altitudes (e.g. Werrikimbe and Gibraltar Range National Parks).

Upper strata species
Banksia spp. *Hakea spp.* *Leptospermum spp.* *Melaleuca spp,* *Kunzea spp.* *Leucopogon spp.* *Epacris spp.* *Dillwynia spp.* *Pultenaea spp.* *Acacia spp.* *Boronia spp.* *Eriostemon spp.* *Xanthorrhoea spp.* *Allocasuarina spp.*

FE 65: Heathy Scribbly Gum

Tall to very tall dry forest dominated by Scribbly Gum (*Eucalyptus signata*) with either Red or Pink Bloodwood (*Corymbia gummifera* or *C. intermedia)* usually present as sub-dominants. There is a relatively dense heathy understorey dominated by Black Oak (*Allocasuarina littoralis)*, banksias (*Banksia oblongifolia* and *B. spinulosa)*, egg and bacon peas (*Pultenaea myrtoides* and *P. retusa*), and Riceflower (*Pimelea linifolia)*. The understorey is a mixture of various grasses, sedges, ferns and forbs such as Blady Grass (*Imperata cylindrica*), Wiry Panic (*Entolasia stricta*), Sword Sedge (*Lepidosperma laterale*) and Bracken (*Pteridium esculentum*).

This ecosystem is distributed on metasediments from the Maria River north to the Richmond River. It is reserved in Bungawalbin, Bundjalung, Yuraygir and Maria River National Parks.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus signata (81) *Corymbia gummifera (63)*	*Pimelia linifolia (81)* *Persoonia stradbrokensis (75)* *Gompholobium pinnatum (63)* *Banksia oblongifolia (63)* *Allocasuarina littoralis (56)* *Banksia spinulosa (56)* *Pultenaea myrtoides (56)*	*Imperata cylindrica (75)* *Entolasia stricta (75)* *Lepidosperma laterale (75)* *Pteridium esculentum (69)* *Dianella caerulea (63)* *Glycine clandestina (63)* *Themeda australis (57)*

FE 72: Low Relief Coastal Blackbutt

Tall to very tall forest usually dominated by Blackbutt (*Eucalyptus pilularis)* with Pink Bloodwood (*Corymbia intermedia)* and Red Mahogany (*E. resinifera)* present as sub-dominants. There is a moderately dense midstorey which usually includes Snow-in-Summer (*Melaleuca linariifolia)*, Cheese Tree (*Glochidion ferdinandi*) and Willow Bottlebrush (*Callistemon salignus*). Common ground layer species include Spiny-headed Matt-rush (*Lomandra longifolia*), Wombat Berry (*Eustrephus latifolius*), Blady Grass (*Imperata cylindrica*) and Bracken (*Pteridium esculentum*).

This ecosystem is distributed in low lying areas on the central coast from Kendall north to Coffs Harbour. It is reserved in Rawdon Creek Nature Reserve and Maria River National Park.

Upper strata species	Mid strata species	Lower strata species
Corymbia intermedia (80, *Eucalyptus resinifera (60)* *Eucalyptus pilularis (60)*	*Glochidion ferdinandi (80)* *Rubus hillii (80)* *Melaleuca linariifolia (60)* *Callistemon salignus (60)* *Breynia oblongifolia (60)*	*Lomandra longifolia (100)* *Eustrephus latifolius (80)* *Pseuderantherum variabile (80)* *Pratia purpurascens (80)* *Entolasia marginata (80)* *Imperata cylindrica (80)* *Viola hederacea (60)* *Pteridium esculentum (60)* *Oplismenus imbecillis (60)*

FE 73: Lowlands Red Gum

Tall to very tall forest dominated by either Forest Red Gum (*Eucalyptus tereticornis*) or Swamp Box (*Lophostemon suaveolens*) with Pink Bloodwood (*Corymbia intermedia*) and Grey Ironbark (*E.siderophloia*) sometimes present. There is a relatively open understorey with Red Ash (*Alphitonia excelsa*) common, and a ground layer dominated by species such as Blady Grass (*Imperata cylindrica*), Spiny-headed Matt-rush (*Lomandra longifolia*) and Kangaroo Grass (*Themeda australis*).

This ecosystem is distributed on high and low quartz sediments in the Clarence lowlands. It is reserved in Bungawalbin National Park.

Upper strata species	Mid strata species	Lower strata species
Lophostemon suaveolens *Eucalyptus tereticornis* *Corymbia intermedia* *Eucalyptus siderophloia*	*Alphitonia excelsa*	*Imperata cylindrica* *Pratia purpurascens* *Lomandra longifolia* *Vernonia cinerea* *Cymbopogon refractus* *Themeda australis* *Entolasia stricta*

FE 74: Lowlands Scribbly Gum

Tall to very tall forest dominated by Scribbly Gum (*Eucalyptus signata).* There is often a scattered understorey of Tea-tree (*Leptospermum polygalifolium), Melaleuca sieberi* and *Banksia oblongifolia.* The ground layer is diverse and includes a number of swamp elements such as Feather Plant (*Baloskion tetraphyllum)* and the twig-rushes *(Baumea articulata* and *B. rubiginosa)* as well as Wiry Panic (*Entolasia stricta*) and Spiny-headed Matt-rush (*Lomandra longifolia*). This ecosystem is distributed predominantly on coastal sands and sandstone from Kempsey to the Tweed River. It is reserved in Limeburners Creek Nature Reserve and Bundjalung and Mount Jerusalem National Parks.

Upper strata species	Mid strata species	Lower strata species
Eucalyptus signata (75)	*Leptospermum polygalyfolium (50)*	*Entolasia stricta(58)* *Dianella caerulea (58)* *Lomandra longifolia (58)* *Pteridium esculentum (58)*

FE 77: Mangrove

Low to tall woodland and forest, sometimes grading into shrubland. Grey Mangrove (*Avicennia marina* ssp. *australasica*) characteristically dominates the overstorey, although occasional associates are Black Mangrove (*Bruguiera gymnorrhiza*), Spider Mangrove (*Rhizophora stylosa*), Milky Mangrove (*Excoecaria agallocha*) and Cottonwood Hibiscus (*Hibiscus tiliaceus*). River Mangrove (*Aegiceras corniculatum*) may be present as an understorey shrub, or otherwise dominate localized stands of shrubland in the absence of Grey Mangrove. The immediate ground surface is either unvegetated apart from pneumatophores, or else supports lower saltmarsh species such as Sand Couch (*Sporobolus virginicus*).

This ecosystem occupies intertidal flats in estuaries, and is widespread along the coast in both CRA Regions.

Upper strata species	Mid strata species	Lower strata species
Avicennia marina ssp. Australasica *Bruguiera gymnorrhiza* *Rhizophora stylosa* *Excoecaria agallocha* *Hibiscus tiliaceus*	*Aegiceras corniculatum*	*Sporobolus virginicus*

FE 96: Native Grasslands

Sod grassland and tussock grassland dominated by one or more grasses, for example Kangaroo Grass (*Themeda australis*), Hairy Spinifex (*Spinifex sericeus*), Weeping Grass (*Microlaena stipoides*), Snow Grass (*Poa sieberiana*), speargrass (*Austrostipa* spp.) and wallaby grass (*Austrodanthonia* spp.). Forbs and heath shrubs may be sub-dominant.

This ecosystem is an aggregation of different plant communities. It has scattered occurrences in both CRA Regions, and extends from sea level (e.g. Yuraygir National Park, Moonee Beach and Limeburners Creek Nature Reserves) to the tablelands.

Upper strata species	Lower strata species
Themeda australis *Spinifex sericeus* *Microlaena stipoides* *Poa sieberiana* *Austrostipa spp.* *Austrodanthonia spp.*	forbs

FE 106: Open Coastal Brushbox

Tall to very tall forest dominated by Brush Box (*Lophostemon confertus*) with Turpentine (*Syncarpia glomulifera)* present as a sub-dominant. There is often a midstorey of Forest Oak (*Allocasuarina torulosa)*, and an open to moderately dense understorey of semi-moist shrubs such as Tree Heath (*Trochocarpa laurina)*, Narrow-leaved Palm Lily (*Cordyline stricta)* and Scentless Rosewood (*Synoum glandulosum)*. The ground layer is dominated by ferns such as Gristle Fern (*Blechnum cartilagineum)* and Giant Maidenhair (*Adiantum formosum)* and forbs such as Spiny-headed Mat-rush (*Lomandra longifolia*) and Blue Flax Lily (*Dianella caerulea*).

This ecosystem is distributed on coastal lowlands and foothills from the Manning Valley north to the Corindi River. It is reserved in New England and Kumbatine National Parks and Ngambaa Nature Reserve.

Upper strata species	Mid strata species	Lower strata species
Lophostemon confertus (78) *Syncarpia glomulifera (64)*	*Dioscorea transversa (70)* *Smilax australis (70)* *Trochocarpa laurina (64)* *Allocasuarina torulosa (64)* *Cordyline stricta (61)* *Wilkea huegeliana (61)* *Synoum glandulosum (56)* *Cryptocarya microneura (56)* *Lantana camara (53)*	*Dianella caerulea (70)* *Lomandra longifolia (70)* *Blechnum cartilagineum (61)* *Pseuderantherum variabile (58)* *Morinda jasminoides (58)* *Doodia aspera (53)* *Gymnostachys anceps (53)*

FE 112: Paperbark

Low to very tall woodland and forest in which Broad-leaved Paperbark (*Melaleuca quinquenervia*) commonly dominates the overstorey, or occasionally another paperbark (e.g. *M. alternifolia*, *M. sieberi*, *M. linariifolia*, *M. styphelioides*). Associates include Swamp Mahogany (*Eucalyptus robusta*), Swamp Oak (*Casuarina glauca*) and Swamp Box (*Lophostemon suaveolens*). Understorey and ground layer composition varies with substrate, depth and extent of waterlogging, and water quality. Sawsedges (*Gahnia* spp.), twig-rushes (*Baumea* spp.), *Carex* spp., Bungwahl Fern (*Blechnum indicum*), Feather Plant (*Baloskion tetraphyllum*), tea-tree (e.g. *Leptospermum juniperinum*), bottlebrush (e.g. *Callistemon pachyphyllus*) and certain grasses (e.g. *Hemarthria uncinata*, *Ischaemum australe*) may dominate, or alternatively rainforest trees, shrubs and vines such as Cabbage Tree Palm (*Livistona australis*), Cheese Tree (*Glochidion ferdinandi*) and Common Silkpod (*Parsonsia straminea*) can be common.

This ecosystem is widespread on the coastal lowlands in both CRA Regions (e.g. Bundjalung, Crowdy Bay and Myall Lakes National Parks).

Upper strata species	Mid strata species	Lower strata species
Melaleuca quinquenervia *Melaleuca alternifolia* *Melaleuca sieberi* *Eucalyptus robusta* *Casuarina glauca* *Lophostemon suaveolens*	*Livistona australis* *Glochidion ferdinandi* *Parsonsia straminea* *Leptospermum juniperinum* *Callistemon pachyphyllus*	*Gahnia spp.* *Baumea spp.* *Carex spp.* *Blechnum indicum* *Baloskion tetraphyllum* *Hemarthria uncinata* *Ischaemum australe*

FE 120: River Oak

Tall to very tall woodland and forest along permanent freshwater streams in which River Oak (*Casuarina cunninghamiana*) dominates the overstorey. The understorey of this riparian ecosystem varies with locality, although it may support a variety of rainforest trees and shrubs such as Silky Oak (*Grevillea robusta*) and Weeping Lilly Pilly (*Waterhousea floribunda*), or alternatively more sclerophyllous species such as Rough-barked Apple (*Angophora floribunda*), Broad-leaved Apple (*A. subvelutina*) and Drooping Bottlebrush (*Callistemon viminalis*). The ground stratum is prone to disturbance by floodwaters, and often supports a mixture of natives and exotics.

This ecosystem has a widespread but restricted distribution in both CRA Regions (e.g. Mann River Nature Reserve, Oxley Wild Rivers National Park)

Upper strata species	Mid strata species
Casuarina cunninghamiana	*Grevillea robusta* *Waterhousea floribunda* *Angophora floribunda* *Angophora subvelutina* *Callistemon viminalis*

FE 121: Rock

Rocky sites are widespread in habitats ranging from littoral (e.g. seacliffs) to sub-coastal and upland (e.g. granite, sandstone and serpentinite outcrops on ranges and the Tablelands). Rock surfaces may be largely devoid of vascular plants, although they often support small patches of vegetation in crevasses, cracks and depressions where soil and moisture accumulates. Any overstorey may be structurally depauperate (e.g. open woodland or mallee) but nonetheless floristically similar to adjoining forests on deeper soils. In other situations the vegetation may feature species with restricted or highly disjunct distributions, for example Bell-fruited Mallee (*E. codonocarpa*) or *E. serpentinicola*. Understorey and ground stratum species vary with locality and geology, and floristic composition in general may be very different from one rocky site to the next.

This ecosystem is widespread in both CRA Regions (e.g. Tapin Tops, Nymboida and Border Ranges National Parks, and Mernot Nature Reserve).

FE 125: Saltmarsh

Dwarf to low chenopod shrubland in which Samphire (*Sarcocornia quinqueflora*) dominates, or occasionally Austral Seablite (*Suaeda australis*). Sand couch (*Sporobolus virginicus*) and Streaked Arrowgrass (*Triglochin striatum*) are frequent associates, and may become co-dominant.

This ecosystem occurs on tidal flats periodically inundated with seawater, and it extends along the coast of both CRA Regions (e.g. Bundjalung, Yuraygir and Booti Booti National Parks).

Upper strata species
Sarcocornia quinqueflora *Suaeda australis* *Sporobolus virginicus* *Triglochin striatum*

FE 141: Swamp

This ecosystem comprises sedgeland, rushland, forbland, fernland and mossland in inundated or perpetually moist sites. It extends from sea level to the Tablelands, and floristic composition varies with locality and habitat. Although herbaceous species dominate, trees and shrubs may be present in low cover-abundance, for example Broad-leaved Paperbark (*Melaleuca quinquenervia*) near the coast and Alpine Bottlebrush (*Callistemon pityoides*) at high altitudes.

This ecosystem is an aggregation of many different plant communities. It is widespread in both CRA Regions (e.g. Gibraltar Range, Barrington Tops, Bundjalung and Crowdy Bay National Parks and Moffats Swamp Nature Reserve).

FE 142: Swamp Mahogany

Mid-high (rarely low) to very tall woodland and forest in which Swamp Mahogany (*Eucalyptus robusta*) dominates or co-dominates the overstorey. Associates include Broad-leaved Paperbark (*Melaleuca quinquenervia*), Swamp Oak (*Casuarina glauca*), Red Mahogany (*Eucalyptus resinifera*), Forest Red Gum (*E. tereticornis*), Pink Bloodwood (*Corymbia intermedia*) and Swamp Box (*Lophostemon suaveolens*). Understorey composition varies with substrate, depth and extent of waterlogging, and water quality; although examples of tree, shrub and vine species include paperbarks (*Melaleuca spp*.), Cabbage Tree Palm (*Livistona australis*), Cheese Tree (*Glochidion ferdinandi*), Narrow-leaved Palm Lily *(Cordyline stricta*), Pink-flowered Doughwood (*Melicope elleryana*), Maiden's Wattle (*Acacia maidenii*), Wallum Bottlebrush (*Callistemon pachyphyllus*), tea-trees (e.g. *Leptospermum juniperinum*), Clustered Baeckea (*Baeckea frutescens*) and Common Silkpod (*Parsonsia straminea*). Ground layer species include Feather Plant (*Baloskion tetraphyllum*), sawsedges (*Gahnia spp.),* Spear Grasstree (*Xanthorrhoea fulva*), Knotted Scale-rush (*Sporadanthus interruptus*), various ferns (e.g. *Blechnum camfieldii, B. indicum, Hypolepis muelleri)* and grasses (e.g. *Ischaemum australe*).

This ecosystem occupies drainage lines and open depressions near the coast in both CRA Regions (Broadwater, Yuraygir, Hat Head, Crowdy Bay, Khappinghat and Myall Lakes National Parks, and Lake Innes Nature Reserve).

Upper strata species	Mid strata species	Lower strata species
Eucalyptus robusta *Melaleuca quinquenervia* *Casuarina glauca* *Eucalyptus resinifera* *Eucalyptus tereticornis* *Corymbia intermedia* *Lophostemon suaveolens*	*Melaleuca spp.* *Livistona australis* *Glochidion ferdinandi* *Cordyline stricta* *Melicope elleryana* *Acacia maidenii* *Callistemon pachyphyllus* *Leptospermum juniperinum* *Baeckea frutescens* *Parsonsia straminea*	*Baloskion tetraphyllum* *Gahnia spp.* *Xanthorrhoea fulva* *Sporadanthus interruptus* *Blechnum camfieldii* *Blechnum indicum* *Hypolepis muelleri* *Ischaemum australe*

FE 143: Swamp Oak

Low to very tall woodland and forest with the overstorey clearly dominated by Swamp Oak (*Casuarina glauca*). Associates include Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Forest Red Gum (*Eucalyptus tereticornis*). Composition of the understorey varies with habitat (e.g. estuarine or floodplain), and it may be poorly developed where the overstorey is dense. Examples of smaller trees, shrubs and vines include various paperbarks (e.g. *Melaleuca ericifolia, M. styphelioides*), Groundsel Bush (*Baccharis halimifolia*), Lantana (*Lantana camara*), Swamp Hibiscus (*Hibiscus diversifolius*), *Goodenia ovata*, Common Silkpod (*Parsonsia straminea*) and Five-leaf Morning Glory (*Ipomoea cairica*). Ground layer species include Bare Twig-rush (*Baumea juncea*), Maritime Rush (*Juncus kraussii*), *Enydra fluctuans*, Brown Fringe-rush (*Fimbristylis ferruginea*), Tall Saw-sedge (*Gahnia clarkei*), and various grasses (e.g. *Entolasia spp., Oplismenus spp., Phragmites australis, Sporobolus virginicus, Isachne globosa*) and forbs (e.g. *Pratia purpurascens, Viola hederacea, Centella asiatica, Hydrocotyle acutiloba*).

This ecosystem is widespread on poorly drained sites in coastal areas of both CRA Regions (e.g. Ballina, Richmond River, Limeburners Creek and Yahoo Nature Reserves, and Khappinghat, Bundjalung, Yuraygir and Myall Lakes National Parks).

Upper strata species	Mid strata species	Lower strata species
Casuarina glauca *Melaleuca quinquenervia* *Eucalyptus tereticornis*	*Melaleuca ericifolia* *M. styphelioides* *Baccharis halimifolia* *Lantana camara* *Hibiscus diversifolius* *Goodenia ovata* *Parsonsia straminea* *Ipomoea cairica*	*Baumea juncea* *Juncus kraussii* *Enydra fluctuans* *Fimbristylis ferruginea* *Gahnia clarkei* *Entolasia spp.* *Oplismenus spp.* *Phragmites australis* *Sporobolus virginicus* *Isachne globosa* *Pratia purpurascens* *Viola hederacea* *Centella asiatica* *Hydrocotyle acutiloba*

FE 151: Wattle

Generally low to mid-high forest, although occasionally taller or a woodland. The overstorey is clearly dominated by a species of wattle (e.g. *Acacia disparrima*, *A. melanoxylon, A. irrorata*). Understorey composition varies with habitat and location (e.g. coastal or tableland). This ecosystem is scattered in both CRA Regions (e.g. Iluka Nature Reserve). In some instances it is likely to have developed following disturbance (e.g. fire).

Upper strata species
Acacia disparrima *Acacia melanoxylon* *Acacia irrorata*

FE 154: Wet Flooded Gum Tallowwood

Tall to extremely tall forest dominated by Flooded Gum (*Eucalyptus grandis*) with Tallowwood (*E. microcorys*), Brush Box (*Lophostemon confertus*) and Turpentine (*Syncarpia glomulifera*) frequently present. There is usually a dense understorey of trees and shrubs such as Bangalow Palm (*Archontophoenix cunninghamii*), Rose Maple (*Cryptocarya rigida*) Narrow-leaved Palm Lily (*Cordyline stricta*) and Lilly Pilly (*Acmena smithii*). Many sites are disturbed and have a dense understorey of Lantana (*Lantana camara*). Vines are common and the ground layer is often sparse with Gristle Fern (*Blechnum cartilagineum*), Blue Flax Lily (*Dianella caerulea*) and Rough Maidenhair (*Adiantum hispidulum*) common.

This ecosystem is predominantly distributed on near coastal valleys and foothills of the Nambucca, Bellinger, Orara and Tweed Valleys. Small areas are reserved in Bindarri National Park and Bollanolla Nature Reserve.

Upper strata species	**Mid strata species**	**Lower strata species**
Eucalyptus grandis (88) *Eucalyptus microcorys (75)* *Lophostemon confertus (69)* *Syncarpia glomulifera (63)*	*Dioscorea transversa (94)* *Wilkiea huegeliana (82)* *Lantana camara (82)* *Cordyline stricta (82)* *Cryptocarya rigida (82)* *Archontophoenix cunninghamiana (75)* *Cissus hypoglauca (75)* *Guioa semiglauca (75)* *Acmena smithii (75)* *Smilax australis (69)* *Cryptocarya microneura (69)* *Synoum glandulosum (69)* *Trochocarpa laurina (69)*	*Morinda jasminoides (82)* *Blechnum cartilagineum (82)* *Dianella caerulea (75)* *Smilax glyciphylla (65)* *Hibbertia scandens (63)*

FE 168: Rainforest

Typically Closed Forest (>70% crown cover) dominated by Rainforest species. Characteristic features may include vines, epiphytes, drip tips, mosses, compound leaves and tree buttresses. May include emergent Eucalypt species and/or Brushbox with up to 50% crown cover. Includes all Rainforest classes (Sub-tropical, Warm Temperate, Cool Temperate, Littoral, Dry and Viney Scrub); Rainforest sub-alliances of Floyd A G (1989) and 'Forest Types' 1 - 26 described in Research Note 17, Forestry Commission of NSW (1989). Where emergent Eucalypt or other non-rainforest species occur, the Rainforest canopy stratum is more or less continuous with crowns typically touching or overlapping.

FE 171: Water bodies

This forest ecosystem includes natural and artificial water bodies.

FE 172: Sand Ridge

Generally occurring in littoral areas and usually unvegetated but may support scattered herbs.

FE 311: Native Grassland

This FE is analogous to FE 96 Native Grassland.

FE 313: Wet Heath

This community is a sub form of FE 64 Heath. It has been mapped separately as it forms part of the wetland complex and like other wetland communities is dependent on high ground water levels. Within the study area the wet heath generally occurs adjacent to the wetland communities such as swamp and swamp sclerophyll communities. The structure is typically low to tall heathland generally less than 2 m high. The canopy cover and species richness is generally high, and composition varies with locality, disturbance history and habitat (e.g. groundwater depth).

This community is dominated by the following families Proteaceae (e.g. *Banksia* and *Hakea* spp.), Myrtaceae (e.g. *Leptospermum, Melaleuca* and *Kunzea* spp.), Epacridaceae (e.g. *Leucopogon* and *Epacris* spp.), Fabaceae (e.g. *Dillwynia, Pultenaea* and *Acacia* spp.), Rutaceae (e.g. *Boronia* and *Eriostemon* spp.), Xanthorrhoeaceae (*Xanthorrhoea* spp.) and Casuarinaceae (*Allocasuarina* spp.). Many sedge and forb species are present. This ecosystem is an aggregation of many different plant communities.

FE 322: Coastal Pink Bloodwood

This forest ecosystem is generally confined to coastal areas occurring on sand and clay soils. The community structure is generally open dry sclerophyll forest with a shrubby understorey. The canopy is dominated by pink bloodwood (*Corymbia intermedia*), hand associates include blackbutt (Eucalyptus pilularis) scribbly gum (*E signata*) tallowwood (*E microcorys*) bustard tallowwood (*E planchoniana*) and forest red gum (*E tereticornis*). Where this forest occurs on sand substrates it is part of Keith's coastal dune dry sclerophyll forest. And where it occurs on other substrates it's composition may be the result of logging removing more commercially valuable canopy species.

FE 323: Hunter-Macleay dry sclerophyll forest

This community is not recognised in the Field Key to Forest Ecosystems (DEC2004) however it is equivalent to the Hunter Macleay dry sclerophyll forest class as described in Keith 2004. *Ocean Shores to Desert Dunes: The Native Vegetation of NSW and ACT*. It has been assigned a forest ecosystem number corresponding to a regional study undertaken by xx. The following description is derived from the DEC threatened species website and is based on Keith 2004.

FE 323 consists of dry open eucalypt forest to 30 m tall, with a mixed sclerophyll and mesophyll shrub stratum and semi-continuous grassy groundcover.

This ecosystem occurs in the eastern parts of the Hunter, Manning and Macleay river valleys, on the foothills and undulating terrain in rain shadow areas below 400 m elevation. The soils are well-drained loams derived from shales.

Upper strata species	Mid strata species	Lower strata species
Corymbia maculata *Eucalyptus crebra* *Eucalyptus propinqua* *Eucalyptus siderophloia* *Syncarpia glomulifera*	*Allocasuarina torulosa* *Daviesia ulicifolia* *Breynia oblongifolia* *Notelaea longifolia* *Persoonia linearis* *Pultenaea villosa* *Rapanea variabilis*	*Desmodium varians* *Dichondra repens* *Pratia purpurascens* *Vernonia cinerea,* *Cheilanthes sieberi* *Cymbopogon refractus* *Entolasia stricta* *Microlaena stipoides* var. *stipoides* *Themeda australis*

Modified or disturbed FE mapping units

FE 164: Agricultural Plantations Orchards

Areas where perennial agricultural crops have been planted.

FE 170: Urban

Developed land including urban and industrial areas.

FE 173: Cleared, partially cleared

Lands originally forested, subsequently cleared and generally are devoid of native vegetation.

FE 201: Camphor laurel

Camphor laurel dominated communities, mostly mapped in the upper North East mapping area of the North Coast bioregion.

FE 211: Isolated or Individual Fig Trees

Areas of isolated or individual fig trees.

FE 800: Coastal Complex

Represents a complex mosaic of the forest ecosystems associated with coastal sand dunes. Previous disturbance or vegetation community complexity has made detailed mapping impractical. FE 800 is an amalgamation of the following Forest ecosystems. FE 5, FE 18, FE 27, FE 46, FE 64, FE 74, FE 96, FE 106, FE 112, FE 141, FE 142, FE 143, FE 168, FE 169, FE 172 and FE 322.

FE 1000: Introduced

Areas of dense infestation with woody introduced plant species.

Conservation Status of Mapped Forest Ecosystems

The following information on the conservation status of the mapped Forest Ecosystems is related only to naturally occurring FEs and is sourced from the Field Key to Forest Ecosystems (DEC, 2004).

Table 1 *Conservation Status of mapped Forest Ecosystems (source: DEC, 2004)*

FE No.	Forest Ecosystem	% Remaining	Status	Severely depleted	Highly Inadeq-uately reserved	Private land priority	% target met
5	Banksia	47.76	Vul			*	58.7
22	Coast Cypress Pine	100	Rare				91.18
26	Coastal Flooded Gum	57.71				*	61.19
27	Coastal Sands Blackbutt	64.06					100
32	Dry Foothills Blackbutt-Turpentine	69.32				*	60.22
34	Dry Grassy Blackbutt-Tallowwood	44.04		*	*	*	37.38
36	Dry Grassy Tallowwood-Grey Gum	67.55					89.07
46	Eastern Red Gums	100	Rare				94.74
47	Escarpment Redgum	27.35	Vul	*	*	*	16.08
64	Heath	-	Rare			*	76.28
65	Heathy Scribbly Gum	74.84					100
72	Low Relief Coastal Blackbutt	46.63			*	*	46.59
73	Lowland Red Gum	63.76	Rare			*	35.25
74	Lowlands Scribbly Gum	84.36					100
77	Mangrove	-	Rare			*	56.74
96	Natural Grassland	-	Rare				80.43
106	Open Coastal Brushbox	62.85					91.96
112	Paperbark	-	Vul				99.97
120	River Oak	58.88	Rare			*	48.59
121	Rock	-					100
125	Saltmarsh	106.95	Rare		*	*	
141	Swamp	-	Rare				85.86
142	Swamp Mahogany	46.87				*	78.91
143	Swamp Oak	22.67	Vul	*		*	46.53
151	Wattle	-					10.05
154	Wet Flooded Gum-Tallowwood	65.59				*	62.95
168	Rainforest	-	Rare			*	67.02
313	Wet Heath	Not Known					Not Known

FE No.	Forest Ecosystem	% Remaining	Status	Severely depleted	Highly Inadeq-uately reserved	Private land priority	% target met
322	Coastal Pink Bloodwood	Not Known					Not Known
323	Hunter Macleay dry sclerophyll forest	Not Known					Not Known

The following definitions apply to the above table;

- **Status**
    - **End** - an **endangered ecosystem** is one where its distribution has contracted to less than 10% of its former range or the total area has contracted to less than 10% of its former area, or where 90% of its area is in small patches which are subject to threatening processes and unlikely to persist.
    - **Rare** - a **rare ecosystem** is one where its geographic distribution involves a total range of generally less than 10,000ha, a total area of generally less than 1,000ha or patch sizes of generally less than 100ha, where such patches do not aggregate to significant areas.
    - **Vul** - a **vulnerable ecosystem** is one which is approaching a reduction in areal extent of 70% within a bioregional context and which remains subject to threatening processes or [which is] not depleted but subject to continuing and significant threatening processes which may reduce its extent.

- **Severely Depleted -** refers to the extent to which a forest ecosystem has been cleared. Forest ecosystems that have been more than 70% cleared (i.e. that have less than 30% of their original extent remaining as defined by the pre-1750 modelled distribution) are regarded as severely depleted.

- **Highly Inadequately Reserved -** forest ecosystems that required 60% or more of their current area to be reserved in order to meet the 15% target, but which achieved less the 40% of the reservation target during the RFA, were identified as 'Highly Inadequately Reserved'. The 'Highly Inadequately Reserved' rating system has been used to identify high conservation value ecosystems that are poorly represented in conservation reserves.

- **Private Land Priority -** ecosystems that have only limited extent on public land and whose reservation target could not be met through reservation of public land were identified as 'Private Land Priority'. Ecosystems identified as being a 'Private Land Priority' are under represented within the public reserve system.

- **% Target Met –** relates to the percentage of target met updated for NPWS Estate as at June 2004.

Endangered Ecological communities

The Threatened Species Conservation Act 1995 (TSC Act) defines an ecological community as an assemblage of species in a particular area. As such, the primary determinant of an ecological community to be a potential *Endangered Ecological Community* (EEC) is the species composition. However it is also important to consider the structure, habitat, distribution and other environmental characteristics that in combination provide strands of evidence to facilitate an informed diagnosis of an EEC (Penny Kendall pers com. David Keith Aug 2005).

Therefore in order to determine *Candidate* EECs it is necessary to consider both ecological community descriptors (such as species composition and vegetation structure) and environmental determinates (including habitat, distribution, and other determinants such as proximity to coast, elevation, soil type, periodic flooding, etc).

Ecological community descriptors

The final determinations for each EEC generally contain a descriptive paragraph indicating the most common floristic components for that EEC. It would be expected that each occurrence of the EEC contain the majority of these species. A list of the characteristic assemblage of species is also provided.

The determinations also describe the structural features of the EEC. It would be expected that each occurrence of the EEC would generally conform to the structural attributes described in the final determination.

Environmental determinates

Information in the final determination about environmental characteristics should be used as guides to further describe the ecological community and provide evidence to assist in the determination of EECs (Penny Kendall pers com. David Keith Aug 2005).

Although it would be expected that most of the environmental determinants would be present for a community to be included as an EEC, it is the combination of these strands of evidence that provides a weight of evidence to enable an informed decision to be made for a particular ecological community. Provided that the weight of evidence of the environmental factors indicate that an ecological community is part of the EEC, then some deviations from these environmental determinants are not considered enough to eliminate it as an EEC.

DEC wildlife atlas endangered ecological communities (EEC)

The following endangered ecological communities potentially occur within the Study Area (see ***Appendix D*** for details of determinations):

- *Subtropical Coastal Floodplain Forest* of the NSW North Coast bioregion;
- *Swamp Oak Floodplain Forest* of the NSW North Coast, Sydney Basin and South east Corner bioregions;
- *Littoral Rainforest* in the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- *Hunter Lowland Redgum Forest* in the Sydney Basin and NSW North Coast Bioregions;

- *Lowland Rainforest on Floodplain* in the NSW North Coast Bioregion
- *Coastal Saltmarsh* in the NSW North Coast, Sydney Basin and South east Corner Bioregions;
- *Freshwater Wetlands on Coastal Floodplains* of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- *River-Flat Eucalypt Forest on Coastal Floodplains* of the NSW North Coast, Sydney basin and South East Corner bioregions; &
- *Swamp Sclerophyll Forest on Coastal Floodplains* of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- *Themeda grassland on seacliffs and coastal headlands* in the NSW North Coast, Sydney Basin and South East Corner bioregions

The Department of Environment and Conservation has indicated that this list is only indicative.

Methodology for identification of Candidate EEC's

This project aims to derive Candidate EECs for the Study Area. The methodology used attempts to identify Candidate EECs from broad scale vegetation mapping and is purposely inclusive, encompassing as many areas as possible given the constraints of resources for the Study.

It must be emphasised that the actual determination of an ecological community as an Endangered Ecological Community requires considerably more detailed investigation than that undertaken for this study. As such the Candidate EEC mapping should be considered to be indicative of the potential occurrence of an EEC in any geographic area rather than indicating the actual occurrence of an EEC at that site.

Further, although the Candidate EEC mapping is intended to be inclusive of all potential ecological communities that may be EECs, it is likely that the mapping misidentifies some ecological communities as Candidate EECs when more detailed investigations would show otherwise, whilst in other cases does not identify some ecological communities as Candidate EECs when more detailed investigation would show that they should be.

The following steps outline the methodology used to derive the Candidate EEC datasets;

1. Identify all possible Forest Ecosystems and CRAFTI codes that are likely to contain species assemblages or floristic communities associated with each Candidate EEC as per the NSW Scientific Committee Determinations. ***Appendix C - Candidate EEC Floristics Associations*** shows the relationships between Forest Ecosystems / CRAFTI vegetation communities and individual Candidate EECs used for this project.
2. Using ARCView GIS, for each Candidate EEC occurring within the Study Area, select out the identified FE and CRAFTI vegetation types and form into a discrete dataset.
3. Use the Ecological Community descriptors and environmental determinants to classify each of the vegetation polygons in the new Candidate EEC dataset according to Probability of Occurrence (Very Low Likelihood, Low Likelihood, Moderate Likelihood, High Likelihood, and Very High Likelihood).

Vegetation polygons identified as either Very Low Likelihood or Low likelihood have been included to minimise the potential for vegetation communities that are actual EECs being excluded from the dataset. For example the determination of some EECs is dependant upon secondary determinants such as correlation with floodplain soils or proximity to marine infuences. However, with all EECs it is the species assemblage which is the primary determinant. Consequently, where the species assemblage correlates well with a Candidate EEC but the secondary determinant does not correlate well, the vegetation polygon is still identified as a Candidate EEC but with a lower probability of occurrence.

The exact process used for each of the 10 Candidate EECs identified as potentially occurring within the study area is outlined below. Additional datasets were used to assist this process including DNR 1:100,000 Soil Landscape mapping series (Macksville-Nambucca and Kempsey), and DPI Fisheries Aquatic Vegetation dataset 2005.

4. Merge the 10 individual Candidate EEC datasets into one dataset which allows the identification of Candidate EECs by individually selected vegetation polygon.

The precise method used to identify Candidate areas for each of the 10 potentially occurring EECs is outline below. Full copies of the NSW Scientific Determinations for each of the potentially occurring EECs are provided in ***Appendix D***.

Candidate Coastal Saltmarsh

A primary environmental determinant is that these communities occur in the intertidal zone on the shores of estuaries and lagoons including when they are intermittently closed along the NSW Coast.

Data sources were;

- Areas mapped as FE 125 under this project
- Areas mapped as Saltmarsh under the CRAFTI mapping which were subsequently transferred to the FE classification under this project
- Areas mapped as FE 1000 Introduced where the notes indicated the presence of *Juncus acutis* were included after cross-matching with DPI Fisheries Aquatic Vegetation 2005 data.
- Soil Landscape mapping (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000, “estuarine” soil landscapes.

Probability of Occurrence was either;

Very High Likelilhood	Where it occurred on known associated soil landscapes
Moderate Likelihood	Where it was mapped but did not correlate with soil landscapes

The NSW DPI Fisheries Aquatic Vegetation 2005 dataset is a more precise dataset having been mapped from 1:10,000 photos. It would form a useful dataset for refining the Candidate Coastal Saltmarsh EEC dataset, however there are several gaps in this dataset around the study area, particularly in small estuary systems south of South West Rocks.

Candidate Littoral Rainforest

A primary environmental determinant is that these communities are strong influenced by proximity to the ocean and generally occur within 2km of the sea. However, Littoral Rainforest may be found further inland, but within reach of maritime influence.
Data sources were;

- Areas mapped as FE 168 Rainforest under this project
- Areas mapped under the CRAFTI mapping as per the *Candidate EEC Floristics Associations (Appendix C)*
- Department of Planning SEPP 26 layer was used as a cross-check. The data set derived for this project is more inclusive than the SEPP26 layer and contains many polgons not identified in the SEPP26 dataset.
- Derived coastline using the 1:25,000 orthophotos (Sept 2003).
- Local knowledge of small remnants occurring on the back of headlands

Probability of Occurrence was either;

Very High Likelilhood	A subset of all rainforest polygons (as derived from the above data sources) within 2kms of the coast
High Likelihood	A subset of all rainforest polygons (as derived from the above data sources) which included all polygons between 2kms and 3 kms of the coast, plus the full polygon that covers the SWR Lighthouse reserve area as a high potential polygon. This polygon is part of the Hat Head NP and was not mapped under this project or previous projects but is thought to contain remnant littoral rainforest fragments.
Low Likelihood	Where polygons were occurring outside the area of the probable marine influence due to altitude or aspect. These polygons are also likely to be captured by the Candidate EEC Lowland Rainforest in NSW North Coast and Sydney Basin bioregions – Preliminary Listing (which has a criteria which allows rainforest occurring under 600m to be included).

Some of the polygons included in this dataset will also appear in the Candidate Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion EEC.

Candidate Swamp Oak Floodplain Forest

A primary environmental determinant for this Candidate EEC is that the communities are generally associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins, and estuary fringes associated with coastal floodplains.

Data sources were;

- Areas mapped as FE 143 Swamp Oak under this project
- Areas mapped under the CRAFTI as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil Landscape mapping (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000, floodplain associated soil landscapes (including alluvial, swamp, estuarine, and Aeolian process types).

Probability of Occurrence was either;

Very High Likelihood	Mapped as FE 143 Swamp Oak or as 40051 Cauarina glauca under NPWS_Coast Veg.
Moderate Likelihood	Mapped as FE 112 Paperbark or FE 142 Swamp Mahogany and occurring on floodplain associated soil landscapes. Mapped under CRAFTI as E5 Swamp Mahogany Dry Sclerophyll Forest, SFp Swamp Paperbark Swamp Oak, FpFw Paperbark Complex ~ Wattle, Native Pioneers, and occurring on floodplain. associated soil landscapes; or mapped as Lookup_31 or Lookup_32 under SF mapping and occurring on floodplain associated soil landscapes; or mapped as NPWS_Coast Veg as 40021, 40022, 40031, 40032, 40031/40121, 40121, 40981, 40982, 40991, or 55061 and occurring on floodplain associated soil landscapes.
Low Likelihood	Mapped as for Moderate Likelihood but NOT occurring on floodplain associated soil landscapes.

Many of the polygons included in this dataset will also appear in other Candidate EEC coverages, particularly in the Candidate Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This is particularly the case where the base data source is the CRAFTI mapping which has many vegetation communities which are likely to include Swamp Oak elements but which do not easily sit in any one Forest Ecosystem.

Candidate Lowland Rainforest on Floodplain

The primary determinant for this community is species assemblage, with the secondary environmental determinant that the community occurs on floodplains.

Data sources were;

- Areas mapped as FE 168 Rainforest under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil Landscape mapping (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000, floodplain associated soil landscapes.
- Derived coastline using the 1:25,000 orthophotos (Sept 2003).
- Candidate Littoral Rainforest EEC mapping

Probability of Occurrence was either;

Very High Likelilhood	Mapped as FE 168 Rainforest and occurring on floodplain associated soil landscapes and outside of 2km from the coast
High Likelihood	Mapped as FE 168 Rainforest but not associated clearly with floodplain associated soil landscapes, outside of 2km from the coast
Moderate Likelihood	Mapped as Rainforest under either FE mapping or CRAFTI or NPWS_Coast veg but within 2km of the coast (but not closer than 500m to the coast). High Likelihood of being Candidate Littoral Rainforest EEC.
Low Likelihood	Mapped as Rainforest under either FE mapping or CRAFTI or NPWS_Coast veg but within 500m of the coast. Very High Likelihood of being Candidate Littoral Rainforest EEC.

Candidate Swamp Sclerophyll Forest on Coastal Floodplains

A primary environmental determinant for this Candidate EEC is that the communities are generally associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Further the community generally occurs below 20m elevation but may occur up to 50m elevation in some locations.

Data sources were;

- Areas mapped as FE 64 Heath, FE 112 Paperbark, FE 142 Swamp Mahogany under this project

- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil Landscape mapping (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000, floodplain associated soil landscapes.

Probability of Occurrence was either;

Very High Likelihood	Mapped as FE 64 Heath, FE 112 Paperbark, FE 142 Swamp Mahogany and occurring on floodplain associated soil landscapes.
High Likelihood	Mapped as FE 64 Heath, FE 112 Paperbark, FE 142 Swamp Mahogany Dry Sclerophyll but NOT occurring on floodplain associated soil landscapes.
Moderate Likelihood	Areas mapped under CRAFTI as Fp Paperbark Wetland, E5 Swamp Mahogany Dry Sclerophyll Forest, E8E5 Wet Sclerophyll – Swamp Sclerophyll Forest, SFp Swamp Paperbark Swamp Oak, FpFw Paperbark Complex ~ Wattle, Native Pioneers, or Z Heath;, or mapped under NPWS_Coast Veg as 40021, 40022, 40031, 40032, 40031/40121, 40091/40021, 40091, 40092, 40121, 40981, 40982, 40991, 40992, 55061; or mapped under SF as Lookup_31 Swamp Mahogany or Lookup_32 Paperbark; AND occurring on floodplain associated soil landscapes.
Low Likelihood	Areas mapped under CRAFTI as Fp Paperbark Wetland, E5 Swamp Mahogany Dry Sclerophyll Forest, E8E5 Wet Sclerophyll – Swamp Sclerophyll Forest, SFp Swamp Paperbark Swamp Oak, FpFw Paperbark Complex ~ Wattle, Native Pioneers, or Z Heath;, or mapped under NPWS_Coast Veg as 40021, 40022, 40031, 40032, 40031/40121, 40091/40021, 40091, 40092, 40121, 40981, 40982, 40991, 40992, 55061; or mapped under SF as Lookup_31 Swamp Mahogany or Lookup_32 Paperbark; BUT NOT occurring on floodplain associated soil landscapes.

Many of the polygons included in this dataset will also appear in other Candidate EEC coverages, particularly in the Candidate Swamp Oak Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This is particularly the case where the base data source is the CRAFTI mapping which has many vegetation communities which are likely to include Swamp Sclerophyll Forest associated species elements but which do not easily sit in any one Forest Ecosystem.

Candidate Freshwater Wetlands on Coastal Floodplains

A primary environmental determinant for this Candidate EEC is that it is associated with periodic or semi-permanent inundation by freshwater, although minor saline influences may exist in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Freshwater wetlands generally occur below 20m elevation.

Due to the inherent difficulty of mapping wetland areas through aerial photograph interpretation, particularly in cleared and artificially drained landscapes, it is likely that this dataset is incomplete and does not identify all areas of Candidate Freshwater Wetland EEC.

It should also be noted that this EEC uses different definition criteria than those used for the Department of Planning SEPP14 communities, so the layers are not analogous. The NSW Scientific Committee determination lists the main assemblage of species which notably exclude tree species. Therefore the flowing dataset is restricted to rush and sedge communities as per the determination (see ***Appendix D*** for more detail).

Data sources were;

- Areas mapped as FE 64 Heath, FE 141 Swamp, FE 171 Water Bodies (excluding fram dams and waterways), and FE 313 Wet Heath, under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*

Probability of Occurrence was either;

Very High Likelihood	Areas mapped as FE 141 Swamp or FE 313 Wet Heath; or as 64021, 64031, 64041, 64051, 64061, 64061/64041, 64061/64101, 64101, 64121, 65031, 66041, 91040/64061 under NPWS_Coast Veg.
High Likelihood	Areas mapped as FE 64 Heath or FE 171 Water Surfaces (but not dams or waterways), or under CRAFTI as Z Heath, S Sedgeland/ Wetland/ Heath, or AS Coastal Complex Swamp.

Candidate River-flat Eucalypt Forest on Coastal Floodplains

A primary environmental determinant is that these communities occur on silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.

Data sources were;

- Areas mapped as FE 26 Coastal Flooded Gum, FE 46 Eastern Red Gum, FE 73 Lowland Red Gums, FE 120 River Oak, or FE 154 Wet Flooded Gum Tallowwood under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*

- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil landscape units defined as “alluvial” from the Soil Landscape mapping series (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000

Probability of Occurrence was either;

Very High Likelihood	Mapped as FE 26 Coastal Flooded Gum, FE 46 Eastern Red Gum, FE 73 Lowland Red Gums, FE 120 River Oak, or as FE 154 Wet Flooded Gum Tallowwood, and occurring on “alluvial” soil landscapes.
High Likelihood	Mapped as CRAFTI E7, E11, Fr, Z, E6E7, E7E6, E7E8, SZ, ZY , or as SF Lookup_37, Lookup_49, Lookup_540, Lookup_563, or as NPWS_Coast Veg 35121, 35122, 35141, 35331, or 35521 and occurring on “alluvial” soil landscapes.

Candidate Hunter Lowland Redgum Forest

A primary environmental determinant of this Candidate EEC is that it occurs on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley Floor in the Sydney Basin and NSW North Coast Bioregions. It is acknowledged in Point 3 of the determination (see ***Appendix D***) that the community may occur elsewhere in these bioregions. As it is not clear how the determining factors for this EEC relate to this project’s study area, a precautionary approach has been adopted whereby all communities identified with *Eucalyptus tereticornis* as a dominant or co-dominant canopy species have been defined as Candidate Hunter Lowland Redgum Forest. As with other Candidate EECs, appropriate field investigations will be required to determine Actual EEC status on case-by-case basis.

Data sources were;

- Areas mapped as FE 46 Eastern Red Gums or FE 73 Lowland Red Gums under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*

Probability of Occurrence was;

High Likelihood	Mapped as FE 46 Eastern Red Gums , FE 73 Lowland Red Gum, CRAFTI E11 or E8E11 , or as NPWS_Coast Veg 35121, 35122.

Candidate Subtropical Coastal Floodplain Forest

A primary environmental determinant for this Candidate EEC is that these communities occur on silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines

and river terraces associated with coastal floodplains. Typically these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, often fringing treeless floodplain lagoons or wetlands with semi-permanent standing water.

Data sources were;

- Areas mapped as FE 5 Banksia Heath, FE 22 Coastal Cypress Pine, FE 26 Coastal Flooded Gum, FE 36 Dry Grassy Tallowwood-Grey Gum, FE 46 Eastern Red Gum, FE 47 Escarpment Redgum, FE 73 Lowland Red Gums, FE 120 River Oak, FE 142 Swamp Mahogany, FE 151 Wattle Scrubland, FE 322 Coastal Pink Bloodwood, or as FE 154 Wet Flooded Gum Tallowwood under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil landscape units defined as “alluvial” from the Soil Landscape mapping series (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000

Probability of Occurrence was either;

Very High Likelihood	Mapped as FE 5 Banksia Heath, FE 22 Coastal Cypress Pine, FE 26 Coastal Flooded Gum, FE 36 Dry Grassy Tallowwood-Grey Gum, FE 46 Eastern Red Gum, FE 47 Escarpment Redgum, FE 73 Lowland Red Gums, FE 120 River Oak, FE 142 Swamp Mahogany, FE 151 Wattle Scrubland, FE 322 Coastal Pink Bloodwood, or as FE 154 Wet Flooded Gum Tallowwood, and occurring on “alluvial” soil landscapes.
High Likelihood	Mapped as CRAFTI E5, E5E13, E6E7, E6E8, E7, E7E6, E7E8, E8, E8E11, E8E13, E8E14, E8E5, E8E6, E8E7, E8E9, E11, E11Fp, E14E6, E14E8, FpFw, Fr, Fw, SZ, Z, ZY; or as SF Lookup_31, Lookup_37, Lookup_49, Lookup_Lookup_61, Lookup_308, Lookup_309, Lookup_592, Lookup_597, Lookup_600, Lookup_603, Lookup_609; or as NPWS_Coast Veg 35121, 35122, 35141, 35212, 35281, 35331, 35431, 35521, 40021, 40022, 40031, 40091, 40121, 40981; AND occurring on “alluvial” soil landscapes.
Moderate Likelihood	Mapped as either of above categories above BUT NOT occurring on alluvial, swamp, Aeolian, estuarine, or disturbed soil landscape process types, but occurring within 100m of a freshwater wetland feature, or swamp sclerophyll forest or swamp oak forest.

Low Likelihood	Mapped as either of the above top two categories BUT NOT occurring on alluvial, swamp, Aeolian, estuarine, or disturbed soil landscape process types, and NOT occurring within 100m of a freshwater wetland feature, or swamp sclerophyll forest or swamp oak forest.

Candidate Themeda Grassland on Seacliffs and Coastal Headlands

Primary determinant is that these communities occur on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions. The community is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.

Data sources were;

- Areas mapped as FE 5 Banksia Heath, FE 96 Natural Grassland, FE 121 Rock, FE 311 Native grasslands, FE 800 Coastal Comple under this project
- Areas mapped under the CRAFTI mapping as per *Candidate EEC Floristics Associations (Appendix C)*
- Areas mapped by NPWS_Coast Veg and State Forests as per *Candidate EEC Floristics Associations (Appendix C)*
- Soil landscape units defined as “colluvial”, “erosional”, “residual” or “transfer” from the Soil Landscape mapping series (DIPNR) Macksville Nambucca 1:100,000 and Kempsey 1:100,000
- Derived coastline using the 1:25,000 orthophotos (Sept 2003).

Probability of Occurrence was either;

Very High Likelihood	Mapped as FE 5 Banksia Heath, FE 96 Natural Grassland, FE 121 Rock, FE 311 Native grasslands, FE 800 Coastal Complex; or as CRAFTI A, K, Z, SZ, ZY; or SF Lookup_235; or as NPWS_Coast Veg 63021, 90300; AND occurring within 200m of the coastline AND occurring on “colluvial” , “erosional”, “residual” or “transfer” soil landscapes.
High Likelihood	Mapped as FE 5 Banksia Heath, FE 96 Natural Grassland, FE 121 Rock, FE 311 Native grasslands, FE 800 Coastal Complex; or as CRAFTI A, K, Z, SZ, ZY; or SF Lookup_235; or as NPWS_Coast Veg 63021, 90300; AND occurring within 200m of the coastline BUT NOT occurring on “colluvial”, “erosional”, “residual” or “transfer” soil landscapes.

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NSW Scientific Committee (2004) *Final Determination to list "River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions" as an endangered ecological community.*

NSW Scientific Committee (2005) *Final Determination to list "Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions" as an endangered ecological community.*