VEGETATION MAPPING
FOR THE
LISMORE LOCAL GOVERNMENT AREA
GREEN (NORTHERN) ZONE

December 2019

Landmark Ecological Services Pty. Ltd.

A S Murray & Associates

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Project Team

The project team comprised Annette McKinley (Landmark), Barbara Stewart (Landmark), Andrew Murray (A.S. Murray & Associates), and Wendy Neilan (LCC). Roles were as follows:

Annette McKinley – Project co-ordination, API, fieldwork, reporting
Andrew Murray – GIS co-ordination, API, fieldwork, reporting
Barbara Stewart – fieldwork
David Milledge - fieldwork

Wendy Neilan– fieldwork, Council liaison

Acknowledgements

The project was undertaken with project co-ordination and field assistance from Wendy Neilan (Environmental Strategies Officer – Ecology, LCC). Angus Underwood previous Environmental Strategies Co-ordinator at LCC) provided assistance at the commencement of the project. Russell Bell (GIS liaison. Nanette Nicholson provided information on vegetation communities and distribution.

Council provided background information including GIS layers (details Section 1.4).

1 Introduction

1.1 Background

Landmark Ecological Services Pty Ltd (Landmark) has been engaged by Lismore City Council (LCC) to conduct fine-scale mapping of vegetation, including Endangered Ecological Communities (EECs) and Koala habitat across the north west of the Local Government Area (LGA), (the study area).

1.2 The study area

In a previous mapping exercise, the Lismore LGA was divided into three zones (**Figure 1, Table 1**). The focus of this report is the North west portion of the LGA known as the Green zone, mapped in 2018-2019. The Blue and Grey zones were mapped in 2011 (Stewart et al. 2011). National Parks estate, including National Parks (NPs), Nature Reserves (NRs) and State Conservation Areas (SCAs) as well as State Forests (SFs) are outside the scope of the mapping project, but are shown on maps and included in area statistics in **Table 1**.

Table 1 Details of zones within Lismore LGA.

Zone	Area (ha)	
Green	56,274.83	The Green Zone is located north of the area bounded by the line that extends SSW from the intersection of the Whian Whian SCA and Rocky Creek to Dunoon Road. The boundary then follows Dunoon Road south to the corner of Cusack Road. It then extends westward approximately following the 50m contour along the floodplains of Leycester Creek (south), Booerie Creek, Terania Creek, Goolmangar Creek, Jiggi Creek, Leycester Creek (west) and Back Creek west to the boundary of the Lismore and Richmond Valley LGAs.
Grey	20,873.71	The Grey Zone lies in the southeast of the LGA. This zone is bounded by the Wilsons River in the north and west and the border with Ballina Shire in the east. In the south, the boundary follows Delelvin Lane, Paff Lane, Maxwell Lane, Tuckean Island Road, along the drainage canal to the south of Tuckean Island Road and then along the southern boundary of Tuckean Nature Reserve. The Grey Zone corresponds to the koala planning area defined in the Comprehensive Plan of Management for south-east Lismore.
Blue	51,582.02	The Blue Zone lies to the south of the southern boundary described for the Green Zone and occupies the remainder of the study area. The Blue Zone lies across the centre of the LGA, extends along its western boundary and occupies the far south of the LGA.
TOTAL	128,730.55 ha	

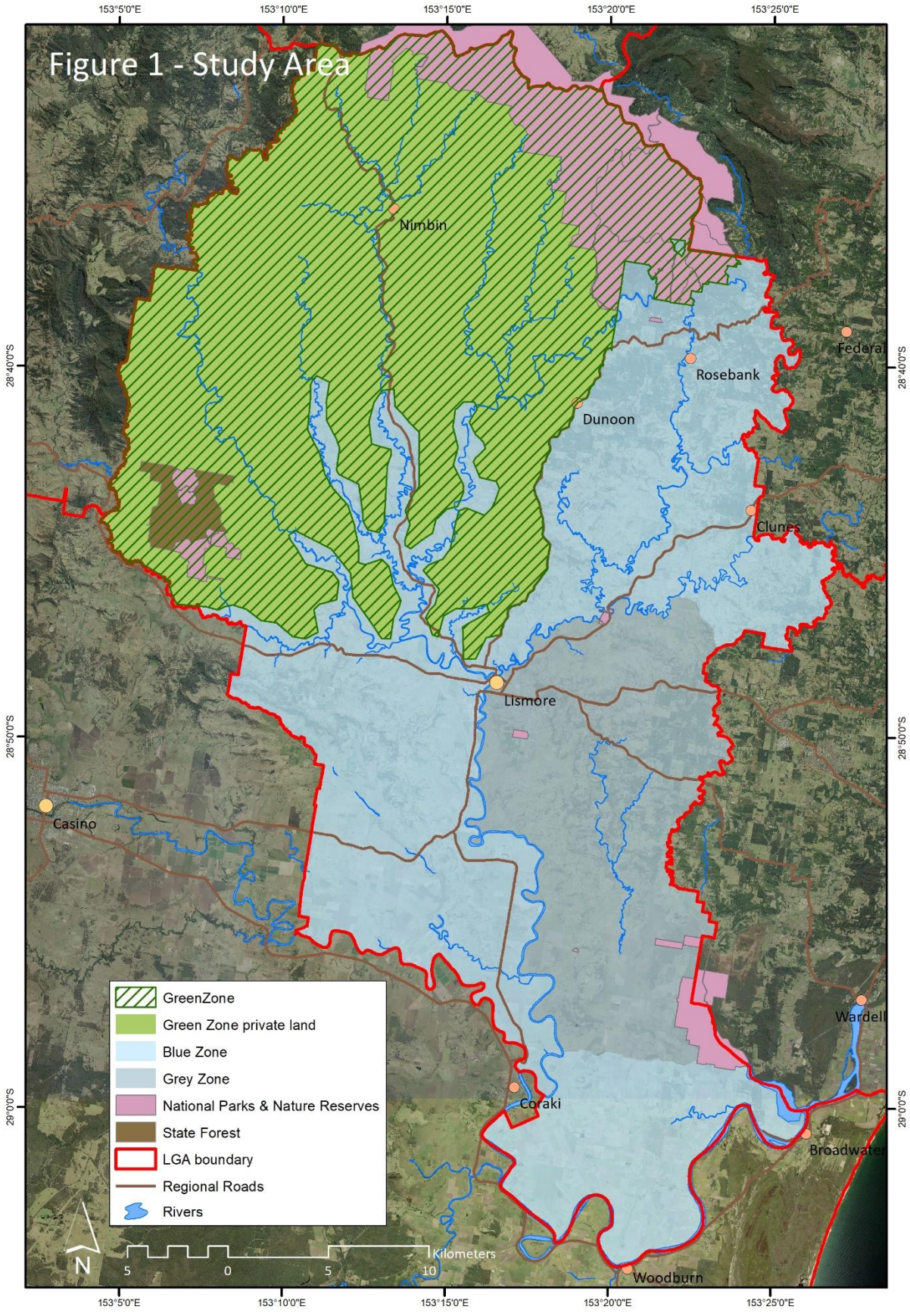

Figure 1 Map of Lismore LGA showing the current study area as the “Green Zone”

1.3 Aims and objectives

Aim:

The aim of the project was to produce fine scale vegetation mapping for the 'Green Zone' of the Lismore LGA identifying vegetation communities, endangered ecological communities and koala habitat. The mapping was to be completed using Land and Property Information high resolution digital photography. At the time the project was commissioned, aerial photography available for the study area was limited to the LGA-wide 2009 series (used for the 2011 vegetation mapping project). The project commenced in November 2017 using 2009 aerial photography, along with September 2012 imagery limited to the rural villages of Modanville, Dunoon and Nimbin.

From May 2018 onwards, the project used high resolution aerial photography taken in April 2018.

Objectives:

1. Review existing bushland layer and amend as required to reflect any changes in vegetation extent and cover.
2. Review existing bushland layer to reflect any changes to mapped land use categories (plantations, non-plantation vegetation and open water).
3. Within the bushland layer identify and map vegetation and classify to the vegetation community level.
4. Collect and record attribute data on vegetation condition.
5. Identify and map:
    a. Koala habitat
    b. Endangered Ecological Communities listed on Schedules of the NSW *Threatened Species Conservation Act 1995* or *Environmental Protection and Biodiversity Conservation Act 1999*
6. Undertake field work and data collection to inform assignment of vegetation classification and condition, and improve confidence in mapping accuracy.

1.4 Previous vegetation mapping in Lismore LGA

As part of the process of developing the new Local Environmental Plan, LCC engaged GHD in 2007 to prepare 1:10,000 scale maps of the distribution of vegetation within the LGA based on Keith (2004) involving classification to Formation and Class level. Prior to this mapping exercise, vegetation mapping for the Lismore LGA was conducted as part of larger regional assessments (e.g. CRAFTI).

In 2010 LLC engaged Landmark Ecological Services to conduct fine scale mapping of vegetation communities, including Endangered Ecological Communities (EEC's) and koala habitat across the Local Government Area. As part of this project the LGA was divided into three zones, designated by colour, reflecting the differing levels of available background information, potential for land use conflict with biodiversity objectives, and other threats. National Parks estates, including National Parks, Nature Reserves and State Conservation Areas, and State Forests were not included in the mapping project.

Fine scale mapping was completed in 2011 for the Blue and Grey Zones covering an area of 72,455 hectares in the south and east of the shire.

In the 2011 project, mapping within the Green Zone was limited to delineating a bushland layer which comprised line work that outlines the extent of areas of woody vegetation and enclosed water bodies. The bushland layer was derived through digital interpretation of 2009 ortho-rectified aerial photography. A full description of the methodology can be found in Landmark's Report (Stewart *et al.* 2011). The 'Green Zone' bushland layer was subdivided to delineate plantations and open water however no further classification of vegetation communities or other attributes was undertaken for this area.

1.5 Information sources

Existing vegetation mapping within the LGA included:

- Vegetation mapping conducted as part of larger regional assessments (e.g. Comprehensive Regional Assessment Aerial Photographic Interpretation (CRAFTI).

Other sources included:

- Species lists and reports - LCC lands and some private properties
- Scientific Committee Determinations for Endangered Ecological Communities
- Grasses locations (Stubbs 2001)
- koala habitat sites- McAlpine *et al.* 2019 ARC linkage project LP 160100486
- Koala records - LCC and NSW Wildlife Atlas records
- Plant community types (PCTs) - OEH vegetation survey sites
- NSW BioNet Vegetation Information System (BioNet VIS) survey sites

LCC also provided GIS layers with relevance for vegetation classification and evaluation of conservation status, including:

- Air photo imagery
- Drainage, cadastral and zoning layers
- Soils and geology
- Landform (based on mapping by Morand 1994)
- LCC 100-year flood level (refinement ongoing, version supplied dated August 2011).

Resources did not permit the full evaluation and incorporation of all available background data. Existing mapping and species lists were used for reference; however, for consistency the image analysis, air photo interpretation and field checking methods of the current project were applied in the same manner across all vegetation in the study area.

2 Methods

2.1 Mapping methods

2.1.1 Image analysis and air photo interpretation

All aerial photography used in mapping linework and interpreting vegetation patterns and community types was supplied by Lismore City Council as .ecw files.

A delay in obtaining current aerial photography meant that the project commenced in November 2017 using 2009 aerial photography, plus September 2012 imagery limited to the rural villages of Modanville, Dunoon and Nimbin.

From June 2018 onwards, high resolution aerial photography taken in April 2018 was used. This required revision of some of the previous line work to achieve better accuracy on the newer photoset, and to account for changes from clearing or regrowth in the time since earlier photography. Since a substantial amount of the linework had been completed by this stage, some areas were not redrawn and may show small areas of vegetation where none now exists, or fail to include areas of regrowth younger than 10 years. (See Limitations section 2.4)

Adjustments were made to the colour of the aerial photos supplied to aid in distinguishing tree crowns as separate species (**Figure 2 below**). Image clarity and colour tones varied significantly across the image mosaic, especially on differing sun angles and aspects, near the edges of photo tiles and in steep terrain. This made consistent recognition of dominant species difficult, particularly for mixed Eucalypt stands (See Limitations section 2.4).

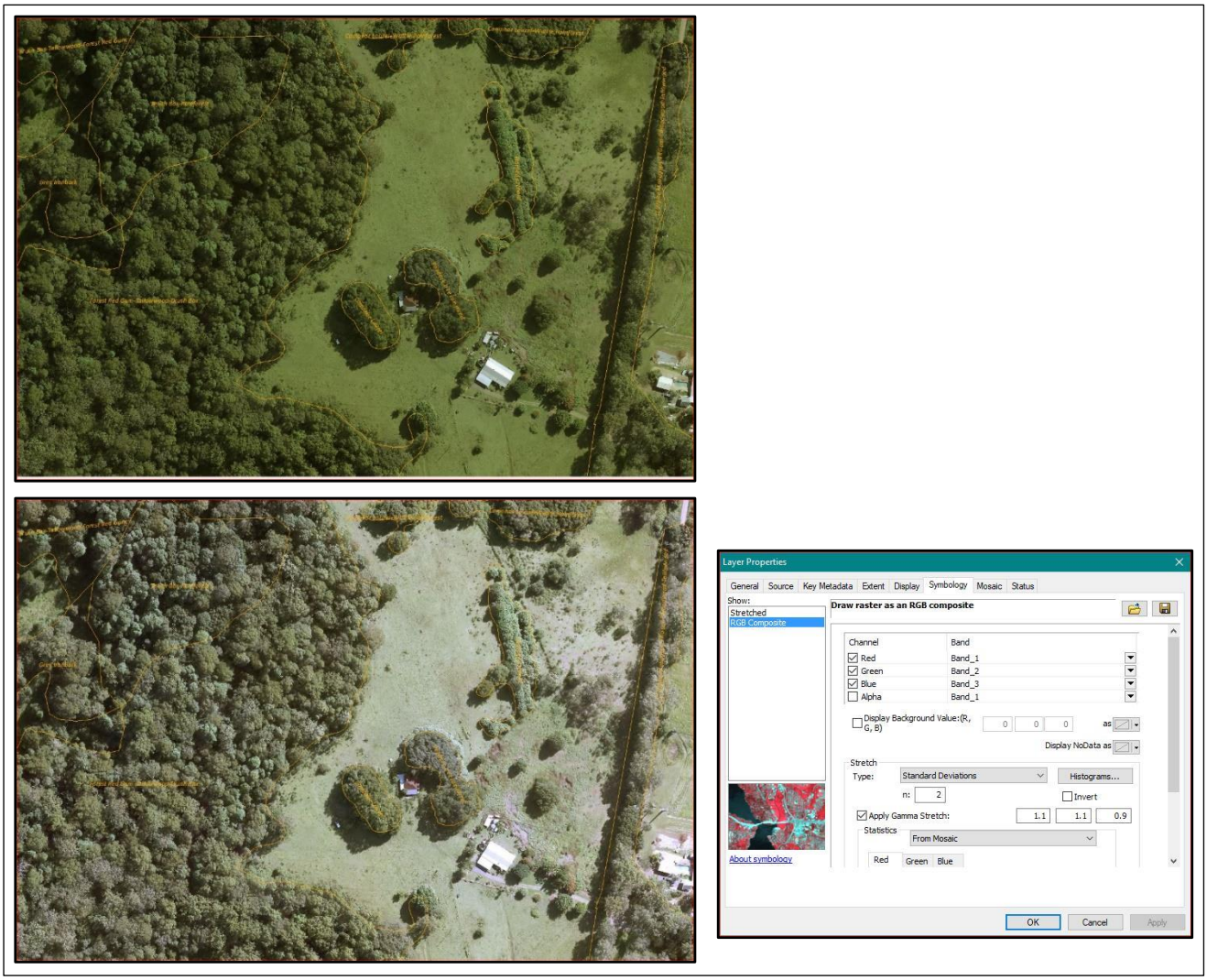

Figure 2: Adjustment of image mosaic colour

Some variations in methodology were employed in parts of the project area as aerial photo interpretation (API) and field work proceeded:

- in delineating plantations, an exception to the 40% canopy cover cutoff was employed to include areas of vegetation with plantation structure but canopy cover <40% where they were enclosed in, or adjacent to, mapped plantation.
- in the case of vegetation of high conservation value (EEC or Koala habitat), further exceptions were employed, guided by API and field checking. Polygons less than 0.5 ha in area and/or having less than 40% canopy cover were included where possible. As resources were limited, mapping of small or sparsely vegetated polygons was not consistent across the study area.

Water bodies, e.g. dams, lagoons and rivers, were identified and mapped at the image analysis stage, as bodies wider than 10 meters and visible in the imagery at 1:4,000 scale.

2.1.2 Field inspection

Field work was undertaken between May 2018 and May 2019. Ground truthing was undertaken to confirm (or modify) the mapped vegetation types, to document their structure and floristics in more detail, and to illustrate the range of variation within and between the polygons.

While the intensity of ground truthing required in the project varied within the study area (Section 1.3), ground truthing priorities were also determined by confidence in API, the desirability of checking a representative sample of each vegetation community and geographic spread of samples.

Field checking was undertaken by traversing the vegetation via meandering transects within the polygon or by remote inspection from roadsides or other vantage points. Where inspection by traverse was undertaken, details of vegetation structure and floristics were recorded, including dominant species in each stratum and measures of weed abundance and severity. As most vegetation in the study area is in private ownership, access for purposes of ground truthing by traverse was very limited (see Limitations section 2.4).

Remote inspection focused on identifying dominant canopy tree species, presence of woody weeds such as Camphor Laurel and Privets. During field checking by remote inspection, vegetation polygons were viewed, wherever possible, from more than one vantage point in order to improve the accuracy of the field assessment of the API. However, in some cases only the edge or a small proportion of a vegetation polygon could be viewed. See Limitations.

2.1.3 Data collection and handling

Data collected during field work was entered directly into the shapefile. Advantage being the field information could be checked against the API.

Data was collected/compiled for some or all of the following fields, depending on the land-use category and the level, if any, of ground-truthing (**Table 2**). The table represents the ideal or maximum data set recorded for each circumstance – resources did not always permit full data collection.

Data was recorded by the following list of observers using the abbreviations shown:

ALM (also AM)	Annette McKinley	JM	Jim Morrison
ASM	Andrew Murray	JW	James Warren
WN	Wendy Neilan	LW	Lui Weber
BS	Barbara Stewart	PG	Phil Gilmour
NN	Nan Nicholson	KM	Katie Maric
ABen	Andrew Benwell	AMoy	Andrew Moy
CMcA	Clive McAlpine		
DM	David Milledge		
DB	Darren Bailey		

Table 2 Details of data collection by land-use category.

		Landuse category			
GIS Database Field Name	**Short description**	**Non-plant-ation veget-ation**	**Plantation**	**Open Water**	**For codes and definitions refer to:**
POLYID	Polygon number	x	x	x	
HECTARES	Area (ha)	x	x	x	
SOIL	Layer supplied by LCC	x	x	x	
MLANDS_31	Layer supplied by LCC	x	x	x	Morand (1994)
FLOOD	% polygon below 100 year flood level	x	x	x	Layer supplied by LCC
ZONE	Subdivision of LGA (Blue-Grey-Green)	x	x	x	
DATE_	Date of field inspection	x	x	x	
RECORDER	Person conducting field inspection	x	x	x	
LOCATION	General geographic location	x	x	x	
LAND_USE	Land-use category	x	x	x	s. 2.2.1
PLANTN_TYP	Plantation type		x		s. 2.2.1
KEITH_FORMATION	Based on Keith	x			Keith (2004)
KEITH_CLASS	Based on Keith	x			Keith (2004)
PCT_291120	Plant Community Type	x			Appendix 1, OEH (2019)
COMM_SHORT_NAME	Abbreviation for community	x			Table 9
COMM_CODE	For mapping labels	x			Table 9
LM_VEG_UNIT	Vegetation unit	x			Table 9
CAN_HEIGHT	Canopy height (m)	x			
CAN_COVER	Canopy cover (%)	x			
WH-STRUCTU	Vegetation structure	x			Walker and Hopkins 1990
FP_EEC_PROB	Likelihood of Floodplain EEC	x	x		s. 2.2.4
FP_EEC_TYPE	Floodplain EEC type	x	x		s. 2.2.4
RF_PROB	Likelihood of Lowland subtropical rainforest EEC	x	x		s. 2.2.4
THREAT_SP	NSW Wildlife Atlas Threatened flora records	x	x		
EMERGENT	Emergent species above canopy	x			
UPPERDOM1	Upper stratum dominant species	x			
UPPERDOM2	Upper stratum dominant species	x			
UPPERDOM3	Upper stratum dominant species	x			
MIDDOM1	Mid stratum dominant species	x			
MIDDOM2	Mid stratum dominant species	x			
MIDDOM3	Mid stratum dominant species	x			
LOWERDOM1	Lower stratum dominant species	x			

LOWERDOM2	Lower stratum dominant species	x			
LOWERDOM3	Lower stratum dominant species	x			
K_HAB_REL	Reliability of Koala habitat typing	x	x		s. 2.2.4
K_HAB_CAT	Koala habitat	x	x		s. 2.2.4
K_RECORDS	Koala records	x	x		
API_SUCC_S	Landscape condition (API)	x			s. 2.2.3
SUCC_STAGE	Site condition (field inspection)	x			s. 2.2.3
CAMPHOR	Camphor cover (API)	x			s. 2.2.3
LANTANA	Lantana cover (API)	x			s. 2.2.3
RELIABILIT	Reliability	x	x	x	s. 2.3
NOTES	Notes	x	x	x	

2.2 Mapping categories and classification

2.2.1 Land-use categories

The mapped area was categorised in broad land-use types as follows:

- Plantations (p)
- Non-plantation vegetation (np)
- Open water (ow)

In most instances changes to vegetation cover and extent over the past 10 years and alignment with current aerial photos necessitated re-drawing of the bushland layer.

A definition of “plantation" based on the NSW Timber Plantations (Harvest Guarantee) Act 1995 was adopted i.e. an area of land on which the predominant number (>50%) of trees or shrubs forming, or expected to form, the canopy are trees or shrubs that have been planted (whether by sowing seed or otherwise):

(a) for the purpose of timber production, or

(b) for the protection of the environment (including for the purpose of reducing the salinity of the land or otherwise repairing or improving the land, for the purpose of biodiversity conservation or for the purpose of acquiring or trading in carbon sequestration rights), or

(c) for any other purpose, including for the purpose of the production of food or any other farm produce other than timber.

Plantations were recognized during API by their structure (usually planted in rows). Plantations were further subdivided into categories based on dominance, as follows:

1. Eucalyptus species
2. Exotic pine
3. Hoop Pine

4. Rainforest (mixed species)
5. Orchard
6. Mixed/other.

2.2.2 Vegetation typing and classification

Vegetation was classified by API mainly on the basis of spatial patterns, texture and colour calibrated by field observations. Non-plantation vegetation polygons were first assigned to vegetation units on the basis of canopy dominant species (following Walker and Hopkins 1990). Where identification of distinct species was not possible, inference from known stands or field inspections in the vicinity or on the same substrate was used to generalise the vegetation type. The convention used in the descriptive [LMVEGTYPE] field is to list the dominant species in order of canopy cover using a hyphen, then adding sub-dominant or associated species following a plus sign. (e.g. Brush Box-Tallowwood+Flooded Gum, Rainforest indicates Brush Box and Tallowwood dominant with lesser canopy components of Flooded Gum and Rainforest spp).

At the conclusion of API and field work, the units recognised within non-plantation vegetation were assigned to groups of similar vegetation and placed in Keith's (2004) formations and classes.

The project brief required vegetation classification at the community level as defined by the NSW BioNet Vegetation Classification using Plant Community Types (PCTs).

BioMetric vegetation types were originally defined under the Native Vegetation Act 2003 and the Environmental Outcomes Assessment Methodology. (Ayers *et al*, 2004. updated 2008). In 2012, OEH revised the vegetation classification for the Northern Rivers Catchment Management Area and used Vegetation Community Profiles to realign the vegetation types (OEH, 2012), but not all these draft revisions were incorporated into the BioMetric Vegetation Types. BioMetric Vegetation Types were retired from the VIS Classification system on 21 August 2017, and were replaced with Plant Community Types (PCTs).

Forty-four (44) PCTs are listed for the Scenic Rim IBRA subregion (Lismore LGA). These plant community types were derived from various sources, including NSW State Forest Types (NPWS 1989), Forest Ecosystems analysis (NPWS 1999), Floyd rainforest types (Floyd 1990) and the BioMetric Vegetation Types.

Many of the 'candidate' PCTs for the LGA were described for estuarine, coastal or lower floodplain substrates and as such were ruled out as candidates for the Green Zone.

In 2017, OEH conducted targeted surveys on the Far North Coast to refine the definition of the PCTs in the Northern Rivers, resulting in a new classification of "RCP Groups" (Regional Community Profile). A draft of this new classification was provided to this project on November 18, 2018 (OEH, 2018) and subsequently used to group polygons into these revised vegetation types for Lismore LGA.

In assigning a vegetation unit to a vegetation community, consideration was given to:

- Canopy dominants and structure (and other floristic data where available)
- Soils and landform
- Spatial relationship to known distribution of vegetation types (GIS map inspection)
- Understanding of vegetation types and distribution gleaned from field work and previous experience of the project team.

Vegetation descriptions were prepared for all vegetation communities. Where vegetation units appeared to be heterogeneous (e.g. units named Forest Red Gum included vegetation located on both the floodplain and higher ground), API and any available field data was assessed polygon by polygon and the unit was split into more than one vegetation community.

Following the June 2019 submission of this report in draft form, the OEH advised that the draft revision of PCTs based on quantitative plot data was available and would form the basis of the State Vegetation Type Map – Eastern scheduled for release in 2020 (OEH 2019). The mapped vegetation types for this project were realigned with the new PCT names where possible.

Communities that could not readily be placed in the revised PCTs were placed in communities recognized and described during this project. (Appendix 1)

2.2.3 Vegetation condition

The project brief required that vegetation condition measures be incorporated into mapping.

Following the methodologies used in previous mapping for Lismore LGA (Stewart et al. 2011) vegetation condition was recorded where possible during fieldwork, using values for site condition, weed density, and weed severity. Cover classes for Lantana *Lantana camara* and Camphor Laurel *Cinnamomum camphora* were assigned from API and validated or refined from ground-truthing when possible. The vegetation floristics and structural data collected in the field (Section 2.1.2) included some further data about the integrity of vegetation strata and weed occurrence.

Categories and codes were as follows:

Landscape condition (from API):

1. Old growth/excellent condition

Vegetation with negligible unnatural disturbance, as discerned from canopy cover relative to undisturbed state of vegetation type.

Evidence of senescent crowns in eucalypt forest >10%

Mature forest or other vegetation with common age related features (fallen logs, senescent trees, stags, tree hollows, epiphytes, lithophytes, buttresses, large trees, emergents etc). API indicators include large crowns, senescent emergents, longevity of mature vegetation in historical aerial photographs, known remnants.

2. Mature forest

Vegetation with small unnatural disturbance, as discerned from canopy cover relative to undisturbed state of vegetation type.
Evidence of senescent crowns in eucalypt forest <10%

Mature vegetation – well developed vegetation; e.g. >5 years old for non-woody vegetation; >8 years for shrublands; >40 years for forests. API indicators include mature crowns dominant, longevity of mature vegetation in aerial photographs

3. Advanced Regrowth
Intermediate successional development, e.g. 1-5 years old for non-woody vegetation; 3-8 years for shrublands, 10-40 yrs for forests

4. Regrowth
Early successional development, e.g. <1 year old for non-woody vegetation; <3 yrs for shrublands; <10 years for forests. API indicators include comparison of aerial photographs from past 10 years.

Non-woody vegetation - vegetation that does not develop woody stems, e.g. herbs, sedges and grasses, in contrast to woody plants –shrubs and trees.

Shrublands – vegetation communities domninated by shrubs (woody plants multi-stemmed at the base or within 200mm from ground level) or, if single-stemmed, less than 2m tall (Walker and Hopkins 1990).

Forests – vegetation communities dominated by tree species.

Lantana cover (from API)
1. >50%: 2. 26 –50% ; 3. 5 –25%; 4 Not detected

Camphor cover (from API)
1. >50%; 2. <50% throughout; 3. Occasional/patchy/edges; 4. Not detected

Site condition (from ground survey)
1. Old growth - Mature forest or other vegetation with common age related features (fallen logs, senescent trees, stags, tree hollows, epiphytes, lithophytes, buttresses, large trees, emergents etc).
2. Mature vegetation – well developed vegetation; e.g. > 5 yrs old for non-woody vegetation; >8 yrs for shrublands; >40 yrs for forests.
3. Advanced regrowth – intermediate successional development e.g. 1 – 5 yrs old for non-woody vegetation; 3 – 8 yrs for shrublands; 10 – 40 yrs for forests.
4. Early successional development e.g. < 1 yr old for non-woody vegetation; < 3 yrs for shrublands; < 10 yrs for forests.

Weed density (from ground survey, includes Camphor and Lantana)
1 – Few or no weeds observed (no or light infestation)
2 – Weeds mainly around edges or very scattered (light to mod),
3 - Weeds common, but patchy or scattered (including canopy),

4 - Weeds throughout excluding canopy (heavy infestation),
5 - Weeds throughout including in canopy (heavy infestation),

Weed severity (from ground survey, includes Camphor and Lantana)
1 –No problem weeds present:
2 –Infestation is mostly minor weeds,
3 –Infestation a mix of minor and moderate weeds, isolated major weeds
4 - Infestation mostly of moderate weeds +/- major weed present,
5 –2 or more major weeds present
(For a list of minor/moderate/major weeds see Appendix 3, Stewart *et al* 2011)

2.2.4 Koala habitat mapping

Koala habitat mapping
Each vegetation polygon was assigned to a Koala habitat category (**Tables 3** and **4**) according to definitions provided by LCC and based on those derived during the development of a Comprehensive Koala Plan of Management for south-east Lismore.

Koala habitat mapping fields and values

[K_HAB_CAT] Koala habitat category (see **Table 3**)
1 - Primary
2 - Secondary A
3 - Secondary B
4 – None
5 - Unknown

Polygons were assigned a Koala habitat reliability code to indicate the confidence in application of the definitions.

[K_HAB_REL] Koala habitat reliability Codes:
1. - Inferred from API, incomplete ground inspection or other sources
2. - Assigned from comprehensive ground inspection
3. - Koala observation from accumulated records

The mapping did not consider fauna data nor observations of animals in assigning habitat (as set out in project brief). Therefore all Koala habitat assessments were based only on flora species present. For field observations of koala, record source(s) were noted in the [K_RECORDS] field of the GIS database and records were compiled for reference in later stages of the project.

[K_RECORDS] Koala records lists the source(s) of koala records for the polygon

Table 3 Koala habitat categories

Preferred Koala Habitat	**1** Primary	Vegetation associations and/or communities wherein primary food tree species comprise the dominant or co-dominant (i.e. ≥ 50%) overstorey tree species.
	2 Secondary A	Vegetation associations and/or communities wherein "primary food tree species" are sub-dominant components of the overstory tree species and usually (but not always) growing in association with one or more "secondary food tree species".
	3 Secondary B	Vegetation associations and/or communities wherein "primary food tree species" are absent, habitat containing "secondary and/or supplementary food tree species" only.
Other Vegetation	**4** Other	Native vegetation associations and/or communities within which "preferred koala food trees" are absent.
Unknown (Koala habitat not assessed)	**5** Unknown	Vegetation mapping polygons for which there is insufficient data available to enable classification. This includes both individual trees and clumps of trees which are unmapped owing to the resolution of the mapping. These trees may be verified as *koala habitat* by a Koala Habitat Assessment.

Koala food tree species considered in the assessing koala habitat are shown in **Table 4** below.

Table 4 Preferred Koala food trees

	Scientific Name	**Common Name**
Primary food tree species	Orange Gum	*Eucalyptus bancroftii*
	Forest Red Gum*	*E. tereticornis*
	Tallowwood	*E. microcorys*
	Swamp Mahogany	*E. robusta*
Secondary and/or supplementary food tree species	Grey Gum	*E. punctata***
	Thin-leaved Stringybark	*E. eugenioides*
	White Stringybark	*E. globoidea*
	Small-fruited Grey Gum	*E. propinqua*
	Narrow-leaved Red Gum	*E. seeana*

* includes the naturally occurring *E. tereticornis* x *E. robusta* hybrid referred to as *E. patentinervis* (Bale, 2003). ** includes synonym *E. biturbinata*.

In some cases, professional judgment was employed in applying the Secondary A habitat definition. For some polygons made up of vegetation that included primary food trees as sub-dominants, assignment to Category 2 Secondary A habitat did not appear in keeping with the intent of the Secondary A habitat definition detailed in the DECC NSW's (2008) Recovery Plan for the Koala (Option 1 definition set) i.e. habitat capable of supporting a medium density of Koalas. Examples included polygons with low numbers of food trees, or where the food trees were localized (e.g. a small Tallowwood *E. microcorys* windbreak associated with a large plantation). Where mapping the polygon as secondary habitat seemed misleading, the polygon was designated "Category 4 Other" and the presence of food trees was documented in the "Notes" field of the GIS database.

2.2.5 Endangered Ecological Communities

A list of EECs reported or considered likely to occur in the LGA (**Table 5**), as shown in the project brief provided by LCC, was used to devise appropriate assessment methods.
The approach to assessing the status of EECs varied between communities, since the NSW Scientific Committee's determinations, which define the communities, are based on different combinations of floristic, structural, locational and edaphic (soils) criteria. The assessment aimed to produce indicative EEC mapping, which may require ground inspection in conjunction with the determinations for confirmation, especially in marginal cases.

Table 5 Endangered Ecological Communities in the Lismore LGA

Full name	**Short name**
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Coastal Saltmarsh
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Freshwater wetlands on coastal floodplains
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	Lowland Rainforest on Floodplain
Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion	Sub-tropical Coastal Floodplain Forest
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp sclerophyll forest on coastal floodplains
Lowland rainforest in the North Coast and Sydney Bioregions	Lowland rainforest

The EECs were treated in two stages. Firstly, the Coastal Floodplain group of EECs were delineated collectively and secondly, the Lowland Rainforest EEC was delineated on lands outside the floodplain. Wherever possible, vegetation types likely to constitute or include EECs were examined during ground survey to assess conformity with the community description in the Scientific Committee's determinations.

Coastal Floodplain EECs

Six of the EECs belong to the Coastal Floodplains group of EECs, which adjoin or intergrade with each other to collectively cover all remaining native vegetation on the coastal floodplains of New South Wales (as stated in the various determinations).

The intersection of the available 100-year flood level GIS layer (supplied by LCC August 2011) with native vegetation was used to delineate the group of EECs. The floodplain layer enclosed mangroves, which are classified as protected marine vegetation (NSW Fisheries Management Act 1994) and were excluded from consideration of EEC status. Vegetation polygons were designated as within (100%) or partly within (percentage assigned) the mapped floodplain.

All polygons partly or wholly within the floodplain were assigned a probability for EEC status as follows:

1. Highly likely (vegetation such as Paperbark *Melaleuca quinquenervia*, Swamp Oak *Casuarina glauca*, Forest Red Gum *E. tereticornis* that fit well with EEC determinations and ecotones between these types)
2. Probable or possible (e.g. exotic vegetation with some components of EEC types)
3. Unlikely but possible (e.g. vegetation types not fitting well with EEC types, such as Blackbutt *E. pilularis* on the edge of floodplain and exotic vegetation with only small components of EEC types). Plantations were also placed in this category.

For polygons intersecting with the floodplain layer, those with an area between 5 and 20% in the floodplain were rated 2 (probable or possible) and those with 20% and greater native veg rated 1 (unless camphor-dominated; and then rated 2).

Where possible, the various floristic descriptors included in the determinations were employed to match mapped vegetation types to particular EECs within the floodplain communities. Some mapped vegetation types appeared to constitute depleted and degraded examples of communities or intergradations between communities and could not be confidently assigned to a specific EEC though were identified as belonging to the Coastal Floodplain group. EECs were coded as follows:

1. Freshwater wetlands on coastal floodplains
2. Lowland Rainforest on Floodplain
3. Sub-tropical Coastal Floodplain Forest
4. Swamp oak floodplain forest
5. Swamp sclerophyll forest on coastal floodplains
6. Ecotonal types, not discernible due to disturbance and exotic vegetation components and plantations.

As background information indicated that Coastal Saltmarsh was not present in the LGA, no code was assigned.

Lowland Rainforest EEC

The determination for the Lowland Rainforest EEC relies on floristic and structural characteristics to define the community, which includes disturbed types. All rainforest and vegetation with rainforest components (outside the floodplain) were selected and coded for likelihood of EEC classification as follows:

1. Highly likely (vegetation types that fit well with EEC determination)
2. Probable or possible (e.g. exotic vegetation with some components of EEC types, dry rainforest types that are included only where grading into the subtropical types)
3. Unlikely (exotic vegetation with small components of EEC types, dry rainforest unlikely to be associated with subtropical types, plantations).

Paddock figs & Paddock rainforest trees were assigned 2 as possible Subtropical Rainforest. The Keith Formation was listed as RAINFOREST but no Keith Class assigned – figs may be components of either subtropical or dry rainforest.

Polygons including rainforest and located on the edge of the floodplain have potential for inclusion in either or both of the EECs, Lowland Rainforest on Floodplain and Lowland Rainforest. Difficulty arises where polygons may be partially located on floodplain and/or the floodplain location is uncertain due to the fine scale of the vegetation mapping and the coarseness of the flood mapping. Such polygons were designated with probabilities for both EECs.

2.3 Reliability

Due to differences in sampling effort and inspection methods, some areas are likely to be more reliably mapped than others. A reliability code was therefore allocated to each mapped polygon, according to the source of the data and/or the manner in which data was collected. Reliability codes are as follows:

1. On-site traverse and API
2. Limited on-site or remote inspection and API
3. Other information source and API
4. API only

2.4 Limitations

In any mapping project of this scale there are always limitations to the mapping process that relate to the inherent variability of natural vegetation and the scale of investigation.

Vegetation communities have been identified by API with ground-checking of a sample of the polygons (Section 2.1). Costs and other practicalities make it impossible to check every patch of vegetation.

Factors limiting confidence are:

- The project was commenced in late 2017 using 2009 airphotos, prior to the availability of the 2018 aerial photography that the final mapping is based on. A considerable area had already been mapped when the new photos became available. Some areas mapped in 2009 had been cleared by 2018, and some areas not vegetated in 2009 now have 9 years regrowth. Some areas of the mapping therefore may show vegetation which no longer exists and there may also be unmapped regrowth vegetation. We have attempted to rectify this where possible.

- Field inspection by traverse was undertaken only occasionally, due to access and resource constraints. Sometimes only the edge of vegetation was visible from a roadside or other vantage point (Section 2.1.2). The edge may not be typical of the whole vegetation polygon. Vegetation condition attributes were not able to be consistently determined due to restricted access and viewpoints at many locations and have been sparsely recorded.

- Access limitations restricted sampling of some vegetation communities. For example, most dry rainforest was viewed only from a distance through binoculars.

- For the photo sets utilized, it was difficult to distinguish some canopy species, especially for the mixed Eucalypt groups. In API, the exotic Large-leaved Privet *Ligustrum lucidum* can sometimes be confused with regrowth rainforest and dense patches of Cockspur *Maclura cochinchinensis* on occasion appeared similar to Camphor Laurel.

- Lantana was difficult to consistently detect using API, except where present as large homogeneous patches. The usefulness of Lantana cover estimates as an indicator of condition (Section 2.2.3) is therefore limited.

- While woody vegetation has been detected readily from API, wetlands such as freshwater meadows, lagoons, swamps and marshes have not been comprehensively recorded. These were sometimes visible from air photos or added during field work. Wetlands may also be more or less visible depending on recent rainfall history.

- Heterogeneous vegetation units were grouped into communities where judged, following consideration of floristic, soil, topographic data and spatial relationships, to be variants of the community. The predominantly early successional and disturbed status of much vegetation contributed to considerable variation within communities.

- Allocation of vegetation types was affected by the ongoing refinement of the NSW Plant Community Types during the project. The release of the draft Revised Plant Community Types in Eastern NSW at the very end of the project allowed reallocation of the assigned units (RCPs) to the new revised PCTs. In the absence of detailed descriptions for the revised PCTs and quantitative site assessments, the allocation of PCTs in this project remains provisional.

3 Results and discussion

3.1 Land use

National Parks, Nature Reserves, State Conservation Areas and State Forests are located in the study area (**Table 6**), but were out of scope of mapping for the current project.

Table 6 Areas of National Parks, Nature Reserves, State Conservation Areas and State Forests

	AREA (Ha)
Bungabbee NR	169.1
Bungabbee SF	1,091.6
Muckleewee Mountain NR	351.7
Nightcap NP	5,526.5
Whian Whian SCA	2,247.4
TOTAL	**9,386.3**

The areal extents of land use categories in each subdivision shown in **Table 7**.

Figures for the areal extents of land use categories in the Green zone are not consistent with the areal figures produced for the 2011 vegetation report. Anomalies in areal extent reported here for the Green Zone are affected by the following factors.

The Green Zone was reported in 2011 as 56,274.8 ha. The description of the area of the Green Zone used for this report (Section 1.2, shapefile GreenZone_NEW) measures 56,255.7 ha., with 37.3 ha. (a private land enclave within Whian Whian SCA) already mapped as part of the Grey Zone ([ZONE] = 2) in 2011.

Some of the polygons mapped in this project extend beyond the Green Zone. These include riparian areas on the western margins of the LGA (could be eliminated by clipping the layer to the LGA boundary) and additional polygons in the Grey Zone along the floodplains north of Leycester Creek and along the ridgeline east of Dunoon Road included here due to being overlooked/omitted during the 2011 project. (These polygons are identified in the data tables using [ZONE] = 2.)

Table 7 Land-use categories in Lismore LGA – area
(incorporating new figures for Green Zone and Totals – in bold)

Land-use categories	Area (ha)			% area		
	Grey Zone	**Blue Zone**	**Green Zone**	**Grey Zone**	**Blue Zone**	**Green Zone**
NPs, NRs , SCA and SF (unmapped)	614.6	0.0	9,386.3	2.9	0.0	16.7
Bushland (non-plantation vegetation)	3,653.2	7,946.9	**21920.8**	17.5	15.4	**39.0**
Plantation	1,601.1	3,115.3	**2582.7**	7.7	6.0	**4.6**
Total bushland	5,254.2	11,062.2	**24503.5**	25.2	21.4	**43.6**
Open water	32.5	363.7	**239.1**	0.2	0.7	**0.4**
Total mapped polygons	5,286.7	11,425.9	**24742.6**	25.3	22.2	**44.0**
Non-bushland matrix	14,972.4	40,156.1	**31532.2**	71.7	77.8	**56.0**
Total for zone	20,873.7	51,582.0	56,274.8	100.0	100.0	100.0

Vegetated lands in the Green Zone occupy 34,122 ha, or just over 60% of the total land area. This compares to 40% for the whole LGA (assuming NPs, NRs, SCA and SFs to be fully vegetated) and an average of 22.5% for the southern Blue and Grey zones.

Open water occupied a total of 239.1 ha of the Green Zone. The area of open water is likely to be underestimated since some of the areas mapped as woody vegetation along creek lines may contain slivers of open water that are not visible where the banks are vegetated on both sides.

About 10% of the mapped vegetation consisted of plantation. Most plantation vegetation consisted of orchards, most commonly noted as Macadamia, though the type of orchard was noted for only a small proportion of polygons. Eucalypt plantations included plantings for

timber production, windbreaks around orchards and some for conservation purposes (e.g. Koala food trees, revegetation projects). Cultural plantings and gardens were included in the mixed/other category. Though many plantings were of exotic or non-locally native species, some vegetation in the mixed/other category included mature trees contributing to habitat values and landscape connectivity. Exotic species with invasive characteristics were also common e.g. Jacaranda *Jacaranda mimosifolia*, Golden Rain Tree *Koelreuteria paniculata*.

Table 8 Plantations

	Area (ha)			
Plantation Type	**Grey Zone**	**Blue Zone**	**Green Zone**	**Total**
Sclerophyll	168.6	389.4	**656.9**	
Slash Pine	7.0	12.0	**61.4**	
Hoop/Bunya Pine	6.1	2.5	**15.2**	
Rainforest	11.1	65.7	**51.8**	
Orchard	1,228.1	2,378.2	**1300.4**	
Mixed/other	180.1	267.6	**496.9**	
Total	**1,601.1**	**3,115.3**	**2582.7**	

3.2 Vegetation mapping

For the purposes of this section, the mapped sections of non-plantation vegetation of the Green Zone are referred to as the vegetation mapping area.

3.2.1 Classification

The vegetation classification used in the mapping of the Blue-Grey Zones in 2011 is no longer consistent with NSW vegetation mapping standards. As noted in Section 2.2.2, BioMetric Vegetation Types were retired from the VIS Classification system on 21 August 2017, and were replaced with Plant Community Types (PCTs).

The following table (**Table 9**) lists the consolidated vegetation types for the mapping area, and the combined area for each community. Some of the vegetation types were initially aligned with the 2018 OEH RCP groups, but various legacy types (generally aligning to redundant PCTs or Biometric types) are conserved from the previous mapping project to assist in characterising vegetation that did not readily match the RCP Groups. Following release of the revised Plant Community Types for Eastern NSW (OEH,2019), the RCP groups were translated into this most-recent classification where appropriate. Descriptions of the vegetation types are provided in **Appendix 1**.

Table 9: Mapped Vegetation Classes and Plant Community Types

KEITH FORM	KEITH CLASS	Vegetation Community (PCT# or reference)	derived from RCP Group	Area (Ha.)
RAINFORESTS				
	Dry Rainforests			
		Far North Arytera distylis Dry Rainforest (3064)	R11.84a	79.645
		Far North Hinterland Brush Box Dry Rainforest (3149)	R11.76	89.366
		Far North Basalt Gully Dry Rainforest (3065)	R11.95	2246.895
		Big Scrub-Tweed Dry Rainforest (3002)	R11.81	2.152
		Dry Rainforest on alluvium (Landmark 2019)		148.082
		Dry Rainforest on rhyolite (Landmark 2019)		51.141
		Dry Rainforest on sandstone (Landmark 2019)		475.222
		Dry Rainforest on Walloon Coal Measures (Landmark 2019)		244.167
	Subtropical Rainforests			
		Northern Lowland Subtropical Rainforest (3021)	R5.97	314.462
		Far North Lowland Subtropical Rainforest (3011)	R5.91	1848.875
		Far North Lowland Black Bean Riverine Rainforest (3007)	R11.9a	102.736
		Riparian rainforest - upper reaches (Landmark 2019)		205.338
		Subtropical Rainforest on Walloon Coal Measures (Landmark 2019)		382.759
		paddock tree/trees (Rainforest, Figs)		33.522
	Rainforests - derived			
		Camphor Laurel (Stewart et al 2011)		1328.803
		Lantana shrubland (Landmark 2019)		115.491
		Privet (Stewart et al 2011)		304.323
WET SCLEROPHYLL FORESTS				
	North Coast Wet Sclerophyll Forests			
		Border Ranges Brushbox-Tallowwood Wet Forest (3139)	R5.13	529.145
		Far North Brush Box-Bloodwood Wet Forest (3147)	R5.61	31.275
		Far North Brush Box-Walnut Wet Forest (3148)	R5.41	284.430
		Northern Brush Box Subtropical Wet Forest (3165)	R5.53	315.734
		Northern Ranges Brush Box-Flooded Gum Wet Forest (3172)	R5.67	3546.981
		Northern Turpentine-Brush Box Wet Forest (4066)	R5.7	0.762
		Mount Billen Scree Wet Forest (3163)	R1.89e	14.332
	Northern Escarpment Wet Sclerophyll Forests			
		Mid North Ranges Blackbutt Forest (3202)	R5.94	478.313
	Northern Hinterland Wet Sclerophyll Forests			
		Northern Blackbutt-Turpentine Dry Shrubby Forest (3248)	R9.121	68.853
		Northern Gorges Diverse Grassy Forest (3251)	R1.33	5093.980
		Northern Hinterland Tallowwood-Forest Oak Grassy Forest (3254)	R9.122	6.982
GRASSY WOODLANDS				
	Coastal Valley Grassy Woodlands			
		Far North Hinterland Red Gum Grassy Forest (3322)	R1.22	2028.586
		Far North Lowland Basalt Grassy Forest (3323)	R1.99b	1135.701
		Forest Oak grassy forest and woodland (Landmark 2019)		8.486

KEITH FORM	KEITH CLASS	Vegetation Community (PCT# or reference)	derived from RCP Group	Area (Ha.)
GRASSLANDS				
		Grasses of the Big Scrub (Stubbs 2001)		5.247
DRY SCLEROPHYLL FORESTS (Shrubby sub-formation)				
	North Coast Dry Sclerophyll Forests			
		Far North Rhyolite Scribbly Gum Woodland (3571)	R8.119	84.256
HEATHLANDS				
	Northern Montane Heaths			
		Tweed Caldera Outcrops Grassy Scrub (3850)	R7.139	10.904
FRESHWATER WETLANDS				
	Coastal Freshwater Lagoons			
		Freshwater Meadows (Stewart et al 2011)		4.112
FORESTED WETLANDS				
	Coastal Floodplain Wetlands			
		Northern Lowland Swamp Turpentine-Red Gum Forest (4046)	R9.79	8.467
		Willow Bottlebrush (Stewart et al 2011)		6.342
	Eastern Riverine Forests			
		Far North River Oak Wet Forest (4070)	R11.85	200.757
Other Mapped Types (Landmark 2019, Stewart et al 2011)				
		Exotic		34.700
		paddock tree/trees		37.514
		Natural Features		
		Rock outcrop		11.426
		open water		239.083
		Planted Vegetation		
		Planted sclerophyll		656.925
		Planted exotic pine		61.434
		Planted hoop pine		15.211
		Planted orchard		1300.450
		Planted rainforest		51.811
		Mixed Planting		496.868

3.2.2 Distribution and abundance

About 29% of the vegetation is classified in the rainforest formation. Much of the rainforest present is disturbed and in early to mid-regrowth stages, but some excellent examples of rainforest remnant lying outside the NP estate are included in the Green Zone. Rainforest is generally in good condition in less accessible areas in the ranges in the north-east of the Green Area adjoining Nightcap National Park. There are also significant patches of remnant rainforest in upper Boundary Creek and in the vicinity of Mt Billen, Nimbin Rocks and around Rocky Creek. These remnants are in old growth condition or in advanced stages of regrowth. Rainforests generally have outstanding biodiversity, biogeographical and evolutionary significance (Adam 1987). Subtropical rainforests in the vegetation mapping area are listed as threatened ecological communities (Section 3.2.4), reflecting both their values for biodiversity and ecosystem services and the threats to those values.

A further 8% of the vegetation is mapped as Rainforest – derived, (Camphor Laurel, Privet and Lantana-dominated). More information about the extent of Camphor infestation in the Camphor Laurel community is contained in details of canopy dominants of component vegetation units (**Appendix 1**) and Camphor cover codes used as a measure of vegetation condition (Section 3.2.3).

About 47% of the mapped vegetation is wet sclerophyll forest, and 15% belongs to grassy woodland and dry sclerophyll sub-formations. Sclerophyll forests are made up largely of species having fire tolerance or those reliant on fire for regeneration, though long intervals between fire can permit fire-intolerant mesic species to develop in lower strata of wet sclerophyll forests. Koalas depend on a sub-set of sclerophyll dominants for food resources.

Forested wetlands and freshwater wetlands occupy just 1% of the mapped non-plantation vegetation in the Green Zone, with open water (dams and creeks) a further 1.1%. Most wetlands in the vegetation mapping area are listed as threatened ecological communities (Section 3.2.4) reflecting their values for biodiversity and ecosystem services and threats to those values. Freshwater meadows, lagoons, swamps and marshes were mapped where possible but mapped areas are likely to represent only a small proportion of the actual extent (Section 2.4). It is likely that some of the wetlands detected and mapped should better be classed as coastal floodplain sedgelands, rushlands and forblands – the distinction would require comprehensive field survey.

Grasslands were not mapped except for the 5.25 ha Durrobbee Grass at Frasers Road. Grasslands comprise most of the unmapped portion of the Green Zone, consisting mainly of exotic pasture species with a variable component of native grasses, sedges, forbs and rushes, but delineation of grassland communities was considered beyond the scope of this project.

Naturalised exotic woody vegetation is widespread, usually as small components of otherwise native vegetation but sometimes dominant in the canopy and therefore detected with the mapping methods employed in the current project. Small areas dominated by exotics, e.g. Lantana were mapped as well as the large areas of Privet *Ligustrum* spp and Camphor-dominated vegetation.

3.2.3 Vegetation condition

Landscape condition (from API)

Some aspects of vegetation structure visible in air photos and correlated with maturity and disturbance were utilised to broadly categorise landscape condition of non-plantation vegetation (**Table 10**). Slightly less than 10% of the vegetation was classed as old-growth/excellent condition, with a further 70% classed as mature.

Table 10 Landscape condition of non-plantation vegetation in the Green Zone (full definitions of codes see **Section 2.2.3).**

Landscape condition (code and short definitions)	Area (ha)	%
1 Old growth/excellent	2157.6	9.8
2 Mature	15241.1	69.5
3 Advanced regrowth	4436.1	20.2
4 Early regrowth	87.7	0.4
Total	21922.5	100.0

Camphor cover (from API with some field checking)

The Camphor Laurel community includes a range of vegetation units (**Appendix 1**). The vegetation unit Camphor Laurel consists of polygons with Camphor cover code of 1 (>50% canopy), while other vegetation units include polygons with mixtures of Camphor cover codes (**Figure 5 Appendix 2**).

Table 11 Camphor cover (code and definitions)

CAMPHOR code	Extent of Canopy comprised of camphor Cover	Area (ha.) in green zone
1	>50%	981.4
2	<50% throughout	1738.2
3	Occasional/patchy/edges	2913.3
4	Not detected	16289.2

Lantana cover (from API)

The level of Lantana infestation in non-plantation vegetation is shown in **Table 12**. Lantana was present in the higher cover classes in only small proportions of the vegetation in the Green Zone. Lantana was difficult to consistently detect using API, except where present as large homogenous patches. It was found to be widespread in disturbed forest margins of rainforest, wet sclerophyll and dry sclerophyll forest, in moist gullies and on roadsides. The usefulness of Lantana cover estimates as an indicator of condition (Section 2.2.3) is therefore limited.

Table 12 Lantana cover

Lantana CODE	Percentage canopy cover	Area (ha)
1	>50%	119.3
2	25 - 50%	262.2
3	5-25%	73.2

Large-leaved Privet

Substantial areas of Forest Red Gum grassy and shrubby forest have been invaded by Large-leaved Privet *Ligustrum lucidum* and most remaining areas are under imminent threat, unless maintained by, e.g. grazing or ecological burns. Regular cool burns would have maintained these grassy and shrubby woodlands and forests prior to grazing being introduced. In unburned, ungrazed areas where privet is either absent or is a relative newcomer, dry rainforest species have colonised the understorey. Again, in absence of fire, these dry sclerophyll communities will convert to dry rainforest. Eucalypt seed cannot germinate under the closed canopy established by Privet.

3.2.4 Koala habitat

Primary and Secondary A habitat makes up about 39% of the total mapped vegetation in the Green Zone (**Table 13**). Secondary food tree species were encountered in the field in association with Primary food tree species but Secondary B habitat was not detected in API, (Table 13). By definition primary food tree species are absent in Secondary B koala habitat. Reliability codes for Koala habitat mapping are presented in **Table 14**.

Table 13 Koala habitat categories (full definitions Section 2.2.4)

Koala habitat (codes and short descriptions)		Area (ha)	% mapped vegetation
1	Primary	5257.3	21.2
2	Secondary A	4387.9	17.7
3	Secondary B	0.0	0

Table 14 Koala habitat reliability (full definitions Section 2.2.4)

Koala habitat reliability (codes and short descriptions)		
K_HAB_REL		Area (ha)
1	Inferred from API, incomplete ground inspection or other sources	23316.6
2	Assigned from comprehensive ground inspection	42.5
3	Koala observation from accumulated records	1383.0

Koala habitat mapping (**Figure 6, Appendix 2**) shows habitat exists across most of the Green Zone predominately on the mildly leached chocolate soils and krasnozems but also on sandstone, Walloon Coal Measures, alluvium and rhyolite. Koala habitat was previously mapped on alluvium on the floodplain and along the Richmond River, extending along the mid and upper reaches of Jiggi, Leycester and Terania Creeks (Stewart *et al* 2011). (Note that small areas of Secondary B habitat, vegetation with very small components of food tree species, some scattered paddock trees and some components of the "Unknown" category are additional to the Koala habitat shown in **Figure 6**.)

The main primary food tree species recorded in the Green Zone were Forest Red Gum *E. tereticornis* and Tallowwood *E. microcorys*. Substantial areas of Forest Red Gum and Tallowwood were mapped in the south west of the Green Zone on basalt derived soils although there are few Koala records in this area, which receives less rainfall than the eastern part of the LGA. On the floodplain, substantial areas of Forest Red Gum were

mapped, often comprising grazed open woodland and isolated trees. The primary food tree Swamp Mahogany *E. robusta* was occasionally recorded (often planted) and Grey Ironbark *E. siderophloia* (secondary and/or supplementary food tree species) was sometimes recorded as a component of Forest Red Gum and Tallowwood forest and woodland.

Tallowwood *E. microcorys* is commonly planted as windbreaks around plantations and these windbreaks were generally mapped as Koala habitat depending on size and context (Section 2.2.4).

3.2.5 Endangered Ecological Communities

Of the seven EECs listed in Table 5, six were recorded during the vegetation mapping process. The EEC Coastal Saltmarsh was not found to be present and possible habitat is very limited in the LGA, with none in the study area.

Coastal Floodplain EECs

Five of the recognised EECs belong to the Coastal Floodplain group. Only about 10% of original vegetation remains on the floodplain and most is considered highly likely to be classed as an EEC (**Table 15 below, Figure 7 Appendix 2**). (Note that Categories 1 and 2 only are mapped in **Figure 7** – other mapped and unmapped vegetation on the floodplain may also be classified as an EEC, but most of the Category 3 vegetation is exotic-dominated. Only the Rainforest floodplain EEC polygons were typed)
The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices. The NSW Scientific Committee determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats and the determinations make clear the intention to include all remaining (native) vegetation on the coastal floodplains as EECs.

Table 15 Floodplain EEC probability

FP_EEC_PRO		Area (ha)
1	Highly Likely	569.3
2	Possible or probable	278.3
3	Unlikely but possible	52.1

In the absence of detailed floodplain mapping for the Green Zone, the Zone_1r_region layer provided by LCC was used as a surrogate to identify floodplain vegetation on the upper floodplains of the major tributaries of Leycester Creek.
Delineating the coastal floodplain EECs using this method relies on the intersection of the 100 year flood level line with the mapped vegetation layer being an approximation of the distribution of vegetation the floodplain.
The 100 year flood level GIS layer is indicative of the habitat of the communities described in the determinations as:

> "periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990)."

The determinations also specify the soil types of the habitats as alluvium. The 100 year flood line encompasses, however, small areas of other soil types besides alluvium. As mapping of alluvium and other soil types with sufficient accuracy to delineate communities on alluvium is not available, verification of Coastal Floodplain EEC status may require on ground checking of soil type among other considerations that also apply to the Lowland Rainforest EEC (below).

Vegetation polygons that intersected with the Zone_1r_region layer were selected and the percentage area of the polygon within the floodplain zone calculated to fill the field [FLOOD]. Only those polygons more than 5% within the floodplain were assigned a floodplain EEC type and probability score.

Table 16 shows division of the floodplain vegetation into specific EECs.

Table 16 Floodplain EEC types
Floodplain EEC types (codes and short descriptions) Area (ha)

FP_EEC_TYP		Area (ha)
0	<5% on Floodplain; open water, plantation	561.1
1	Freshwater wetlands on coastal floodplains	2.4
2	Lowland Rainforest on Floodplain	441.5
3	Sub-tropical Coastal Floodplain Forest	401.9
4	Swamp oak floodplain forest	0
5	Swamp sclerophyll forest on coastal floodplains	0.7
6	Ecotonal types, not discernible due to disturbance and exotic vegetation components and plantations.	1.4

The most abundant is Lowland Rainforest on Floodplain, which has been mapped to include Hoop Pine *Araucaria cunninghamii*-dominated forests and much riparian vegetation. River Oak *Casuarina cunninghamiana*-dominated vegetation, which does not clearly fit community descriptions in any of the determinations, has mostly been classed with Lowland Rainforest. River Oak dominated vegetation usually included rainforest components.

Lowland rainforest EEC

The remaining EEC, Lowland rainforest (**Table 17 below, Figure 8 Appendix 2**), is defined in terms of canopy structure and floristics, while noting modification resulting from disturbance. (Note that Categories 1 and 2 only are mapped in **Figure 8** – other mapped and unmapped vegetation with rainforest components may also be classified as an EEC.) The EEC includes subtropical rainforests on high nutrient substrates and excludes most warm temperate rainforest on acid volcanics and much dry rainforest. The determination notes that scattered eucalypt emergents (e.g. Flooded Gum *Eucalyptus grandis*, Sydney Blue Gum *E. saligna*) may occasionally be present and Brush Box *Lophostemon confertus* is listed as a characteristic species, leaving open the possibility that some wet sclerophyll vegetation types might be considered to be part of the Lowland rainforest EEC.

Table 17 Lowland rainforest EEC probability

RF_PROB		Area (ha)
1	Highly likely (vegetation types that fit well with EEC determination)	2067.8
2	Probable or possible (e.g. exotic vegetation with some components of EEC types, dry rainforest types that are included only where grading into the subtropical types)	1110.4
3	Unlikely (exotic vegetation with small components of EEC types, dry rainforest unlikely to be associated with subtropical types, plantations).	18742.4

As some rainforest polygons located on the edge of the floodplain have been assigned probabilities for two EECs (Section 2.2.4), the total area of possible EECs may be slightly overestimated in the statistics presented.

Verifying EECs

Other issues influencing classification of EECs include:

- Patch size -Minimum patch sizes are not specified in the determinations, hence EECs outside the mapped vegetation (small polygons, sparse vegetation) may be present.
- Depleted and degraded vegetation - EEC descriptions all extend to depleted and degraded examples of the communities. Vegetation that has been modified to the extent that e.g. canopy species characteristic of an EEC are no longer present, may sometimes be considered to constitute examples of EECs.
- Exotic species - In all determinations, the presence of weeds in many occurrences of the EECs is acknowledged. The Scientific Committee determinations do not provide guidance as to levels of weed dominance acceptable, hence much disturbed vegetation with exotic species components must be considered as potentially classed as an EEC.
- Plantations - Determinations do not preclude classification of plantations as EECs.

In conclusion, mapping of EECs is indicative only. Legal definitions of EECs are provided in the Scientific Committee's determinations. It is recommended that determining whether any particular area of vegetation constitutes an EEC requires ground inspection especially in marginal cases.

See Figure 8 Lowland rainforest EEC probability. Appendix 2

3.3 Reliability

A total of 40 person-days were dedicated to ground-truthing. However, due to the exceptionally high number of polygons (~24,600) for the Green Zone this translates to a relatively low percentage of polygons being ground-truthed. Just over 6% of the mapped area was described from on-site traverse or detailed other source such as VIS plots. Another

10% was checked from limited on-site or remote inspection. Since most ground-truthing was confined to public roads and restricted viewpoints, large areas of the shire could not be directly accessed for assessment.

Table 18 Reliabilty

RELIABILIT		Area (ha)	% of mapped
1	On-site traverse and API	433.3	1.8
2	Limited on-site or remote inspection and API	2512.6	10.2
3	Other information source and API	1090.2	4.4
4	API only	20706.0	83.7

See **Figure 9 Appendix 2** Data sources used for determining vegetation characteristics

Recommendations

Future mapping endeavours should be resourced to produce mapping approaching the Native Vegetation Interim Standard (Sivertsen 2009. In particular, plot-based sampling (structure and floristics) should be conducted to provide a sound basis for further developing a system of classification and for assignment of vegetation to recognised communities. Plot data could be used locally to refine the subjective classification developed during the current project, and/or incorporated into databases used for regional Interim Vegetation Classification.

Plots should be placed in undersampled vegetation units - e.g. native vegetation on Walloon Coal Measure and on Sandstone - to better inform the vegetation classification.

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Appendix 1 Vegetation Descriptions

Vegetation communities were originally grouped into units following the OEH draft **Regional Community Profiles (RCP's)**. The RCPs had not been completed but there were draft descriptions for some profiles and these descriptions were used to identify candidate RCPs for the mapped vegetation communities.

Subsequent to the submission of the draft report to Council, new revised OEH PCTs have become available, although the descriptions had not yet been finalised. The names of the revised PCTs have been provided in this Appendix and, where applicable, the new name of the draft PCT.
The RCP descriptions were used to inform the final **OEH Plant Community Types (PCTs)**.

Vegetation formations and classes (Keith 2004) used to group plant community types:

RAINFORESTS
- Dry Rainforests
- Subtropical Rainforests
- Rainforests (derived)

WET SCLEROPHYLL FORESTS
- North Coast Wet Sclerophyll Forests
- Northern Escarpment Wet Sclerophyll Forests
- Northern Hinterland Wet Sclerophyll Forests

DRY SCLEROPHYLL FORESTS
- North Coast Dry Sclerophyll Forests

GRASSY WOODLANDS
- Coastal Valley Grassy Woodlands

GRASSLANDS
- Grasslands

HEATHLANDS
- Northern Montane Heaths

FRESHWATER WETLANDS
- Coastal Freshwater Lagoons

FORESTED WETLANDS
- Coastal Floodplain Wetlands
- Eastern Riverine Forests

MISCELLANEOUS
- Exotic
- Lantana shrubland

The **RCP** Identification code is provided at the end of each profile.
The **PCT** number code or other reference is given in brackets after the PCT Name.

RAINFORESTS

DRY RAINFORESTS

The dry rainforests encompass a broad array of plant assemblages that occur where the average annual rainfall is less than 1100mm, and in some cases as low as 600mm. Typically these rainforest occur in rough terrain on rocky substrates, such as basalt, trachyte, and some granites or metasediments that contain moderate to high levels of soil nutrients. Unlike other rainforests, they usually occur in landscapes dominated by dry sclerophyll forests (Keith 2004).

Dry rainforest in the Green Zone was mapped largely on basalt soils in the south of the Green Zone, particularly around Bentley but was also recorded on other soil types.

Plate 1 Dry rainforest near Bentley, the canopy dominated by Red Kamala.

Red Kamala *Mallotus philippensis*, Green Kamala *Mallotus claoxyloides,* Rough-leaved Elm *Aphananthe philippinensis*, Two-leaved Tuckeroo *Rhysotoechia bifoliolata,* Cockspur Vine *Maclura cochinchinensis* and Macaranga *Macaranga tanarius* are characteristic dry rainforest species. Forest Red Gum *Eucalyptus tereticornis*, Grey Ironbark *E. siderophloia* and/or Hoop Pine *Araucaria cunninghamii* are often present as emergents.

Weed species, particularly Large-leaved Privet *Ligustrum lucidum* and Small-leaved Privet *L. sinense* were common, dominating the dry rainforest in many areas.

Candidate OEH PCTs for Dry Rainforest in the Green Zone are:

Far North Arytera distylis Dry Rainforest
Far North Basalt Gully Dry Rainforest
Far North Floodplain Dry Rainforest
Far North Floodplain Eucalypt Dry Rainforest
Far North Grey Myrtle Riparian Dry Rainforest

Far North Hinterland Kamala-Coogera Dry Rainforest
Far North Native Elm Riparian Dry Rainforest
Lower Richmond Floodplain Waterhousea Forest
Richmond Valley Riparian Waterhousea Forest
Southern Lismore Basalt Dry Rainforest

Draft descriptions were provided by OEH for RCPs in the following communities in 2018 . Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Far North Arytera distylis Dry Rainforest (3064)

Un-named geology but influenced by Walloon Coal Measures
Drainable black clayey alluvials

Plate 2 Far North Arytera distylis Dry Rainforest

At this site (Plate 2) on a steep creek bank on Calico Creek, Red Kamala and Two-leaved Tuckeroo were present in the canopy. The understorey included the vine *Austrosteenisia glabristyla*, Whalebone Tree *Streblus brunonianus*, Cleistanthus and shrub *Atractocarpus chartaceus*. There was a sparse ferny understorey with Rough Maidenhair Fern *Adiantum aethiopicum* and Sickle Fern *Pellaea nana*.

Characteristic species for this PCT include Red Kamala, Green Kamala, Twin-leaf Coogera *Arytera distylis*, Rough-leaved Elm, Two-leaved Tuckeroo and Wait-a-While *Calamus muelleri*.

OEH RCP – reference R11.84a

Far North Hinterland Brush Box Dry Rainforest (3149)

Lismore Basalt
(lithosols, mildly leached chocolate soils.

Plate 3 shows Grey Ironbark emergents in dry rainforest near Larnook with Red Kamala, Mock Olive *Notelaea longifolia* and Black Plum *Diospyros australis* dominating the canopy.

This PCT describes dry rainforest with a Eucalypt overstorey. Eucalypts present may include Tallowwood *Eucalyptus microcorys*, Flooded Gum *E. grandis*, Grey Gum *E. biturbinata* and Grey Ironbark. Brush Box *Lophostemon confertus* may also be present.

The rainforest species found in this PCT include Red Kamala, Guioa *Guioa semiglauca*, Socketwood *Daphnandra* sp., Hoop Pine, Hard Quandong *Elaeocarpus obovatus*, Black Plum and Cockspur *Maclura cochinchinensis*.

OEH RCP – reference R11.76

Far North Basalt Gully Dry Rainforest (3065)

Lismore Basalt

Plate 4 Grey Ironbark and dry rainforest at Bentley

The Lismore basalt dry gully rainforest PCT describes rainforest with Hoop Pine or with a sclerophyll canopy or emergent (Forest Red Gum or Brush Box) on sheltered slopes or in gullies on basalt.

Red Kamala is dominant. No other dry rainforest species are common or dominant in this PCT.

Frequent low-cover species include Cockspur, Scrambling Lily *Geitonoplesium cymosum*, Austral Basket Grass *Oplismenus aemulus*, Foambark *Jagera pseudorhus*, Hairy Bird's Eye *Alectryon tomentosus*, Green Kamala and Rough-leaved Elm. Grey Ironbark, Broad-leaved Apple *Angophora subvelutina*, Red Bloodwood *Corymbia gummifera* and Pink Bloodwood *C. intermedia* have also been recorded in this community.

OEH RCP – reference R11.95

Big Scrub-Tweed Dry Rainforest (3002)

Lismore Basalt

Plate 5 The Big Scrub-Tweed Dry Rainforest PCT on Goolmangar Creek.

The Big Scrub Dry Rainforest PCT is predominately found in the area once covered by the Big Scrub. The Big Scrub comprises a mosaic of rainforest types. The Big Scrub Dry Rainforest PCT includes a drier range of rainforest species than the Tweed Valley Lowland Subtropical Rainforest which also occurs in the Big Scrub area (see Subtropical Rainforests below).

Characteristic species of the Big Scrub-Tweed Dry Rainforest PCT are Guioa, Sweet Pittosporum *Pittosporum undulatum*, Creek Sandpaper Fig *Ficus coronata* and Red Kamala. Socketwood, Cudgerie *Flindersia schottiana*, Red Bean *Dysoxylum mollissimum*, Red Ash *Alphitonia excelsa*, Brown Bolly Gum *Litsea* australis., Bolly Gums *Neolitsea* spp. are often present.

Rasp Fern *Blechnum neohollandicum* and the rainforest sedge *Cyperus tetrapyllus* are frequent in the ground cover.

OEH RCP – reference R11.81

There are a number of dry rainforest types on different (non-basaltic) soil substrates, that have not been surveyed and descriptions are not available.

Dry Rainforest
- on Walloon Coal Measures
- on Sandstone
- on Rhyolite
- on Alluvium

These dry rainforest types are likely to fit into one of the revised OEH plant community types but were unable to be allocated as the descriptions were not available.

SUBTROPICAL RAINFORESTS

"Subtropical Rainforests have a dense multi-layered tree canopy, 20-40m tall, comprising large emergent trees such as figs and cedars, and a sub-canopy of smaller trees including palms. Typically, the canopy includes many species, which have a wide range of leaf sizes, some as big as 30cm in length and including many compound types made up of two or more leaflets. Many of the trees have buttressed trunks. Their branches may be decorated with epiphytic orchids and ferns, or festooned with lianas whose looping stems extend to the highest branches" (Keith 2004).

Subtropical Rainforests, along with their tropical rainforest analogues in north-east Queensland, have the most diverse tree flora of any vegetation type in Australia (Floyd 1990, in Keith 2004).

Major stands occur in far north-eastern New South Wales in the Mt Warning caldera and in remnants of the Big Scrub near Lismore… (Keith 2004).

Subtropical Rainforest occurs mostly in gullies and sheltered slopes in the rugged northern ranges of the Green Zone but also on alluvium in riparian areas. In the ranges subtropical rainforest often grades into Brush Box.

Within the Green zone the rainforest sub-alliances that occur are as follows.

Sub-alliance 1 – *Heritiera trifoliolata.* The upper stratum includes Strangling Fig *Ficus watkinsiana*, Giant Stinging Tree *Dendrocnide excelsa* and Yellow Carabeen *Sloanea woollsii,* White Booyong *Heritiera trifoliolata*, Red Carabeen *Geissois benthamii*, Yellowwood *Flindersia xanthoxyla*, Cudgerie *F. schottiana* and Rose Marara *Pseudoweinmannia lachnocarpa*. Woody vines and epiphytes are common.

Sub-alliance 5 – *Castanospermum australe-Dysoxylum muelleri.* The main emergent in this suballiance is Moreton Bay Fig. The upper stratum may comprise Black Bean, Red Bean *Dysoxylum mollisimum*, Purple Cherry *Syzygium crebrinerve*, White Booyong, Yellowwood, Cudgerie and Red Cedar *Toona ciliata*. Woody vines and epiphytes are common.

Sub-alliance 21 – *Araucaria*. Hoop Pine is typically emergent. The upper stratum includes Croton *Croton verreauxii*, Yellow Tulip *Drypetes australasica*, Python Tree *Austromyrtus bidwillii*, Celerywood *Polyscias elegans*, Ribbonwood *Euroschinus falcata*, Guioa *Guioa semiglauca*, Beetroot *Elattostachys nervosa,* Red Cedar, Black Plum *Diospyros australis* and Myrtle Ebony *D. pentamera*. The shrub layer is composed of small-leaved, prickly species, including Capparis *Capparis arborea* and Orange Thorny Pea *Citriobatus pauciflorus* with Broad-leaved Palm-lily *Cordyline petiolaris* in the moister gullies. The herb layer is very sparse with ferns such as Rasp Fern *Doodia aspera*. Vines are particularly well-developed. (Floyd 1990).

Candidate RCPs for Subtropical Rainforest in the Green Zone are:

- Big Scrub Subtropical Rainforest
- Big Scrub-Tweed Dry Rainforest

Border Ranges Black Booyong Subtropical Rainforest
Far North Bangalow Palm Swamp Forest
Far North Floodplain Subtropical Rainforest
Far North Lowland Bangalow Riverine Rainforest
Far North Lowland Black Bean Riverine Rainforest
Far North Lowland Dry Rainforest
Far North Lowland Palm Gully Rainforest
Far North Lowland Subtropical Rainforest
Far North Waterhousea Riparian Rainforest
Lower Richmond Floodplain Subtropical Rainforest
Lower Tweed Hills Subtropical Dry Rainforest
Upper Tweed Palm Gully Rainforest

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Northern Lowland Subtropical Rainforest (3021)

Nimbin Rhyolite

Plate 6 Lowland Subtropical Rainforest on rhyolitic soils near Wallace Rd, Tuntable.

The canopy and sub canopy are dominated by various combinations of Bangalow Palm, Maiden's Blush *Sloanea australis*, Yellow Carabeen *Sloanea woollsii* and Green-leaved Rose Walnut *Endiandra muelleri*.

Common understorey species include Walking Stick Palm *Linospadix monostachyos*, Pothos, Prickly Supplejack *Ripogonum discolor*, Prickly Tree Fern *Cyathea leichardtii* and Wait-a-While. Ribbonwood, Rose Marara *Caldcluvia paniculata* and Crabapple *Schizomeria ovata* are often present.

The ground layer typically includes Shield Ferns *Lastreopsis* spp.

OEH RCP – reference R5.97

Far North Lowland Subtropical Rainforest (3011)

Lismore Basalt
Red and yellow podzolic soils

Plate 7 Far North Lowland Subtropical Rainforest on basalt soils at Larnook with Hoop Pine emergent, Yellow Carabeen *Sloanea woollsii*, Bangalow Palms and Ribbonwood in the canopy.

There are no clearly dominant canopy species in this PCT, but relatively frequent species include Bangalow Palm, Grey Walnut *Beilschmiedia elliptica*, Pepperberry *Cryptocarya obovata*, Red Bean and White Booyong. Common climbers include Wait-a-While, Pothos, *Arthropteris tenella*, Burny Vine *Trophis scandens* and Native Grape *Cissus antarctica*.

Hoop Pine, Whalebone Tree, Rough-leaved Elm, Brown Tamarind *Castanospora alphandi* and Pencil Cedar *Polyscias murrayi* are present in some sites.

OEH RCP – reference R5.91

Far North Lowland Black Bean Riverine Rainforest (3007)

Alluvium

Plate 8 Forest Red Gum was emergent and Black Bean common at this riparian site on Oaky Creek at Bentley. Giant Water Gum *Syzygium francisii* was also present.

In the Green Zone this PCT occurs on the Lower Richmond floodplain. Black Bean *Castanospermum australe* is typically dominant in the canopy. Three-veined Laurel *Cryptocarya triplinervis* and Giant Water Gum are often present. Forest Red Gum and Hoop Pine are common emergents. Far North Lowland Black Bean Riverine Rainforest PCT is found on warmer, wetter and on higher fertility soils than other riparian rainforest types.

OEH RCP – reference R11.9a

Riparian rainforest – upper reaches (Landmark 2019)

Alluvium

This rainforest community occurs along creek lines in the upper reaches of the Lismore Green zone, e.g. Terania Creek, Bishops Creek, Mulgum Creek.

The canopy was typically dominated by Blue Fig *Elaeocarpus grandis* with Bangalow Palm, Silver Quandong *Elaeocarpus kirtonii*, Red Cedar *Toona australis*, Red Ash, Red Bean, Foambark, Pencil Cedar and Giant Water Gum. Flooded Gum and River Oak are sometimes emergent. The understorey often included Creek Sandpaper Fig and Water Gum *Tristaniopsis laurina*.

This community is likely to fit one of the currently undescribed Subtropical Rainforest PCT's such as Far North Lowland Bangalow Riverine Rainforest.

Subtropical rainforest on Walloon Coal Measures (Landmark 2019)

The canopy typically included Red Ash, Brown Kurrajong, Cheese Tree, Red Kamala, Red Cedar, Silky Oak, Native Tamarind, Cudgerie, Foambark and Guioa.

The community is described by distance assessment only. There is currently no information on understorey or ground cover species.

This community is likely to fit one of the currently undescribed Subtropical Rainforest PCT's listed above.

RAINFORESTS (DERIVED)

Camphor Laurel (Landmark 2019)

Areas dominated by Camphor Laurel *Cinnamomum camphora*.

The Camphor Laurel community often occurred as pure, even-aged stands with or without rainforest species in the understorey. Camphor Laurel has invaded eucalypt forest on high fertility soils (particularly volcanic soils) and, in the absence of fire, often forms a dense mid stratum below Forest Red Gum or other forest types. Camphor Laurel was recorded as co-dominant with Privet, River Oak, Rainforest and Swamp Sclerophyll forest. Rainforest species often dominate the mid stratum of Camphor Laurel forest to the exclusion of Camphor.

Camphor Laurel was particularly common in the eastern half of the Green Zone, with only scattered patches in the drier western section of the Green Zone.

Privet (Landmark 2019)

A low to tall closed to open forest. The canopy was dominated by Large-leaved Privet *Ligustrum lucidum*. Large-leaved Privet is colonising areas that would once have supported dry rainforest and rainforest regrowth species (Macaranga, Red kamala, Cockspur Vine) were common associates. This is particularly noticeable around Goolmangar, Koonorigan and Blakebrook. In the absence of fire Large-leaved Privet is also colonising Coastal Valley Dry Grassy Woodlands.

Large-leaved Privet was common as an understorey component of rainforest regrowth and wet sclerophyll forest.

WET SCLEROPHYLL FORESTS (shrubby sub-formation)

NORTH COAST WET SCLEROPHYLL FORESTS

Wet Sclerophyll Forests grow where the rainfall exceeds 1000 mm per annum, on the relatively fertile rocky substrates of the coastal ranges and foothills or on alluvium in sheltered creek flats (Keith 2004).

Wet Sclerophyll Forests in the Green Zone are influenced by geology, aspect and moisture availability. They are dominated by eucalypt species and, in sheltered sites and in absence of high frequency fire, Brush Box.

Brush Box forests may include eucalypt species, particularly Tallowwood and Flooded Gum as emergents but not as dominants.

In drier areas the understorey may be sparse with a dense ground layer of ferns and/or grasses. In moister sites Brush Box develops a well-established rainforest understorey.

With higher frequency fire eucalypts dominate the canopy although Brush Box may still be present and the understorey is often dominated by rainforest species.

Flooded Gum, Blue Gum and Tallowwood form associations in moister locations. Flooded Gum is typically found on lower slopes and Blue Gum on mid to upper slopes. Pink Bloodwood and Red Mahogany may also be present. The understorey characteristically includes Scentless Rosewood, Forest Maple with Gristle Fern and Rasp Fern as common ground species.

Candidate PCTs for North Coast Wet Sclerophyll Forests in the Green Zone are:

Border Ranges Brushbox-Tallowwood Wet Forest, RCP5.13
Far North Brush Box-Bloodwood Wet Forest
Far North Brush Box-Walnut Wet Forest RCP 5.41
Far North Hinterland Brush Box Dry Rainforest
Mount Billen Scree Wet Forest
Northern Brush Box Subtropical Wet Forest, 5.53
Northern Hinterland White Mahogany Moist Grassy Forest, 9.33
Northern Ranges Brush Box-Flooded Gum Wet Forest, 5.67
Northern Turpentine-Brush Box Wet Forest, 5.7
Tweed Valley Lowland Wet Forest

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Border Ranges Brushbox-Tallowwood Wet Forest (3139)

Lismore Basalt, Kangaroo Creek sandstone
(krasnozems, mildly leached chocolate soils, lithosols (edge), red and yellow podzolic soils

Plate 9 Grey Gum, Pink Bloodwood and White Mahogany tall forest and woodland on basalt soils near Nimbin

This PCT describes a wet sclerophyll forest of Tallowwood and Pink Bloodwood, often with Forest Oak *Allocasuarina torulosa* or with scattered Silver Basswood *Polyscias elegans*, Ribbonwood and Guioa.

There is an understorey of Native Grape, Sarsparilla *Smilax australis* and Native Ginger *Alpinia caerulea*.

Hoop Pine, Brush Box, White Mahogany, Flooded Gum, Grey Ironbark and Red Mahogany *Eucalyptus resinifera* may also be present.

The understorey of the Grey Gum-Pink Bloodwood-White Mahogany community shown in Plate 9 included Pink Bloodwood, Muttonwood *Myrsine variabilis* and the weed species Camphor Laurel.

Native Ginger, Blady Grass *Imperata cylindrica* and Kangaroo Grass dominated the ground cover.

OEH RCP – reference R5.13

Far North Brush Box-Bloodwood Wet Forest (3147)

Sandstones, lithosols,+ metasediments

The Far North Brush Box-Bloodwood Wet Forest PCT is mainly dominated by Brush Box, usually with Pink Bloodwood or Blackbutt.

There is often an understorey of Scentless Rosewood, Guioa or Sweet Pittosporum and a ground cover of Rainbow Fern *Calochlaena dubia* and Gristle Fern *Blechnum cartilagineum*. Native grasses are often present.

Broad-leaved White Mahogany and Forest Oak have also been recorded in this community.

OEH RCP – reference R5.61

Far North Brush Box-Walnut Wet Forest (3148)

Walloon Coal Measures, Neranleigh Fernvale, Chillingham Volcanics, Lismore Basalt

Plate 10 Far North Brushbox-Walnut Wet forest at Mountain Top Rd on basalt soils

Brush Box and Rainforest species were present in the canopy at this site. Rainforest species included Yellow Carabeen, Bangalow Palms, Hairy Walnut *Endiandra pubens* and Native Grape *Cissus hypoglauca*. The ground layer was dominated by ferns including Shield Fern *Lastreopsis microsora*, Rasp Fern and Gristle Fern.

Far North Brushbox-Walnut Wet forest is usually dominated by Brush Box, rarely with Tallowwood or Flooded Gum in the canopy.

The understorey usually has a high frequency of common and widespread small trees/shrubs like Veiny Wilkiea *Wilkiea huegeliana*, Guioa, Scentless Rosewood *Synoum glandulosum* and Rose Myrtle *Archirhodomyrtus beckleri* with Gristle Fern as a common ground cover. Blue Gum has also been recorded in local plots in the Green Zone.

Other species recorded in this community in the Green Zone include Crabapple, Murrogun *Cryptocarya glaucescens*, Ribbonwood and Bolwarra *Eupomatia laurina*.

OEH RCP – reference R5.41

Mt Billen Scree Wet Forest (3163)

Rhyolite
(lithosols).

Plate 11 The Mt Billen Scree Wet Forest at Mountain Top Road.

The Mt Billen Scree Wet Forest PCT has a canopy dominated by Grey Ironbark, Broad-leaved White Mahogany, Turpentine and Pink Bloodwood.
The understorey is open and the ground layer is dominated by grasses. At this location near Mountain Top Road in the Green Zone the mid stratum included a grass tree *Xanthorrhoea*

malacophylla and Tree Heath *Daviesia arborea*. The ground layer was dominated by Kangaroo Grass and mat-rushes *Lomandra* spp.

OEH RCP – reference R1.89e (Placeholder)

Northern Brush Box Subtropical Wet Forest (3165)

Lismore Basalt, Rhyolite, Walloon Coal Measures

Plate 12 Northern Brush Box Subtropical Wet Forest near Larnook.

Tallowwood and Brush Box were present in the canopy at the site shown in Plate 12. There was a well-developed rainforest understorey with Scrub Turpentine and Black Plum. Gristle Fern and Rasp Fern dominated the ground layer.

The Northern Brush Box Subtropical Wet Forest PCT has a higher component of Brush Box and rainforest species in the canopy than the Northeast Brush Box wet sclerophyll PCT.

Frequent canopy trees are Bangalow Palm, Green-leaved Rose Walnut, Scentless Rosewood, Brush Box, Murrogun, Crabapple and lianes, particularly Native Grapes.

Common understorey species are Gristle Fern, Prickly Supplejack and Veiny Wilkea. Callicoma and Brown Bolly Gum *Litsea australis* have also been recorded in local plots.

Flooded Gum, Blue Gum and Tallowwood often occur in the canopy but are not dominant. The community is found in sheltered sites, often on lower slopes or riparian and usually at low to mid elevations.

OEH RCP – reference R5.53

Northern Hinterland White Mahogany Moist Grassy Forest (3170)

Nimbin Rhyolite
(red and yellow podzolic soils)

Northern Hinterland White Mahogany moist grassy forest is a tall forest variably dominated by one or more of White Mahogany, Blue Gum and/or Tallowwood.

The understorey is a mixture of small trees, vines, ferns, grasses and forbs. Common species include Blady Grass, Green Wattle *Acacia irrorata*, Spiny-headed Mat-rush, Sickle Fern *Pellaea falcata* and Breynia *Breynia oblongifolia*.

The PCT is of widespread but scattered occurrence on the foothills and lower escarpment from Barrington Tops to the western Macpherson Range.

This PCT was not included in the mapping of the Green Zone but some vegetation communities may fit this description.

OEH RCP – reference R9.33

Northern Ranges Brush Box-Flooded Gum Wet Forest (3172)

Lismore Basalt, Nimbin Rhyolite
(krasnozems, mildly leached chocolate soils, lithosols

The Northern Ranges Brush Box-Flooded Gum Wet Forest PCT is dominated by Brush Box or Flooded Gum with a mesic sub canopy of Native Grape, Scentless Rosewood, Guioa, Murrogun and ground layer of ferns such as Rasp Fern and Gristle Fern.

Local sites in the Green Zone also included Tallowwood, Blue Gum and Grey Ironbark.

Plate 13 Northern Ranges Brush Box-Flooded Gum Wet Forest at Mountain Top

The understorey at the location shown in Plate 13 included Forest Oak, Forest Maple and Tree Heath *Trochocarpa laurina*. Turpentine *Syncarpia glomulifera* and White Mahogany *E. acmenoides* were also present. The ground layer included Gristle Fern, and native grasses Austral Basket Grass and *Panicum lachnophyllum*. Lantana was common throughout the understorey.

OEH RCP – reference R5.67

Northern Turpentine-Brush Box Wet Forest (4066)

Walloon Coal Measures, Lismore Basalt, Nimbin Rhyolite

The Northern Turpentine-Brush Box Wet Forest includes a range of canopy species but is mainly dominated by combinations of Turpentine, Brush Box, Tallowwood and Flooded Gum and less commonly by Blackbutt and White Mahogany *E. acmenoides*.

The understorey comprises a mesic tall shrub to small tree understorey of Forest Maple *Cryptocarya rigida*, Scentless Rosewood, Forest Oak and vines such as Native Yam *Dioscorea transversa* and Morinda *Morinda jasminoides*. The ground cover included Gristle Fern.

A local plot in the Green Zone included Pink Bloodwood, Crabapple and Bolwarra.

OEH RCP – reference R5.7

NORTHERN ESCARPMENT WET SCLEROPHYLL FORESTS

The coastal escarpment of northern New South Wales rises 600-1400m above sea level, and draws moisture-laden air streams from the Pacific Ocean (Keith 2004). The coastal escarpment supports very tall wet sclerophyll forests comprising New England Blackbutt *Eucalyptus campanulata,* Tallowwood and Blue Gum.

Towards the foot of the escarpment, the Northern Escarpment Wet Sclerophyll Forests gradually give way to North Coast Wet Sclerophyll Forests.

Candidate PCTs for Northern Escarpment Wet Sclerophyll Forests in the Green Zone are:

- Far North Peaks Scrub Woodland
- Lower North Escarpment Rocky Shrub Woodland
- Far North New England Blackbutt Wet Forest
- Mid North Escarpment Blue Gum Moist Forest
- Mid North Ranges Blackbutt Forest
- Northern Escarpment Blackbutt Wet Forest
- Northern Escarpment Blackbutt-Maple Wet Forest
- Northern Escarpment Blackbutt-Tallowwood Wet Forest
- Northern Escarpment Corkwood-Brush Box Wet Forest
- Northern Escarpment Layered Blackbutt-Fern Forest
- Northern Escarpment Rocky Blackbutt Scrub Woodland

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Mid North Ranges Blackbutt Forest (3202)

Rhyolite Nightcap NP

The Mid North Ranges Blackbutt Forest PCT is a wet sclerophyll forest dominated by combinations of Blackbutt, Scentless Rosewood, New England Blackbutt *E. campanulata* and Tallowwood.

The understorey typically includes Forest Oak, Blueberry Ash *Elaeocaropus reticulatus*, Tree Heath, Tree Daviesia and Forest Maple. Ground cover species include Spiny-headed Mat-rush *Lomandra longifolia*, Bracken Fern *Pteridium esculentum* and False Bracken *Calochlaena dubia*.

Plate 14 Blackbutt wet sclerophyll forest on rhyolite with Tallowwood and Pink Bloodwood.

Plate 15 Old growth Blackbutt forest on rhyolite.

Blackbutt wet sclerophyll forest occurs on rhyolite soils, particularly in the north-east of the Green Zone on the ridges above Tuntable and Terania Creeks. The canopy is dominated by combinations of Blackbutt, New England Blackbutt and Tallowwood.

Additional species associated with Blackbutt areas in the Green Zone include Turpentine *Syncarpia glomulifera*, Callicoma, Coachwood *Ceratapetalum apetalum*, Satinwood *Nematolepis squamea*, and sedges - *Exocarya sclerodes* and *Schoenus melanocarpoa*.

OEH RCP – reference R5.94

NORTHERN HINTERLAND WET SCLEROPHYLL FORESTS

"The Northern Hinterland Wet Sclerophyll Forests cover extensive areas of the low ranges, foothills and plateaux below 600m throughout the coastal hinterland of northern NSW (Keith 2004). The soils are moderately fertile loams derived mostly from siltstones and mudstones. Although the annual rainfall in these areas is more than 1000 mm, the slopes and ridges are too dry to support wet sclerophyll forests with fully developed mesophyllous shrub understories. Instead, they support Northern Hinterland Wet Sclerophyll Forests, which have a prominent grassy ground cover below an open layer of both mesophyllous and sclerophyllous shrubs.

They can be distinguished from the North Coast Wet Sclerophyll Forests by the presence of ironbarks and grey gums, the scarcity of blue gums and the presence of occasional sclerophyllous shrubs and a well-developed grassy layer" (Keith 2004). Keith (2004) also lists Blackbutt *Eucalytus pilularis* as an indicator species.

Other characteristic species of the Northern Hinterland Wet Sclerophyll Forest community are Grey Gum, Grey Ironbark, Tallowwood and Turpentine.

Candidate RCPs for Northern Hinterland Wet Sclerophyll Forests in the Green Zone are:

Far North Coastal Hills Blackbutt-Ironbark Forest
Far North Hinterland Grey Gum Grassy Forest
Lower North Escarpment Red Gum Grassy Forest
Lower North Ranges Turpentine Moist Forest
Lower North Sheltered Valley Red Gum Forest
Mount Jerusalem Rhyolite Wet Grassy Forest
Northern Blackbutt-Turpentine Dry Shrubby Forest, 9.121
Northern Bloodwood-Ironbark Moist Grassy Forest
Northern Foothills Blackbutt Grassy Forest
Northern Gorges Diverse Grassy Forest, 1.33
Northern Hinterland Grey Gum-Mahogany Grassy Forest, 9.115
Northern Hinterland Grey Gum-Turpentine Mesic Forest
Northern Hinterland Tallowwood-Forest Oak Grassy Forest, 9.122

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Northern Blackbutt-Turpentine Dry Shrubby Forest (3248)

Lismore basalt, metasediments, sandstone, high quartz shale

This PCT describes a forest of Blackbutt, Turpentine, Tallowwood and Pink Bloodwood, sometimes with other eucalypts.

Hardy mesic shrubs and ferns such as Lomatia *Lomatia silaiifolia*, Bracken Fern and Rainbow Fern are usually present. Grasses include Blady Grass and Wire Grass *Entolasia* spp.

A local plot in the Green Zone included Forest Oak, Turpentine, Broad Leaved White Mahogany, Pink Bloodwood and Red Ash.

OEH RCP – reference R9.121

Northern Gorges Diverse Grassy Forest (3251)

Nimbin Rhyolite, Walloon Coal Measures, Lismore Basalt

Plate 16 The PCT at Whitney Rd, Stony Chute

The Northern Gorges Diverse Grassy Forest has a canopy of Grey Ironbark, Broad-leaved White Mahogany and Grey Gums with an occasional Tallowwood and/or Forest Red Gum. Most sites have a Forest Oak subcanopy and Kangaroo Grass ground cover, with Blady Grass and forbs - *Desmodiium rhytidophyllum, D. varians, D. brachypodon* all frequently occurring.

Spotted Gum *Corymbia maculata* is present in this PCT further south in its range but Spotted Gum was not recorded as naturally occurring in the Green Zone.

OEH RCP – reference R1.33

Northern Hinterland Grey Gum-Mahogany Grassy Forest (3252)

Lismore basalt

This PCT is a widespread north coast lowland grassy forest of Grey Gum, White Mahogany and Grey Ironbark on ridges and upper slopes of foothills and undulating hills fringing coastal valleys.

Tallowwood and Turpentine are sometimes present in the canopy.

Forest Oak typically dominates the understorey and the ground cover is usually dominated by Kangaroo Grass and Blady Grass, and less often by Spiny-headed Mat-rush and Wire Grass.

Local plots in the Bungabee SF included Broad-leaved White Mahogany, Tallowwood, Pink Bloodwood, Forest Oak and Grey Ironbark as mixed dominants. This community type could not be reliably distinguished from the Northern Gorges Diverse Grassy Forest and is not represented in the mapping, but is likely to be fairly widespread.

Spotted Gum occurs in this PCT but is not known as naturally occurring in the Green Zone.

OEH RCP – reference R9.115

Northern Hinterland Tallowwood-Forest Oak Grassy Forest (3254)

Basalt

The Northern Hinterland Tallowwood-Forest Oak Grassy Forest describes a forest dominated by Tallowwood, Brush Box, white mahoganies and Blue Gum with a sub-canopy of Forest Oak and ground layer of Blady Grass, *Rubus parvifolius, Desmodium varians* and *D. gunnii* with Snow Grass *Poa sieberiana.*

The PCT occurs along the escarpment and nearby ranges north from Barrington Tops with concentration north of Dorrigo. It is found mostly in relatively high rainfall areas for grassy forest but usually frequently burnt.

A local plot in the Green Zone included Forest Oak, Tallowwood, Brush Box, Blady Grass and the Tussock *Poa labillardiera.*

OEH RCP – reference R9.122

DRY SCLEROPHYLL FORESTS (shrubby sub-formation)

The trees in most of the classes of dry sclerophyll forests are invariably eucalypts, and the dry sclerophyll forests have a much greater diversity of eucalypt species than any other formation. They vary in stature from about 10-30m tall, and their foliage cover is generally 20-50 per cent, but they are usually shorter than trees in wet sclerophyll forests and woodlands (Keith 2004).

NORTH COAST DRY SCLEROPHYLL FORESTS

Dry eucalypt forests with fully developed sclerophyllous shrub understories are confined to a relatively small fraction of the landscape in north-eastern New South Wales: areas with impoverished soils. Quartz-rich sandstones of the coastal hills and plateaux support these forests (Keith 2004). They also occur in the Green Zone on rhyolite.

Candidate RCPs for North Coast Dry Sclerophyll Forests in the Green Zone are:

Far North Rhyolite Scribbly Gum Woodland, 8.119
Koonyum Range Rhyolite Outcrop Shrubby Woodland, 10.37

Far North Rhyolite Scribbly Gum Woodland (3571)

Plate 17 Scribbly Gum dry sclerophyll woodland on Nimbin rhyolite at Nimbin Rocks

The understorey of the Scribbly Gum community shown in Plate 17 included a grass tree *Xanthorrhoea johnsonii,* Tree Daviesia and Black She-oak.

OEH RCP – reference R8.119

GRASSY WOODLANDS

COASTAL VALLEY GRASSY WOODLANDS

Coastal Valley Grassy Woodlands comprise a suite of highly diverse plant assemblages isolated in different dry coastal valleys that occupy rain shadows among the surrounding hills (Keith 2004).

Forest Red Gum is a described as a signature species of the Coastal Valley Grassy Woodlands (Keith 2004). This community is widespread in the central and southern parts of the Green Zone. In the absence of grazing and/or fire it may develop a dry rainforest understorey.

Candidate RCPs for Coastal Valley Grassy Woodlands are:

Far North Hinterland Red Gum Grassy Forest 1.22
Far North Lowland Basalt Grassy Forest 1.99b

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Far North Hinterland Red Gum Grassy Forest (3322)

Lismore Basalt

Plate 18 Forest Red Gum grassy woodland along Lindsay Rd, Larnook.

The Far North Hinterland Red Gum Grassy Forest is usually dominated by Forest Red Gum.

Forest Oak is common in the understorey and this PCT appears to be more shrubby than the Far North Lowland Basalt Grassy Forest PCT (described below). The ground cover is comprised mainly of Blady Grass and Kangaroo Grass.

Local plots in the Green Zone included White Mahogany, Broad-leaved Apple, Pink Bloodwood, Forest Oak, Tallowwood and Large-fruited Grey Gum *Eucalyptus biturbinata*.

Border Ranges Red Gum moist grassy forest is found in the ranges of the upper Richmond with scattered occurrences south to the ranges near Nymboida.

OEH RCP – reference R1.22

Far North Lowland Basalt Grassy Forest (3323)

Lismore Basalt, sandstone
(mildly leached chocolate soils,

The Far North Lowland Basalt Grassy Forest PCT is dominated by Forest Red Gum, Pink Bloodwood, Broad-leaved Apple and occurs on Lismore and Kyogle basalt soils. The understorey is open and shrubs are sparse in contrast to the Border Ranges Red Gum moist grassy forest.

Common and frequent ground cover species include Blady Grass, Austral Basket Grass, Kangaroo Grass, *Desmodium varians*, *Desmodiium rhytidophyllum*, *Glycine tabacina*.

Local plots in the Green Zone included Narrow-leaved Ironbark, Brush Box, Willow Bottlebrush and Grey Box.

Plate 19 The Far North Lowland Basalt Grassy Forest at Larnook. Forest Red Gum dominated the canopy. Grey Ironbark was also present. The ground comprised a diversity of native grasses.

Plate 20 The Far North Lowland Basalt Grassy Forest PCT at Bentley. Forest Red Gum-Broad-leaved Apple grassy woodland on a hill slope on basalt soils. Grey Ironbark was also present. The ground was dominated by native grasses including Blady Grass.

OEH RCP – reference R1.99b

Forest Oak grassy forest and woodland (Landmark 2019)

Mainly on basalt, but also recorded on sandstone, alluvium, rhyolite and wallum coal measures

This is a mid-high to tall open forest and woodland dominated by Forest Oak with a grassy understorey.

It is a regrowth community not clearly associated with any of the draft PCTs.

GRASSLANDS

Mapping grasslands generally was outside the scope of this project, but, consistent with Stewart *et al* 2011, we have mapped the location of “Grasses” i.e. small patches of grassland and grassy open-forest in and around the Big Scrub, (Stubbs 2001).) Dorrobbee Grass, at Frasers Road north of Dunoon, is the only distinctive native grassland identified in the Green Zone. It has been managed by a local Trust and the Ngulingah LALC with firestick practices and associated bushland regeneration and restoration programs since 2004.

Kangaroo Grass and Blady Grass are the dominant native grasses, along with Tussock Grass *Poa* spp., Barbed Wire Grass *Cymbopogon refractus* and Austral Basket Grass. Bracken Fern is co-dominant over significant areas. The herb layer commonly includes Whiteroot *Lobelia purpurascens*, Kidney Weed *Dichondra repens* and Native Violet *Viola betonicifolia*. Exotic grasses, forbs and shrubs are common.

Plate 21 Inspection of post-burn regrowth in Themeda grassland at Durrobbee Grass Reserve, October 2019.

HEATHLANDS

Heathlands cover only a small portion of the Australian continent. "….their poor soils have resulted in the evolution of a remarkably diverse native flora, and a curious and complex dependency on fire" (Keith 2004).

Virtually all the common species belong to southern hemisphere families and orders (Myrtaceae, Proteaceae, Restionaceae, Xanthorrhoeaceae, reflecting their Gondwanan evolutionary heritage (Keith 2004).

NORTHERN MONTANE HEATHS

Northern Montane Heaths are elevated rocky outcrops 400-1500m above sea level. Skeletal sandy soils in depressions and crevices support the open Northern Montane Heaths, which may have a layer of emergent mallee eucalypts up to 5m tall and an open ground cover of sclerophyllous sedges and herbs (Keith 2004).

Candidate RCPs for Northern Montane Heaths in the Green Zone are:

Far North Basalt Scarp Tea-tree Scrub
Koonyum-Nightcap Tea-tree Rocky Scrub
Tweed Caldera Outcrops Grassy Scrub, 7.139

A draft description existed for the Tweed Caldera Outcrops Grassy Scrub during the mapped period and areas considered likely to fit with that PCT were mapped. However, these mapped polygons may, on closer inspection, be more consistent with one of the other PCTs listed for Northern Montane Heaths.

Tweed Caldera Outcrops Grassy Scrub (3850)
Nimbin Rhyolite, Lismore Basalt (close to rhyolite)
(lithosols, red and yellow podzolic soils

The Tweed Caldera Outcrops Grassy Scrub describes woodland fringing rock outcrops usually dominated by Black Sheoak *Allocasuarina littoralis*. and Broadleaved White Mahogany is often present. Common shrub species include *Leptospermum microcarpum*, *Xanthorrhoea latifolia* and *Platysace lanceolata*. The ground layer is dominated by grasses and herbs including Kangaroo Grass, Wire Grass *Entolasia stricta*, Rock Orchid *Dendrobium kingianum*, Blue Flax Lily, Spiny-headed Mat-rush, Small-flowered Finger Grass *Digitaria parviflora*, Smelly Plectranthus *Plectranthus graveolens* and Red Natal Grass *Melinus repens*.

OEH RCP – reference R7.139

FRESHWATER WETLANDS

Wetlands are areas of land where the ecological processes are affected by permanent or temporary inundation either by standing or running water (Boulton & Brock 1999, in Keith 2004).
They are extremely important in the processes and function of entire landscapes. They affect water flow and water quality of whole catchments, are key habitat for a diverse range of aquatic invertebrates, birds and other animals (including migratory species) and are vital refuges during drought (Keith 2004).

COASTAL FRESHWATER LAGOONS

Depressions in coastal floodplains and sand plains that are mostly less than 10m above sea level fill periodically or permanently with standing water. These lagoons contain dynamic mosaics of sedgelands, aquatic herbfields and open water that vary with the rise and fall of the water table (Keith 2004).

Only a small number of coastal freshwater lagoons were mapped in the Green Zone as their inclusion was not part of the original brief. Time and financial constraints prevented a more comprehensive survey.

Freshwater Meadows (Landmark 2019)
Floodplain alluvium

Freshwater Meadows occurred on alluvium on the floodplain and comprised a diversity of communities variously dominated by sedges, grasses, rushes and herbs including Tall Saw Sedge, Swamp Foxtail Grass *Pennisetum alopecuroides*, Water Couch, Smartweed, Frogmouth *Philydrum lanuginosum*, Common Reed and Broad-leaf Cumbungi *Typha orientalis*.

FORESTED WETLANDS

The forested wetlands formation incudes the four classes of freshwater wetlands – Coastal Swamp Forests, Coastal Floodplain Wetlands, Eastern Riverine Forests and Inland Riverine Forests. Inland Riverine Forests do not occur to the east of the Dividing Range. The classes are restricted to riverine corridors and to floodplains subject to periodic inundation. They have fertile soils and are generally restricted to low altitudes. The soils vary from peaty and semi-humic loams to alluvial mineral clays and sandy loams, depending on the frequency and duration of inundation, the source of the sediments, and whether they are periodically redistributed by river action (Keith 2004). The Coastal Swamp Forest class was not recorded in the Green Zone although it is possible there are some small areas that may fit the Coastal Swamp Forest description.

COASTAL FLOODPLAIN WETLANDS

In NSW the major rivers to the east of the Great Divide dump their sediment loads on expansive coastal plains. These periodically inundated floodplains were so ideally suited for agricultural development, that they were extensively drained and cleared right from the early days of European settlement. Only degraded fragments and patches of regrowth are left (Keith 2004).

Coastal Floodplain Wetlands in the Green Zone include Swamp Turpentine *Lophostemon suaveolens* and/or Forest Red Gum woodland to open woodland. The community is found on the floodplain in the Green Zone particularly around Bentley.

The most likely candidate RCP for Coastal Floodplain Wetlands in the Green Zone is:

Northern Lowland Swamp Turpentine-Red Gum Forest

Draft descriptions were provided by OEH for the following RCPs in 2018. Vegetation communities considered likely to fit with that RCP were mapped as such. The associated revised PCT name has been used in the following descriptions.

Northern Lowland Swamp Turpentine-Red Gum Forest (4046)
Floodplain alluvium, sedimentary quartz

Plate 21 Forest Red Gum grazed open woodland near Bentley. Swamp Turpentine was also present.

The PCT describes a forest or woodland of Swamp Box *Lophostemon suaveolens* or Forest Red Gum on coastal alluvium. Pink Bloodwood and/or Grey Ironbark are sometimes present.

There is typically an understorey of Red Ash and sometimes mesic small trees like Cheese Tree or lianes such as Common Silkpod *Parsonsia straminea*. The ground cover is usually grassy.

Narrow-leaved Red Gum *Eucalyptus seeana* and Willow Bottlebrush *Callistemon salignus* have also been recorded in local plots of this PCT.

OEH RCP – reference R9.79

Willow Bottlebrush (Landmark 2019)

Basalt, Quaternary Alluvials, Walloon Coal Measures, sandstone

Communities dominated by Willow Bottlebrush were recorded on a variety of substrates particularly on basalt soils and, if not on alluvium, usually on lower slopes or near riparian areas. Associated species included Brush Box, Forest Red Gum, Broad-leaved Apple, River Oak and Grey Ironbark.

The Willow Bottlebrush community is likely to fit into one of the currently undescribed OEH Plant Community Types listed for Freshwater Wetlands although some may more accurately be fitted into dry sclerophyll types.

EASTERN RIVERINE FORESTS

A single species (River Oak *Casuarina cunninghamiana*) dominates the Eastern Riverine Forests throughout their entire distribution (Keith 2004).

The candidate RCP for Eastern Riverine Forest is:

Far North River Oak Wet Forest, R9.60a

Far North River Oak Wet Forest (4070)
Alluvial floodplain

In the Green Zone Forest Red Gum and River Oak fringe creek lines such as Leycester and Webster Creek along the floodplain. Hoop Pines are sometimes emergent and the understorey may include a high proportion of rainforest species including Pepperberry, Giant Water Gum, Native Elm and Whalebone Tree. This vegetation class often merges into the subtropical rainforest vegetation class.

Plate 22 River Oak and Forest Red Gum with a well-established rainforest understorey On Websters Creek in the north-west of the Green Zone.

OEH RCP – reference R11.85

MISCELLANEOUS

EXOTIC

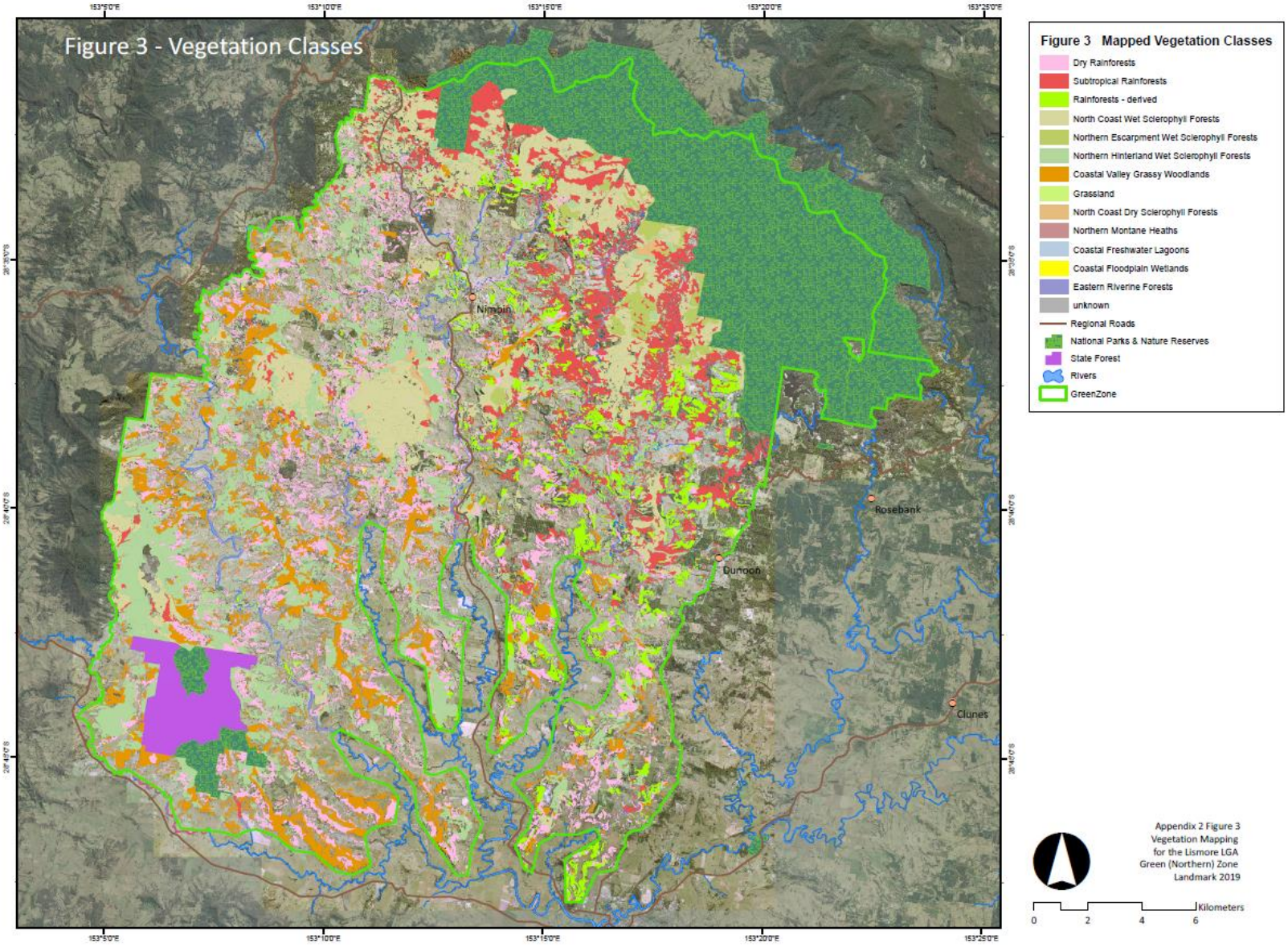
Lantana shrubland

Low to midhigh shrubland to open shrubland dominated by Lantana. Recorded throughout the study area mainly as an understorey to other vegetation but also mapped where Lantana formed large areas of shrubland (300m^2 to 5 ha but generally around 1000m^2). Often developed as mono-specific stands and/or associated with sparse Wattle and rainforest regrowth.

Exotic

This community describes exotic vegetation dominated by species other than Camphor Laurel or Privet. It includes Slash Pine *Pinus eliottii* regrowth, Barner Grass *Pennisetum purpureum* and Indian Coral Tree *Erythrina crista galli*.

Appendix 2. Maps



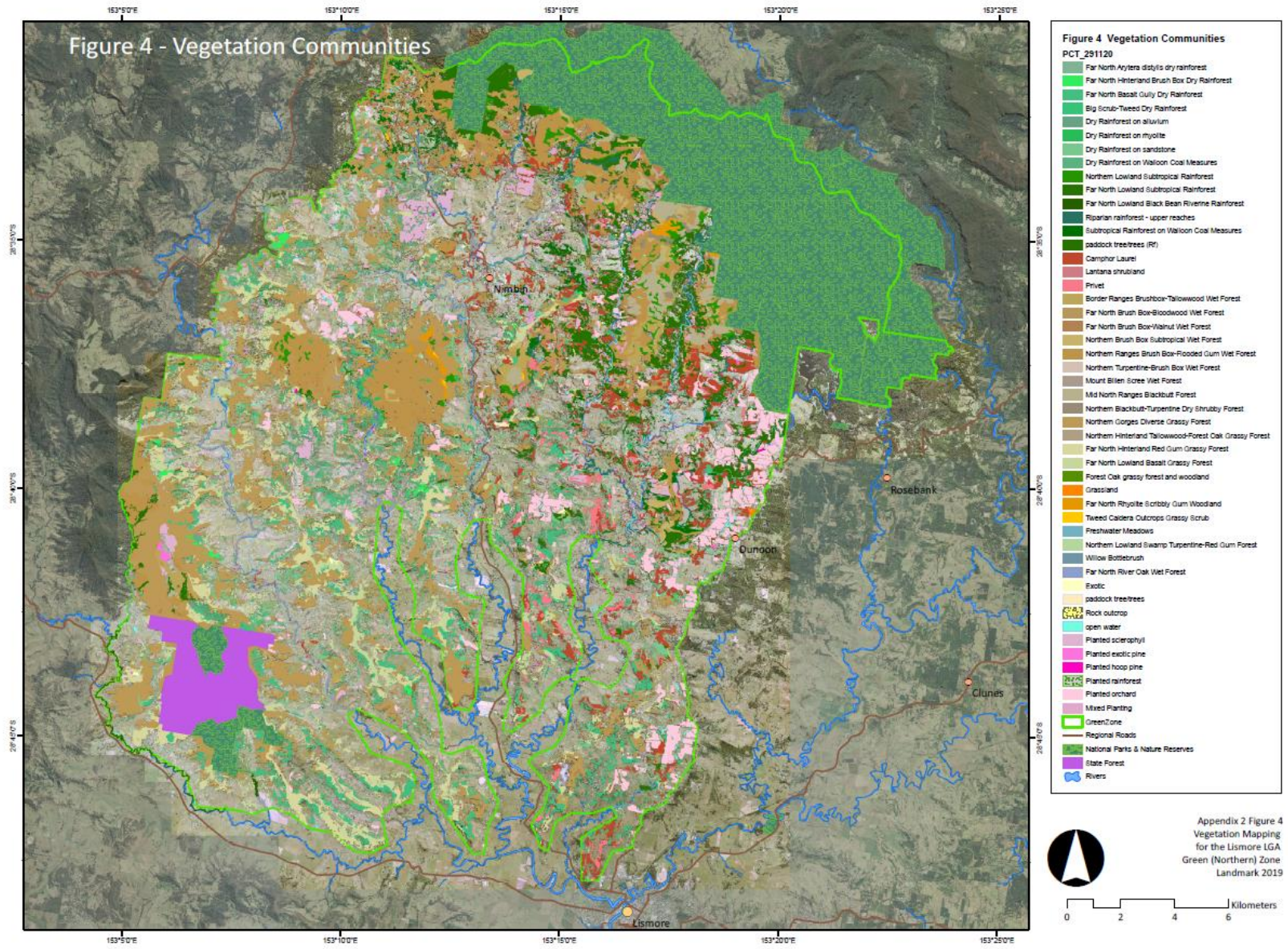


Figure 4 - Vegetation Communities
153°5'0"E
153°10'0"E
153°15'0"E
153°20'0"E
153°25'0"E
28°35'0"S
28°40'0"S
28°45'0"S
Nimbin
Rosebank
Dunoon
Clunes
Lismore
Figure 4 Vegetation Communities
PCT_291120
Far North Arytera distylis dry rainforest
Far North Hinterland Brush Box Dry Rainforest
Far North Basalt Gully Dry Rainforest
Big Scrub-Tweed Dry Rainforest
Dry Rainforest on alluvium
Dry Rainforest on rhyolite
Dry Rainforest on sandstone
Dry Rainforest on Walloon Coal Measures
Northern Lowland Subtropical Rainforest
Far North Lowland Subtropical Rainforest
Far North Lowland Black Bean Riverine Rainforest
Riparian rainforest - upper reaches
Subtropical Rainforest on Walloon Coal Measures
paddock tree/trees (Rf)
Camphor Laurel
Lantana shrubland
Privet
Border Ranges Brushbox-Tallowwood Wet Forest
Far North Brush Box-Bloodwood Wet Forest
Far North Brush Box-Walnut Wet Forest
Northern Brush Box Subtropical Wet Forest
Northern Ranges Brush Box-Flooded Gum Wet Forest
Northern Turpentine-Brush Box Wet Forest
Mount Billen Scree Wet Forest
Mid North Ranges Blackbutt Forest
Northern Blackbutt-Turpentine Dry Shrubby Forest
Northern Gorges Diverse Grassy Forest
Northern Hinterland Tallowwood-Forest Oak Grassy Forest
Far North Hinterland Red Gum Grassy Forest
Far North Lowland Basalt Grassy Forest
Forest Oak grassy forest and woodland
Grassland
Far North Rhyolite Scribbly Gum Woodland
Tweed Caldera Outcrops Grassy Scrub
Freshwater Meadows
Northern Lowland Swamp Turpentine-Red Gum Forest
Willow Bottlebrush
Far North River Oak Wet Forest
Exotic
paddock tree/trees
Rock outcrop
open water
Planted sclerophyll
Planted exotic pine
Planted hoop pine
Planted rainforest
Planted orchard
Mixed Planting
GreenZone
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
Appendix 2 Figure 4
Vegetation Mapping
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
Kilometers
0
2
4
6

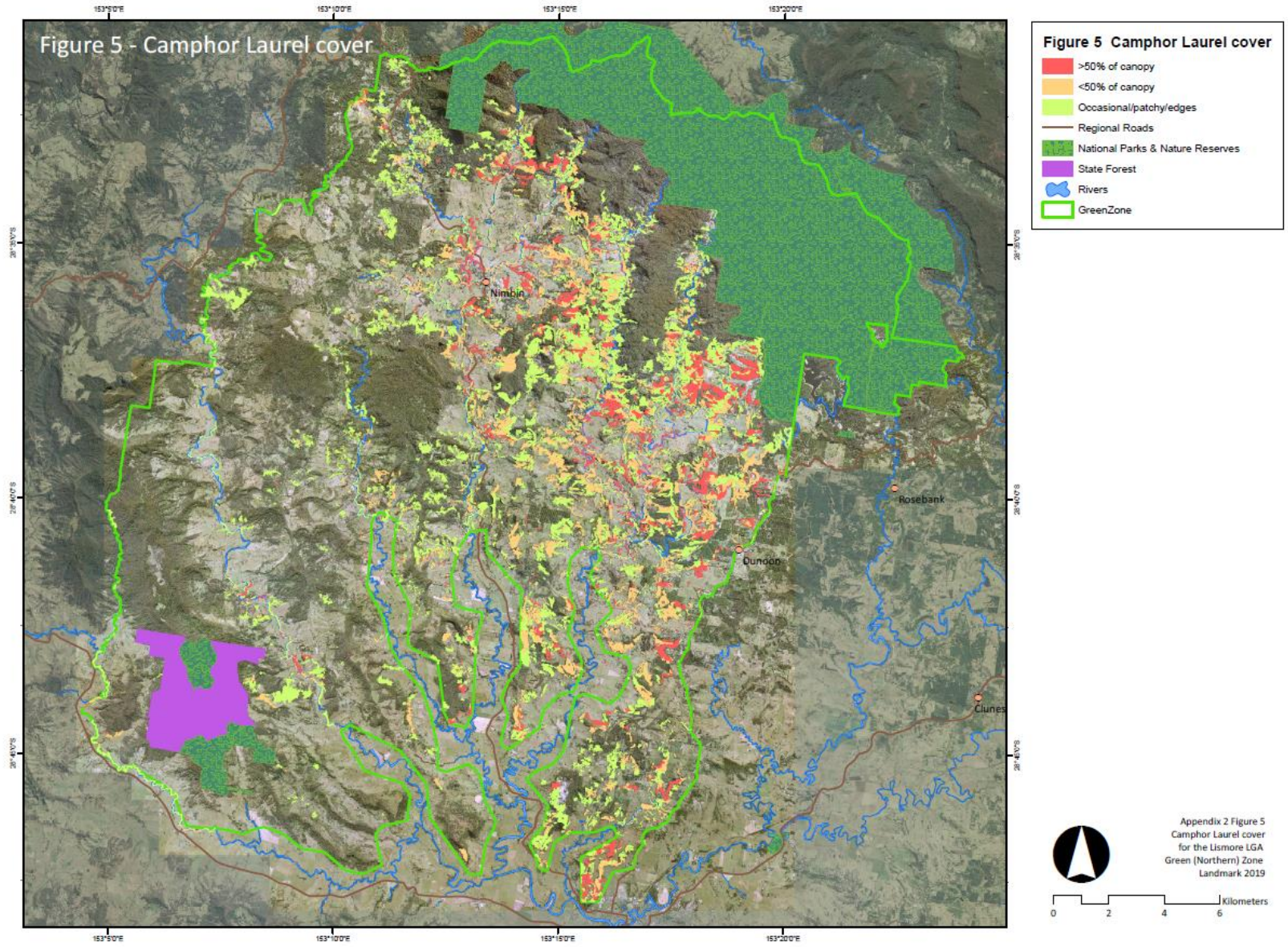


Figure 5 - Camphor Laurel cover
153°5'0"E
153°10'0"E
153°15'0"E
153°20'0"E
28°35'0"S
28°40'0"S
28°45'0"S
Nimbin
Rosebank
Dunoon
Clunes
Figure 5 Camphor Laurel cover
>50% of canopy
<50% of canopy
Occasional/patchy/edges
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
GreenZone
Appendix 2 Figure 5
Camphor Laurel cover
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
0
2
4
6
Kilometers

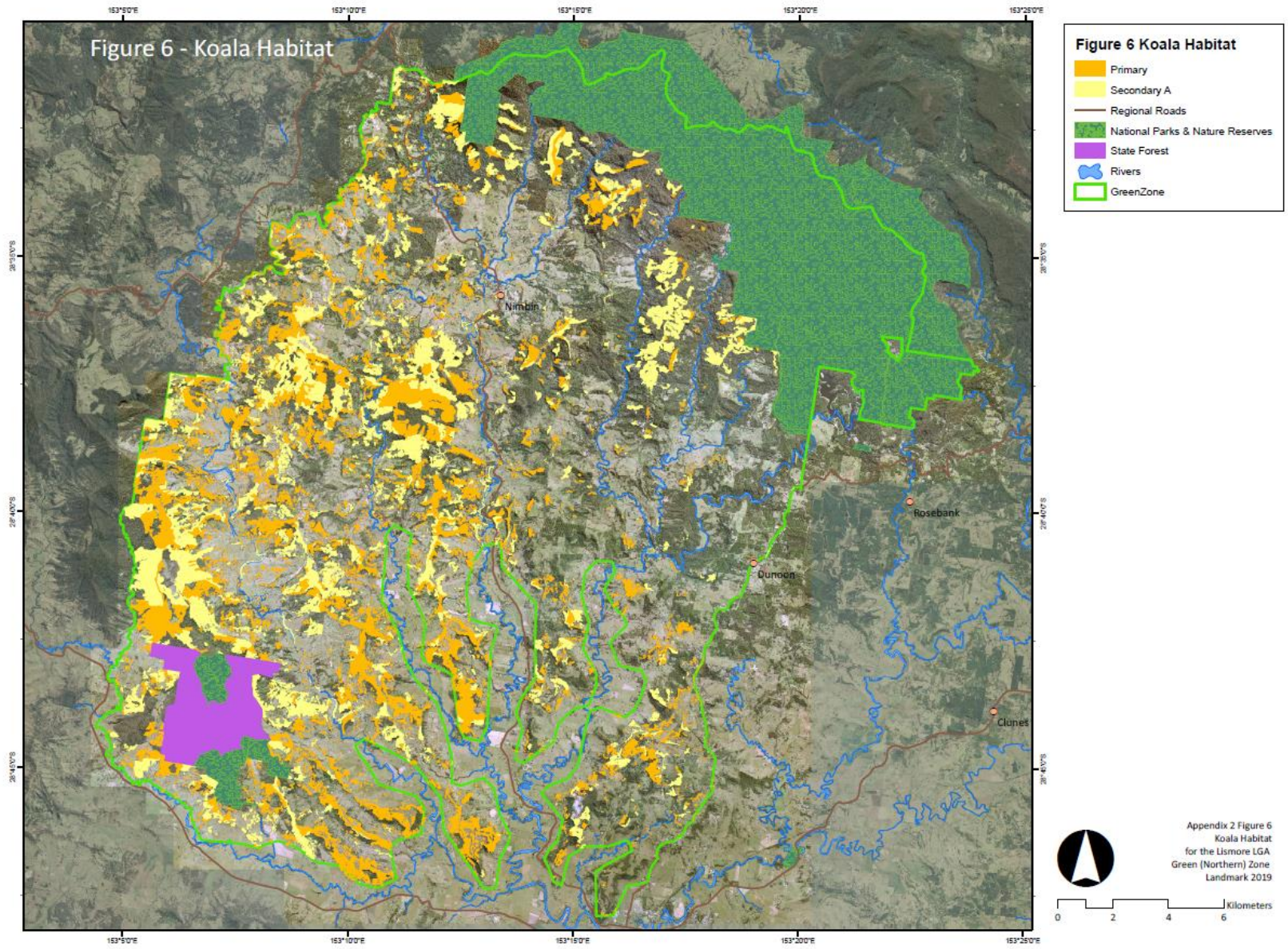


Figure 6 - Koala Habitat
Figure 6 Koala Habitat
Primary
Secondary A
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
GreenZone
Nimbin
Rosebank
Dunoon
Clunes
Appendix 2 Figure 6
Koala Habitat
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
Kilometers
0
2
4
6

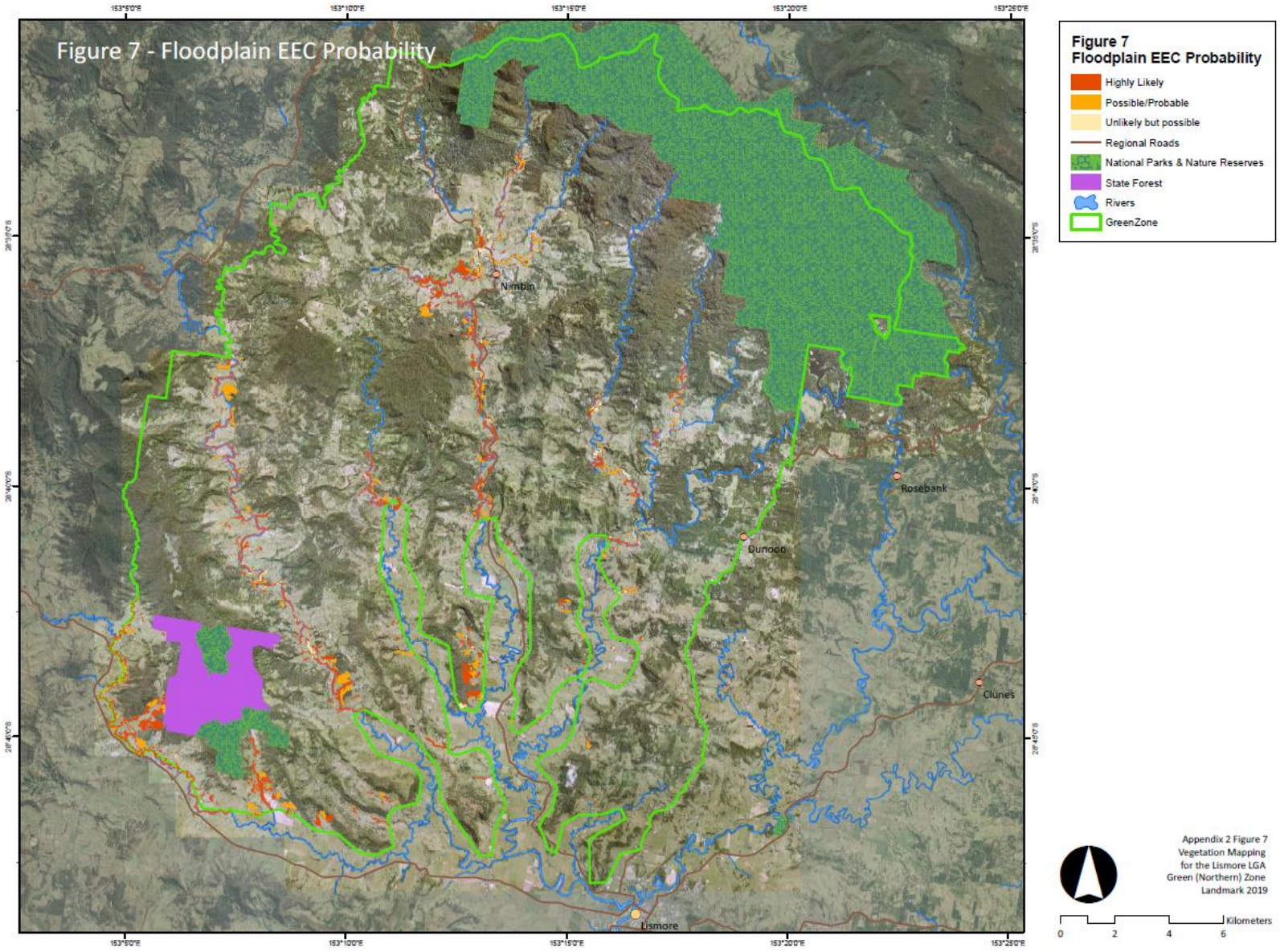


Figure 7 - Floodplain EEC Probability
153°50'0"E
153°100'0"E
153°150'0"E
153°200'0"E
153°250'0"E
28°35'0"S
28°40'0"S
28°45'0"S
Nimbin
Rosebank
Dunoon
Clunes
Lismore
Figure 7
Floodplain EEC Probability
Highly Likely
Possible/Probable
Unlikely but possible
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
GreenZone
Appendix 2 Figure 7
Vegetation Mapping
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
Kilometers
0
2
4
6

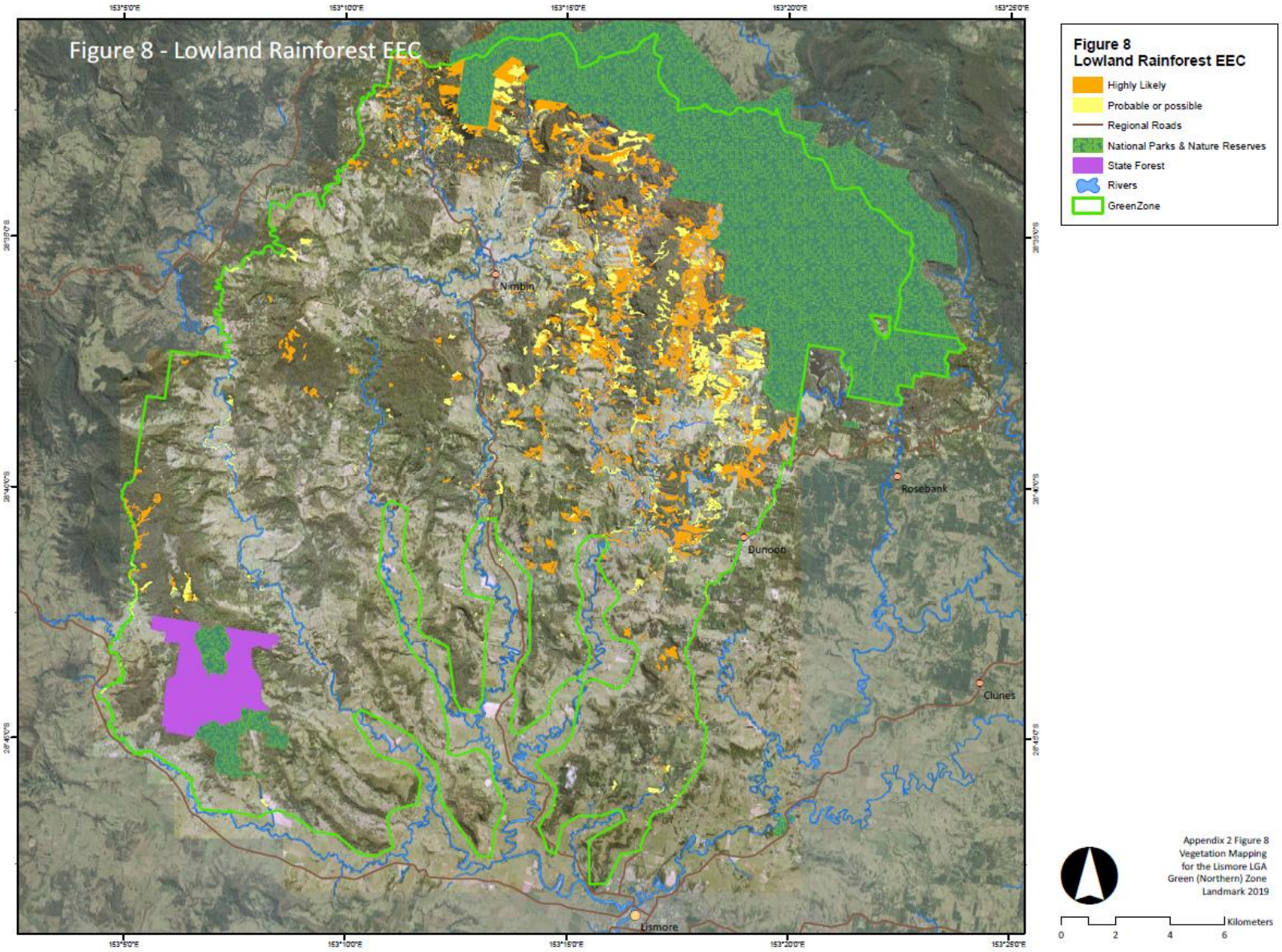


Figure 8 - Lowland Rainforest EEC
153°5'0"E
153°10'0"E
153°15'0"E
153°20'0"E
153°25'0"E
28°35'0"S
28°40'0"S
28°45'0"S
Nimbin
Rosebank
Dunoon
Clunes
Lismore
Figure 8
Lowland Rainforest EEC
Highly Likely
Probable or possible
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
GreenZone
Appendix 2 Figure 8
Vegetation Mapping
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
Kilometers
0
2
4
6

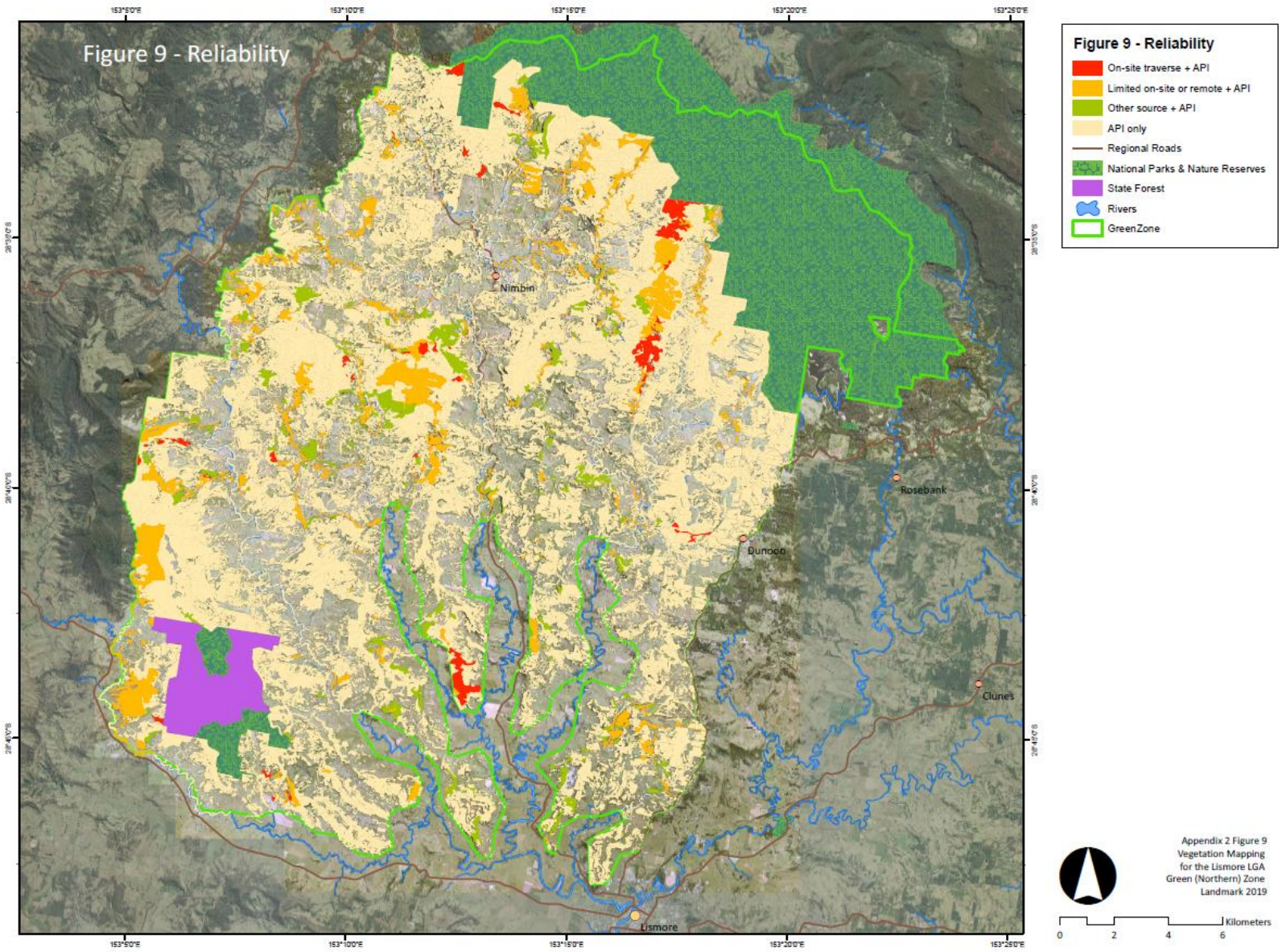


Figure 9 - Reliability
153°50'0"E
153°100'0"E
153°150'0"E
153°200'0"E
153°250'0"E
28°30'0"S
28°40'0"S
28°47'0"S
Nimbin
Rosebank
Dunoon
Clunes
Lismore
Figure 9 - Reliability
On-site traverse + API
Limited on-site or remote + API
Other source + API
API only
Regional Roads
National Parks & Nature Reserves
State Forest
Rivers
GreenZone
Appendix 2 Figure 9
Vegetation Mapping
for the Lismore LGA
Green (Northern) Zone
Landmark 2019
Kilometers
0
2
4
6