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Classification guide and mapping accuracy report

Forest Yield Association Groups of the NSW North Coast

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[Nick Cameron nick.cameron@dpi.nsw.gov.au Forest Science /Parramatta]

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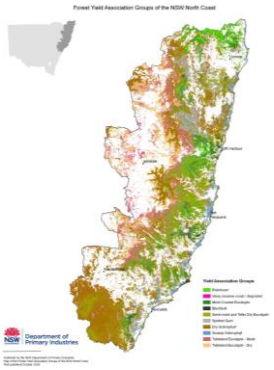

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Contents

Introduction to Yield Association Groups

Yield association groups (YAGs) are assemblages of forest types with common wood properties and common biophysical attributes. YAGs are defined by the tree canopy species mix; elevation above sea level, moisture levels or wetness, and the canopy height of mature trees.

This guide describes the classification of ten native forest YAGs and includes a YAG thematic map covering 5.3 million hectares of NSW North Coast forest. The YAG map has been designed specifically for the hardwood forestry sector, however as it covers all land tenures it has relevance to all forest managers.

The forest YAG map is a planning tool for people with an interest in native forest management. Knowing the extent and distribution of YAGs can assist in the planning of forest management activities like timber harvesting, roading, controlled burning, grazing, apiary and forest recreation.

Forest YAGs have particular relevance to the timber industry that has an interest in the wood values of forests. There are over fifty commercial eucalypt species that grow on the NSW North Coast, however many species grow together and have common wood properties and uses. These common factors allow them to be meaningfully grouped.

Two particular species, namely, Blackbutt and Spotted Gum, are highly valued by the industry and are also sufficiently widespread and common to warrant their own YAG classifications.

Figure 1 – Example of a Dry sclerophyll forest YAG on the mid north coast

The YAG classification system

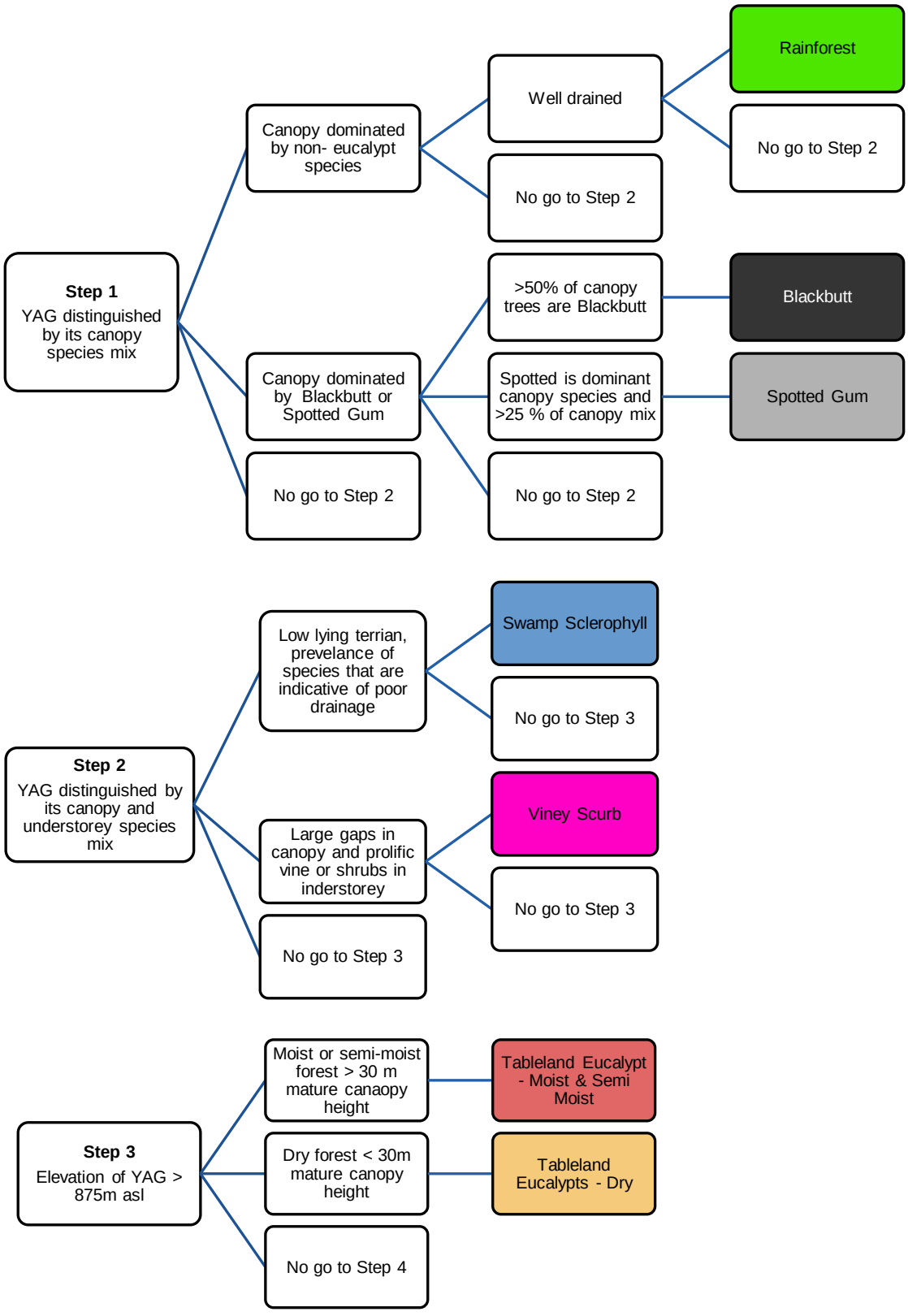
On the NSW North Coast ten different YAGs are recognised (Table 1). The classification of these YAGs is based on four defining biophysical attributes, namely:

i. Canopy species mix
ii. Elevation above sea level
iii. Moisture level or wetness
iv. Height of mature canopy trees

Table 1 – Forest Yield Associations of the NSW North Coast detailing code, defining biophysical attributes and indicative tree height range

Yield Association Group (YAG) (YAG acronym)	Key defining Biophysical Attribute(s)	Indicative Mature Canopy Height Range	
		Min (m)	Max (m)
1. Rainforest	Canopy species mix	5	60
2. Viney Scrub	Fragmented canopy, dense understory	30	60
3. Moist Coastal Eucalypts	Wetness, Mature canopy height	40	60
4. Blackbutt	Canopy species mix	30	60
5. Semi-moist and Taller Dry Eucalypts	Wetness, Mature canopy height	30	40
6. Spotted Gum	Canopy species mix	20	40
7. Dry Sclerophyll Forest	Wetness, Mature canopy height	5	30
8. Swamp Sclerophyll	Canopy and understory species mix, Wetness	15	30
9. Tableland Eucalypts - Moist and Semi-moist	High elevation, Wetness, Mature canopy height	30	60
10. Tableland Eucalypts – Dry	High elevation, Wetness, Mature canopy height	10	30

North coast native forests can be grouped into YAGs using the simple classification key shown at Figure 2 below. For more definitive YAG information refer to the section title Yield Association Group Definitions.



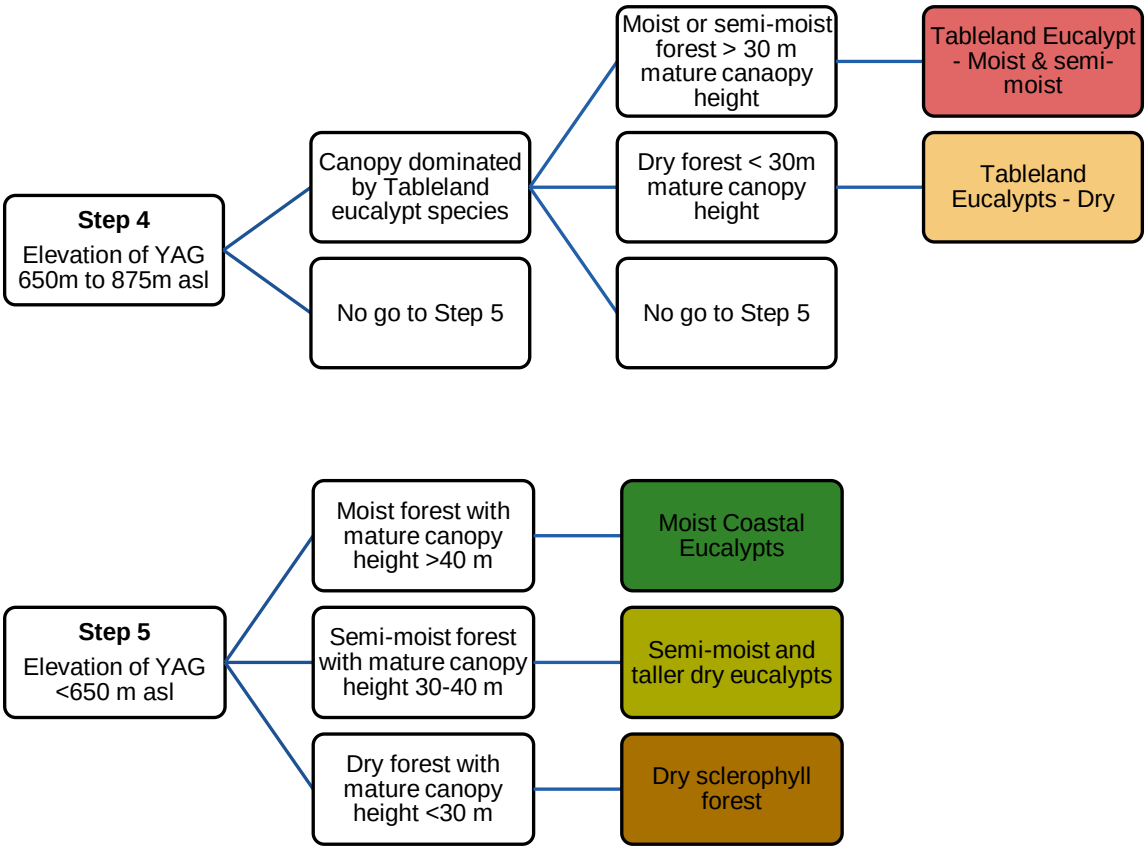


Figure 2 - YAG Classification Key (simplified)

Of the ten YAGs, three can be solely distinguished by their canopy species mix, namely, Blackbutt, Spotted Gum and Rainforest.

For a forest to qualify as a Blackbutt YAG, 50% of the canopy trees must be either Coastal Blackbutt (*Eucalyptus pilularis*) or Large-fruited Blackbutt (*Eucalytus pyrocarpa*). For a forest to qualify as a Spotted Gum YAG, Spotted Gum (*Corymbia maculata/citriodora/henryi* (*ssp. variegata*)) must be the dominant canopy species and constitute at least 25% of the canopy species mix. For a forest to qualify as a Rainforest YAG, the canopy must be dominated by non-eucalypt species which are not adapted to fire.

Two additional YAGs, Swamp sclerophyll forest and Viney Scrub, can be distinguished where there is knowledge of the canopy and understorey species mix. Forests that are dominated by mangrove, paperbark, or swamp oak species can be distinguished as Swamp sclerophyll just by their canopy species. However, where the canopy of a Swamp sclerophyll forest is dominated by eucalypt species (that tolerate periodic or cyclical water inundation) the YAG classification may be less clear. In this case, to qualify as a Swamp sclerophyll YAG, the forest must also feature understorey species that are unique to sites subject to periodic or cyclical water inundation.

Where canopy trees are fragmented and in a degraded state (poor health and condition), the forest may qualify as a Viney Scrub YAG. Viney Scrub YAGs occurs predominantly at the moist end on the spectrum where regeneration (following disturbance events) is not always successful. For all other YAGs the canopy species mix is important but not a defining attribute.

YAGs are divided geographically into two broad groups, those that grow at lower elevations, along the coast and lower ranges (coastal YAGs), and those that grow at higher elevations, on the top of ranges and on the Tableland (tableland YAGs). Coastal YAGs transition to tableland YAGs between 650 metres and 875 metres above mean sea level. The elevation at which this transition occurs is affected by latitude and topographic features.

Coastal YAGs have a high proportion of dense durable species (e.g. Blackbutt, Spotted Gum, Tallowwood, Grey Gum and Ironbark) while tableland YAGs are dominated by species of lower (oven dry) density and durability (e.g. Mountain Gum, Manna Gum, Peppermint, Mountain Grey Gum, Brown Barrel, Messmate and Silvertop Stringybark). Sydney Blue Gum is a dense, moderately durable species that is found in both coastal and tableland YAGs, commonly occupying the transition zone.

YAGs are also grouped by their inherent moisture level or wetness (e.g. dry, semi-moist, moist, rainforest and swamp). Moisture by itself, however, is not a reliable indicator of forest productivity or capacity to yield timber. For example, a swamp sclerophyll forest is lower yielding than a moist eucalypt forest.

Mature tree canopy height is an important structural attribute that provides a reliable indicator of a forest's site productivity and its capacity to yield timber. Mature tree canopy heights can range from as low as 5 metres on infertile dry sites to in excess of 60 metres on moist fertile sites. The taller moist forests (40m+) have the highest timber yielding potential while lower dryer forests (30m-) have the least. Mature tree canopy height is not, however, a reliable indicator for Rainforest or Swamp sclerophyll YAGs.

The YAG Mapping Process

The YAG mapping process was undertaken using spatial analysis and modelling techniques. The process drew upon existing vegetation information systems (VIS)[1] as well as remotely sensed data, namely, Landsat and Sentinel 2 satellite imagery and ADS40 aerial photography. An object based image analysis software package (eCognition (Trimble)), was used in combination with a suite of vegetation indices to differentiate the YAGs.

An outline of the process that was employed to develop the YAG map is shown at Figure 3.

[1] FCNSW Research Note 17, CRAFTI, Keith, and vegetation mapping by individual Local Councils

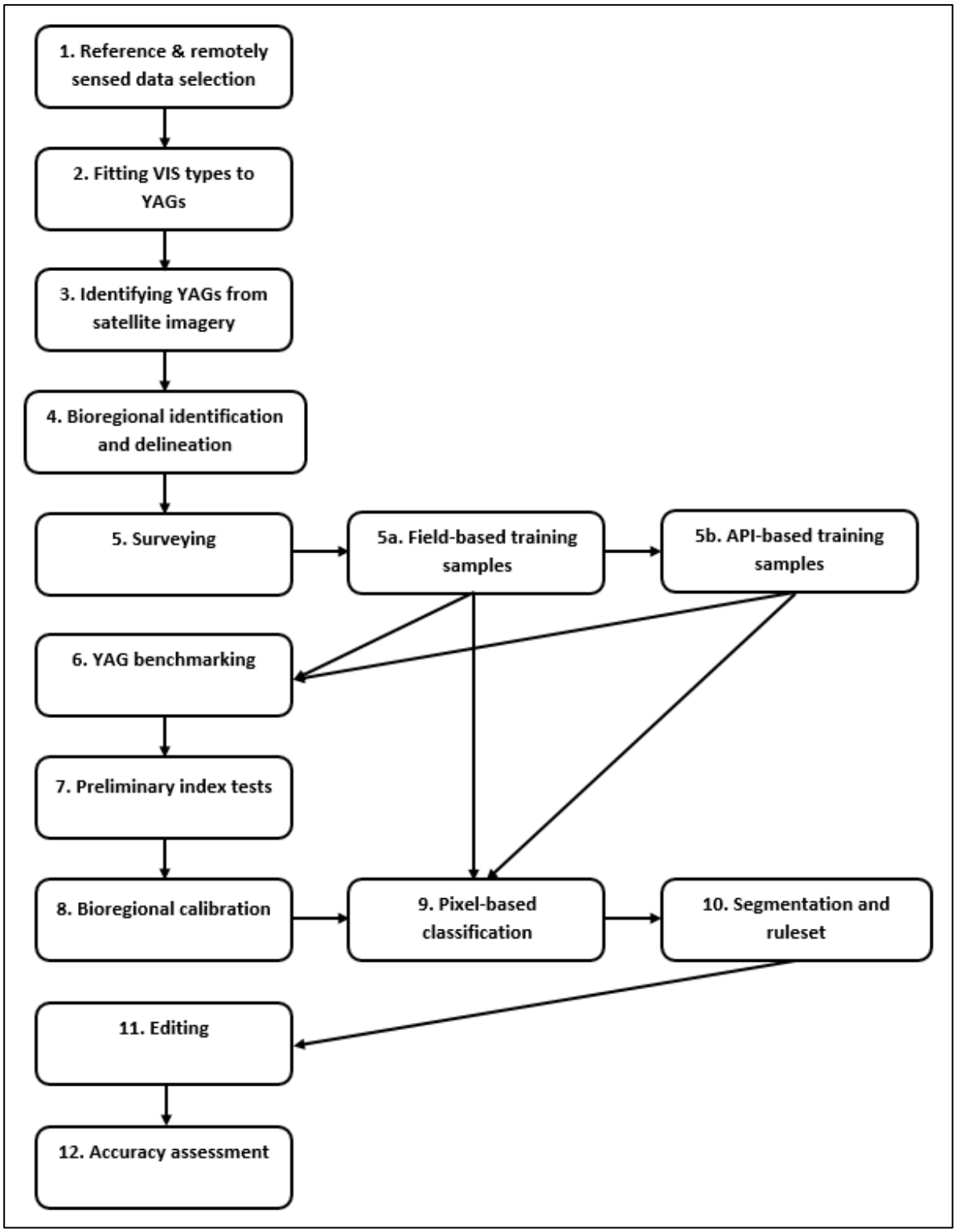


Figure 3 - Forest YAG typing workflow

The YAG Map

A YAG thematic map covering 5.3 million hectares of North Coast forest was produced using the YAG definitions detailed in this report. A low resolution image is shown below (Figure 4). A medium resolution image (300 dpi) is available as an A3 jpg file from the DPI website. High spatial resolution (10m) data is available upon request from the DPI Forest Science unit.

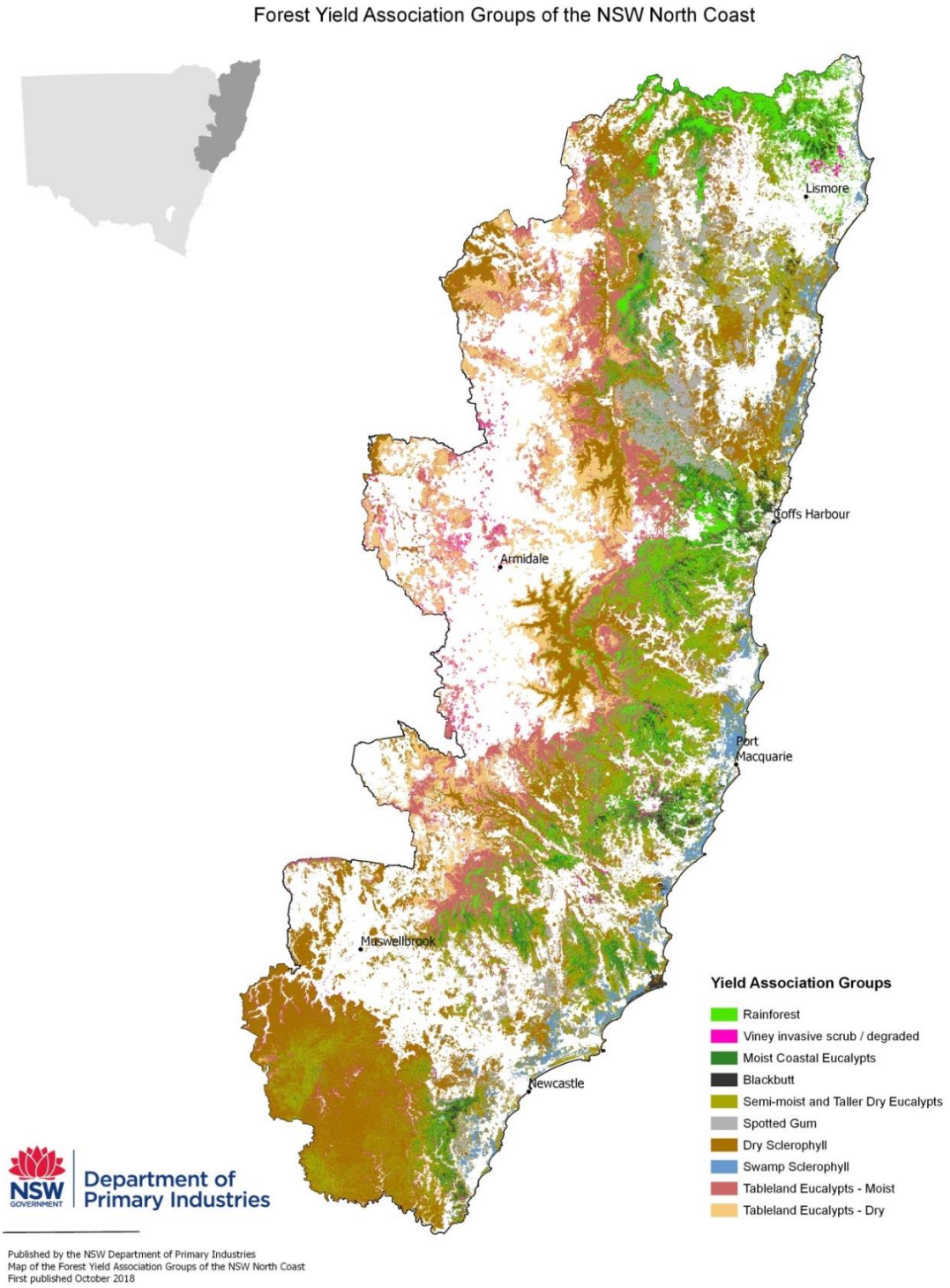


Figure 4 – Forest Yield Association Group Map of the NSW North Coast

The pie charts at Figure 5 show the relative contribution by area of each YAG type for all north coast tenures, for State forests and for private property.

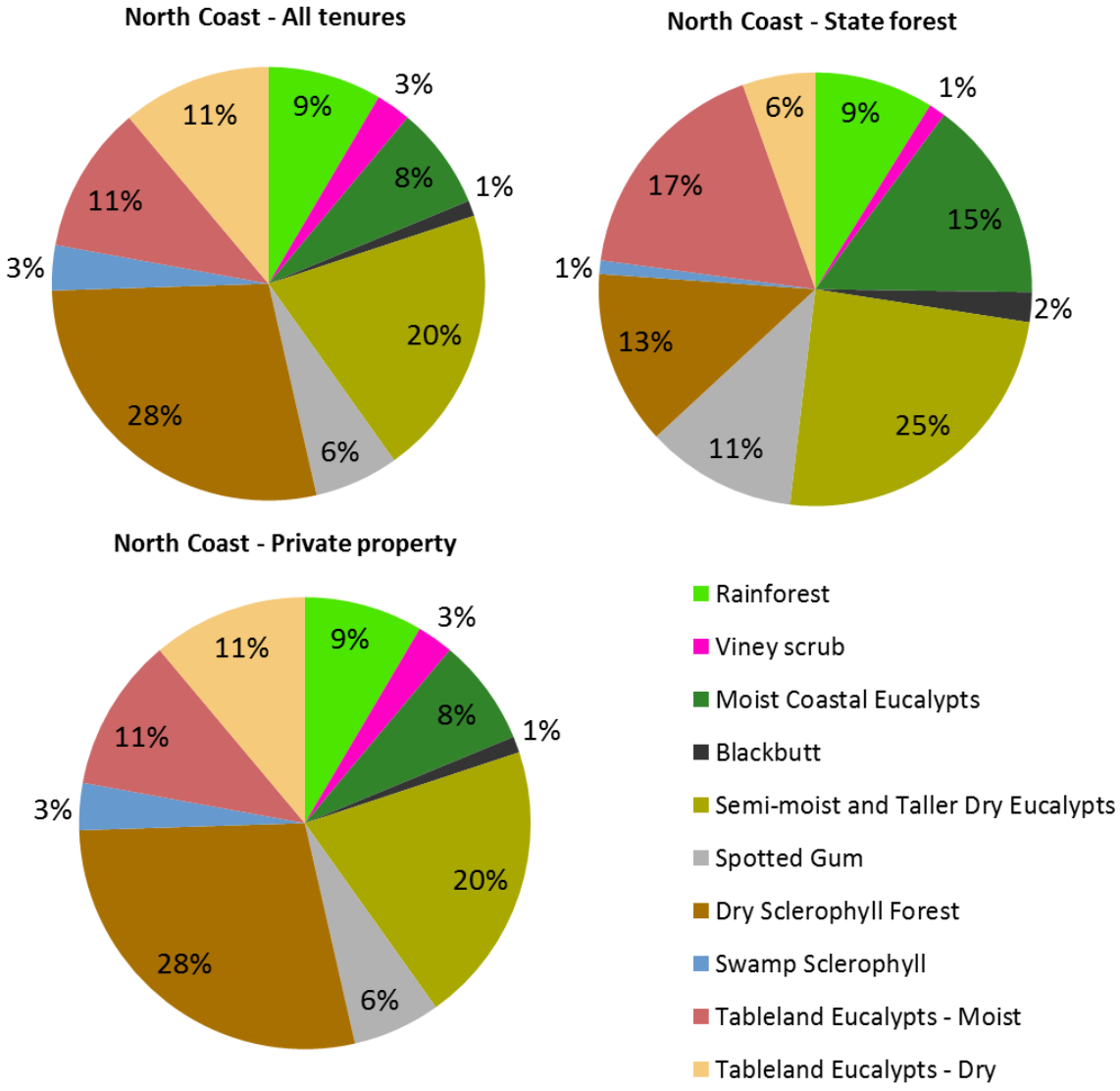


Figure 5 – Relative abundance of North Coast Yield Association Groups

The Accuracy of the YAG Map

In thematic mapping from remotely sensed data, the term accuracy is used typically to express the degree of 'correctness' of a map or classification. A thematic map is therefore considered accurate if it provides an unbiased representation of the land cover of the region it portrays (Campbell, 1996; Maling, 1989).

A sample of 1,035 sites (25m radius) was selected proportionately representing the different YAGs in the map. Using 3D photo imaging software a forest aerial photography

interpretation (API) expert[2] assigned a YAG class to each site. This is considered to be the truth against which the YAG classes from the produced map were compared. **Overall accuracy**, which is the percentage of cases correctly allocated **for the YAG map, was 65.1%.**

Producer's and Consumer's accuracy (Campbell, 1996) was also calculated for the different YAGs in the map. Producer's accuracy is from the point of view of the map maker (the producer), and is a reference-based accuracy that is computed by looking at the predictions produced for a class and determining the percentage of correct predictions. In other words, if I know that a particular area is Blackbutt, what is the probability that the digital map will correctly identify that pixel as Blackbutt?. Consumer's accuracy is the accuracy from the point of view of a map user. It essentially tells a user how often the class on the map will actually be present on the ground. This is also referred to as reliability. For example, if we select any Blackbutt pixel on the classified map, what is the probability that it would be a Blackbutt stand when we visit the site in the field. The Producer's and User's accuracies for the various YAGs are presented in Table 2.

Table 2 –Producer's and User's Accuracy of the NSW North Coast Forest Yield Association Group Map

YAG	Producer's Accuracy	User's Accuracy
1 Rainforest (RF)	69.6%	60.0%
2 Viney Scrub (VS)	100.0%	47.6%
3 Moist Coastal Eucalypts (MCE)	39.7%	39.1%
4 Blackbutt (BBT)	78.5%	82.5%
5 Semi-moist and Taller Dry Eucalypts (SMTD)	50.8%	48.9%
6 Spotted Gum (SG)	69.9%	67.4%
7 Dry Sclerophyll Forest (DSF)	57.8%	74.6%
8 Swamp Sclerophyll (SS)	74.4%	50.0%
9 Tableland Eucalypts - Moist and Semi-moist (TE – MSM)	78.2%	70.8%
10 Tableland Eucalypts – Dry (TE-D)	62.0%	74.7%

Measures such as the percentage of cases correctly classified have often been criticized as they do not take into account that some cases may have been allocated to the correct class purely by chance (Congalton, 1991; Pontius, 2000). To accommodate for the effects of chance agreement, Cohen's kappa coefficient has often been used and some researchers argue that it should be adopted as a standard measure of classification accuracy (Smits et al., 1999). The Kappa Coefficient can range from -1 t0 1. A value of 0 indicated that the classification is no better than a random classification. A negative number indicates the classification is significantly worse than random. A value close to 1 indicates that the classification is significantly better than random. Along with compensating for chance agreement variance of

[2] ForeSense - Natural Resource Remote Sensing and Photogrammetry

this index can be easily calculated, enabling the estimation of confidence boundaries (Rosenfield & Fitzpatrick-Lins, 1986). **The Kappa value for the YAG map is 0.6 with upper and lower confidence values of 0.57 and 0.64.**

Discussion of results

The overall accuracy of the thematic map was not as high as hoped but nonetheless acceptable and significantly better than any known alternative. The accuracy of individual YAGs was quite variable ranging between 39.7% and 100% for Producer's accuracy and between 39.1% and 82.5% for User's accuracy. The most accurately mapped YAG was Blackbutt while the least accurately mapped was Moist Coastal Eucalypts. The low accuracy of the Moist Coastal Eucalypts YAG was mostly caused by confusion with Rainforest. On the map, boundaries between neighbouring YAGs are necessarily definitive and absolute. In reality the transition between YAGs is often gradational. When evaluating the map this difference should be kept in mind.

There is opportunity to improve the quality of the map in the future. For example, if LiDAR data were to be captured over the area of interest this data could greatly improve the accuracy of those YAG which are readily defined by their mature canopy height.

References

Campbell, J. B. (1996). Introduction to remote sensing (2nd ed.). London: Taylor and Francis.

Congalton, R. G. (1991). A review of assessing the accuracy of classifications of remotely sensed data. Remote Sensing of Environment, 37, 35 – 46.

Maling, D. H. (1989). Measurements from maps. Oxford: Pergamon.

Pontius, R. G. (2000). Quantification error versus location error in comparison of categorical maps. Photogrammetric Engineering and Remote Sensing, 66, 1011 – 1016.

Rosenfield, G. H., & Fitzpatrick-Lins, K. (1986). A coefficient of agreement as a measure of thematic classification accuracy. Photogrammetric Engineering and Remote Sensing, 52, 223 – 227.

Smits, P. C., Dellepiane, S. G., & Schowengerdt, R. A. (1999). Quality assessment of image classification algorithms for land-cover mapping: a review and proposal for a cost-based approach. International Journal of Remote Sensing, 20, 1461 – 1486.

Yield Association Group Definitions

1. Rainforest

Description

- ✓ Luxuriant appearance, canopy dominated by (non-eucalypt) species not adapted to fire.
- ✓ Projected foliage cover above 70%.
- ✓ Gullies and south and east aspects are favoured sites. Broader distribution occurs where soils are derived from more fertile volcanic rock.
- ✓ Cool and shady microclimate exists beneath canopy, one to three vertical layers, vines and epiphytes present.
- ✓ Height sub-formations (5-10m, 10-30m and 30m+).
- ✓ Structural sub-formations:
    - i. Subtropical (notophyll vine forest) – 10-60 canopy species, 1300 mm rain.
    - ii. Dry (araucarian notophyll vine forest) – 10- 30 canopy species, 600-1100 mm rain.
    - iii. Warm temperate (simple notophyll evergreen vine forest) – 3-15 canopy species, 1300 mm rain, emergent *Araucaria,* or remnant *Eucalyptus* or *Lophostemon*.
    - iv. Cool temperate (microphyll fern forest) – 1-3 canopy species , 1750 – 3500 mm, usually above 900m elevation, e.g. *Nothofagus moorei*

Canopy Indicator Species

Common Name	*Scientific Name*
Antarctic Beech	*Nothofagus moorei*
Black Bean	*Castanospermum australe*
Brush Box	*Lophostemon confertus*
Camphor Laurel	*Cinnamomum camphora*
Camphorwood	*Cinnamomum oliveri*
Coachwood	*Ceratopetalum apetalum*
Corkwood	*Endiandra sieberi*
Giant Stinger	*Dendrocnide excelsa*
Hoop Pine	*Araucaria cunninghamii*
Lilly Pilly	*Syzygium smithii*
Native Fig	*Ficus spp*
Silky Oak	*Grevillea robusta*
Tuckeroo	*Cupaniopsis anacardioides*
Turpentine	*Syncarpia glomulifera*
White Beech	*Gmelina leichhardtii*
White Booyong	*Argyrodendron trifoliolatum*
Yellow Carabeen	*Sloanea woollsii*

2. Viney Scrub

Description

- ✓ Predominance of low (usually 3m to 8m high), dense shrub, interlaced with vines that form thickets.
- ✓ Introduced shrub common or dominant (e.g. Lantana).
- ✓ Remnant forest trees (often large and old) with a highly fragmented canopy.
- ✓ Merchantable trees rare or absent.
- ✓ Typically a former Rainforest or Moist Coastal Eucalypt forest that has failed to regenerate or is in an early succession stage.
- ✓ May have been previously cleared for agriculture.

Indicator Species

Common Name	*Scientific Name*
Lantana	*Lantana camara*
Cockspur	*Cudrania*
Burny Vine	*Malaisia* spp.
Stinger	*Dendrocnide* spp.
Rainforest canopy species	Refer section 1
Moist Coastal Eucalypt canopy species	Refer section 3

3. Moist Coastal Eucalypts

Description

- ✓ Appearance of a moist sclerophyll forest generally between 40 metres and 60 metres in height.
- ✓ Sheltered sites (south-facing, lower slopes), deep, moist, fertile soils.
- ✓ Carries a dense and lush understory of mesophytic shrubs and herbs which may be converted to dense ferns by burning.
- ✓ Boundary between moist and semi-moist and taller eucalypts usually not distinct.
- ✓ Where Spotted Gum constitutes over 25 per cent of the stand this should be specifically noted however the type should remain as Moist Coastal Eucalypts

Canopy Indicator Species

Common Name	*Scientific Name*
Bangalay	*Eucalyptus botryoides*
Blackbutt	*Eucalyptus pilularis*
Broad-leaved Paperbark	*Melaleuca quinquenervia*
Broad-leaved White Mahogany	*Eucalyptus umbra*
Brush Box	*Lophostemon confertus*
Camphor Laurel	*Cinnamomum camphora*
Dunn's White Gum	*Eucalyptus dunnii*

Flooded Gum	*Eucalyptus grandis*
Grey Ironbark	*Eucalytus siderophloia*
Grey Ironbark	*Eucalyptus paniculata*
Hoop Pine	*Araucaria cunninghamii*
Narrow-leaved White Mahogany	*Eucalyptus acmenoides*
Native Fig	*Ficus spp*
Pink Bloodwood	*Corymbia intermedia*
Red Bloodwood	*Corymbia gummifera*
Red Mahogany	*Eucalyptus resinifera*
Roundleaved Gum	*Eucalyptus deanei*
Small-fruited Grey Gum	*Eucalyptus propinqua*
Spotted Gum	*Corymbia maculata, Corymbia citriodora*
Swamp Mahogany	*Eucalyptus robusta*
Swamp Oak	*Casuarina glauca*
Sydney Blue Gum	*Eucalyptus saligna*
Tallowwood	*Eucalyptus microcorys*
Turpentine	*Syncarpia glomulifera*

4. Blackbutt

Description

- ✓ Blackbutt makes up over 50 per cent and not infrequently up to 100 per cent of the stand (canopy and stocking).
- ✓ Common throughout the coastal districts of the study area to 750m elevation (occasionally to around 900m).
- ✓ Tolerates a range of soil fertilities though has a preference for well drained, rather siliceous soils.
- ✓ Includes moist and dry types
- ✓ Not distinguished by its understory.
- ✓ Between 30 m and 60 m in height.
- ✓ 900-1100 mm rainfall zone.

Canopy Indicator Species (dominant species highlighted)

Common Name	*Scientific Name*
Bangalay	*Eucalyptus botryoides*
Blackbutt	***Eucalyptus pilularis***
Broad-leaved White Mahogany	*Eucalyptus umbra*
Brush Box	*Lophostemon confertus*
Large-fruited Blackbutt	***Eucalyptus pyrocarpa***
Narrow-leaved White Mahogany	*Eucalyptus acmenoides*
Native Fig	*Ficus spp*
Pink Bloodwood	*Corymbia intermedia*
Red Bloodwood	*Corymbia gummifera*
Red Mahogany	*Eucalyptus resinifera*

Common Name	*Scientific Name*
Spotted Gum	*Corymbia maculata, Corymbia citriodora*
Steel Box	*Eucalyptus rummeryi*
Swamp Mahogany	Eucalyptus robusta
Sydney Blue Gum	*Eucalyptus saligna*
Tallowwood	*Eucalyptus microcorys*
Turpentine	*Syncarpia glomulifera*

5. Semi-moist & Taller Dry Eucalypts

Description

- ✓ Semi-moist sclerophyll forest generally ranging between 30 m and 40 m in height.
- ✓ Grows between sheltered and exposed sites on moderate to high quality soils typically between moist and dry sclerophyll forest.
- ✓ Commonly features tall well-formed examples from the durable species mix group (e.g. Grey Box, Grey Gum, Grey Ironbark, Steel Box, Turpentine, Spotted Gum, Blackbutt and Forest Red Gum).
- ✓ Not distinguished by its understory.
- ✓ Where Spotted Gum constitutes over 25 per cent of the stand the type should be classified as Spotted Gum semi-moist.

Canopy Indicator Species

Common Name	*Scientific Name*
Bangalay	*Eucalyptus botryoides*
Blackbutt	*Eucalyptus pilularis*
Blue-leaved Stringybark	*Eucalyptus agglomerata*
Broad-leaved Ironbark	*Eucalyptus fibrosa*
Broad-leaved Red Ironbark	*Eucalyptus fibrosa*
Broad-leaved White Mahogany	*Eucalyptus umbra*
Cabbage Gum	*Eucalyptus amplifolia*
Diehard Stringybark	*Eucalyptus cameronii*
Dungog Grey Gum	*Eucalyptus canaliculata*
Dunn's White Gum	*Eucalyptus dunnii*
Forest Red Gum	*Eucalyptus tereticornis*
Grey Box	*Eucalyptus moluccana*
Grey Gum	*Eucalyptus biturbinata*
Grey Gum	*Eucalyptus punctata*
Grey Ironbark	*Eucalytus siderophloia*
Grey Ironbark	*Eucalyptus paniculata*
Hoop Pine	*Araucaria cunninghamii*
Large-fruited Blackbutt	*Eucalyptus pyrocarpa*
Narrow-leaved Ironbark	*Eucalyptus crebra*
Narrow-leaved White Mahogany	*Eucalyptus acmenoides*
Native Fig	*Ficus spp*

Common Name	*Scientific Name*
Pink Bloodwood	*Corymbia intermedia*
Red Bloodwood	*Corymbia gummifera*
River Oak	*Casuarina cunninghamiana*
Small-fruited Grey Gum	*Eucalyptus propinqua*
Spotted Gum	*Corymbia maculata, Corymbia citriodora*
Steel Box	*Eucalyptus rummeryi*
Swamp Mahogany	*Eucalyptus robusta*
Swamp Oak	*Casuarina glauca*
Sydney Blue Gum	*Eucalyptus saligna*
Tallowwood	*Eucalyptus microcorys*
Turpentine	*Syncarpia glomulifera*
White-topped Box	*Eucalyptus quadrangulata*
Woollybutt	*Eucalytpus longifolia*

6. Spotted Gum

Description

- ✓ Spotted Gum is the dominant species and constitutes 25% or more of the canopy.
- ✓ Common throughout the coastal districts of the study area.
- ✓ Commonly occurs on gravelly soils with heavier texture than those preferred by Blackbutt. Often associated with or growing near Blackbutt stands.
- ✓ Can occur in association with a very large number of species.
- ✓ Not distinguished by its understory or moisture status though semi-forests are the most common
- ✓ Ranging between 20 m and 40 m in height.
- ✓ Common on lower elevation gently sloping terrain throughout the coastal districts. May also occur on more rugged steeper terrain.

Canopy Indicator Species (dominant species highlighted)

Common Name	*Scientific Name*
Bangalay	*Eucalyptus botryoides*
Blackbutt	*Eucalyptus pilularis*
Blue-leaved Stringybark	*Eucalyptus agglomerata*
Broad-leaved Ironbark	*Eucalyptus fibrosa*
Broad-leaved Red Ironbark	*Eucalyptus fibrosa*
Broad-leaved White Mahogany	*Eucalyptus umbra*
Cabbage Gum	*Eucalyptus amplifolia*
Diehard Stringybark	*Eucalyptus cameronii*
Dungog Grey Gum	*Eucalyptus canaliculata*
Dunn's White Gum	*Eucalyptus dunnii*
Forest Red Gum	*Eucalyptus tereticornis*
Grey Box	*Eucalyptus moluccana*
Grey Gum	*Eucalyptus biturbinata*

Common Name	*Scientific Name*
Grey Gum	*Eucalyptus punctate /canaliculata*
Grey Ironbark	*Eucalytus siderophloia*
Grey Ironbark	*Eucalyptus paniculata*
Large-fruited Blackbutt	*Eucalyptus pyrocarpa*
Large-fruited Blackbutt	*Eucalyptus pyrocarpa*
Narrow-leaved Ironbark	*Eucalyptus crebra*
Narrow-leaved White Mahogany	*Eucalyptus acmenoides*
Pink Bloodwood	*Corymbia intermedia*
Red Bloodwood	*Corymbia gummifera*
Small-fruited Grey Gum	*Eucalyptus propinqua*
Spotted Gum	***Corymbia maculata/citriodora/henryi (variegata)***
Steel Box	*Eucalyptus rummeryi*
Swamp Mahogany	*Eucalyptus robusta*
Swamp Oak	*Casuarina glauca*
Sydney Blue Gum	*Eucalyptus saligna*
Tallowwood	*Eucalyptus microcorys*
Turpentine	*Syncarpia glomulifera*
White-topped Box	*Eucalyptus quadrangulata*
White Stringybark	*Eucalyptus globoidea/eugenioides*
Woollybutt	*Eucalytpus longifolia*

7. Dry Sclerophyll

Description

- ✓ Dry Sclerophyll forest predominantly less than 30 m in height.
- ✓ Has a xeric and open understorey which is converted to grasses by burning.
- ✓ Dry and or infertile sites.
- ✓ Fire plays a vital role in regeneration.
- ✓ Forests that meet the definition of 'Spotted Gum', or 'Tableland Eucalypt Dry' should not be included in this YAG.

Canopy Indicator Species

Common Name	*Scientific Name*
Blackbutt	*Eucalyptus pilularis*
Black Cypress Pine	*Callitris endlicheri*
Blakely's Red Gum	*Eucalyptus blakelyi*
Broad-leaved Ironbark	*Eucalyptus fibrosa*
Broad-leaved Red Ironbark	*Eucalyptus fibrosa*
Broad-leaved Stringybark	*Eucalyptus caliginosa*
Broad-leaved White Mahogany	*Eucalyptus umbra*
Cabbage Gum	*Eucalyptus amplifolia*
Caley's Ironbark	*Eucalyptus caleyi*

Common Name	*Scientific Name*
Diehard Stringybark	*Eucalyptus cameronii*
Dungog Grey Gum	*Eucalyptus canaliculata*
Forest Oak	*Allocasuarina torulosa*
Forest Red Gum	*Eucalyptus tereticornis*
Grey Box	*Eucalyptus moluccana*
Grey Gum	*Eucalyptus biturbinata*
Grey Gum	*Eucalyptus punctata*
Grey Ironbark	*Eucalytus siderophloia*
Kurrajong	*Brachychiton populneus*
Large-fruited Blackbutt	*Eucalyptus pyrocarpa*
Mugga Ironbark	*Eucalyptus sideroxylon*
Narrow-leaved Ironbark	*Eucalyptus crebra*
Red Bloodwood	*Corymbia gummifera*
River Oak	*Casuarina cunninghamiana*
Rough-barked Apple	*Angophora floribunda*
Silvertop Ash	*Eucalyptus seiberi*
Smooth-barked Apple	*Angophora costata*
Snappy Gum	*Eucalyptus racemosa*
Swamp Oak	*Casuarina glauca*
Tallowwood	*Eucalyptus microcorys*
White Box	*Eucalyptus albens*
White Cypress	*Callitris glaucophylla*
White Stringybark	*Eucalyptus globoidea*
Woollybutt	*Eucalytpus longifolia*
Yellow Box	*Eucalyptus melliodora*

8. Swamp Sclerophyll

Description

- ✓ All mangrove, paperbark, and swamp oak forest.
- ✓ Eucalypt forest generally less than 30 metres in height on heavy poorly drained soils near the coast.

Canopy Indicator Species

Common Name	*Scientific Name*
Bangalay	*Eucalyptus botryoides*
Broad-leaved Paperbark	*Melaleuca quinquenervia*
Cabbage Palm	*Livistona australis*
Forest Red Gum	*Eucalyptus tereticornis*
Mangrove	*Hibiscus tiliaceus, Rhizophore mucronata, Bruguiera gymnorrhiza*

Common Name	*Scientific Name*
Narrow leaved Paperbark	*Melaleuca alternifolia, Melaleuca linariifolia*
Prickly Paperbark	*Melaleuca styphelioides*
Red Bloodwood	*Corymbia gummifera*
Red Mahogany	*Eucalyptus resinifera*
Swamp Mahogany	*Eucalyptus robusta*
Swamp Oak	Casuarina glauca

9. Tableland Eucalypts – Moist and Semi-Moist

Description

- ✓ To be a Tableland Type the majority of the canopy species must be species unique to the Tablelands.
- ✓ Include moist and semi-moist sclerophyll forest between 30 m and 60 m in height and generally above 750 m elevation.
- ✓ Not distinguished by its understory
- ✓ Sheltered or semi-sheltered sites
- ✓ Soils ranging from deep and fertile soils to moderately fertile,
- ✓ Reliable rainfall.
- ✓ Brown Barrel can be a dominant species as can better formed stands of New England Blackbutt, Silvertop Stringybark, Messmate, Maiden's Gum, Manna Gum and Narrow-leaved Peppermint.

Canopy Indicator Species

Common Name	*Scientific Name*
Blue Mountains Ash	*Eucalyptus oreades*
Brown Barrel	*Eucalyptus fastigata*
Maiden's Gum (Monkey Gum)	*Eucalyptus cypellocarpa*
Manna Gum (Ribbon Gum)	*Eucalyptus viminalis*
Messmate	*Eucalyptus obliqua*
Mountain Gum	*Eucalyptus dalrympleana*
Narrowleaved Peppermint	*Eucalyptus radiata*
New England Blackbutt	*Eucalyptus andrewsii*
Silvertop Stringybark	*Eucalyptus laevopinea*
Sydney Blue Gum	*Eucalyptus saligna*
Tallowwood	*Eucalyptus microcorys*
White-topped Box	*Eucalyptus quadrangulata*

10. Tableland Eucalypts – Dry

Description

- ✓ To be a Tableland Type the majority of the canopy species must be species unique to the Tablelands.
- ✓ Dry sclerophyll forest usually 30 m in height or less generally above 750m elevation.
- ✓ Forest dominated by more than 50% Tableland eucalypt species
- ✓ Exposed sites, shallow and low-mod fertility soils.
- ✓ Includes forests dominated by Stringybark species.

Canopy Indicator Species

Common Name	*Scientific Name*
Black Cypress Pine	*Callitris endlicheri*
Blakely's Red Gum	*Eucalyptus blakelyi*
Broad-leaved Stringybark	*Eucalyptus caliginosa*
Cabbage Gum	*Eucalyptus amplifolia*
Caley's Ironbark	*Eucalyptus caleyi*
McKie's Stringybark	*Euclayptus mckieana*
Moonbi Apple	*Eucalyptus malacoxylon*
Narrowleaved Peppermint	*Eucalyptus radiata*
New England Blackbutt	*Eucalyptus andrewsii*
New England Blackbutt (Gum-topped Peppermint)	*Eucalyptus campanulata*
Rough-barked Apple	*Angophora floribunda*
Scribbly Gum	*Eucalyptus rossii*
Silvertop Ash	*Eucalyptus seiberi*
Silvertop Stringybark	*Eucalyptus laevopinea*
Snow Gum	*Eucalyptus pauciflora*
Tenterfield Woollybutt	*Eucalyptus banksii*
White Cypress	*Callitris glaucophylla*