Ecological attributes determining tree species richness and basal area in the subtropical and tropical forests of Queensland, Australia

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Queensland Herbarium

China
Highest point 8752m
Lowest -152m
Land area 9,600,000 km^2
Population 1.3 Billion

Australia
Highest point 2379m
Lowest -29m
Land area
7,000,000km^2
Population 20 Million

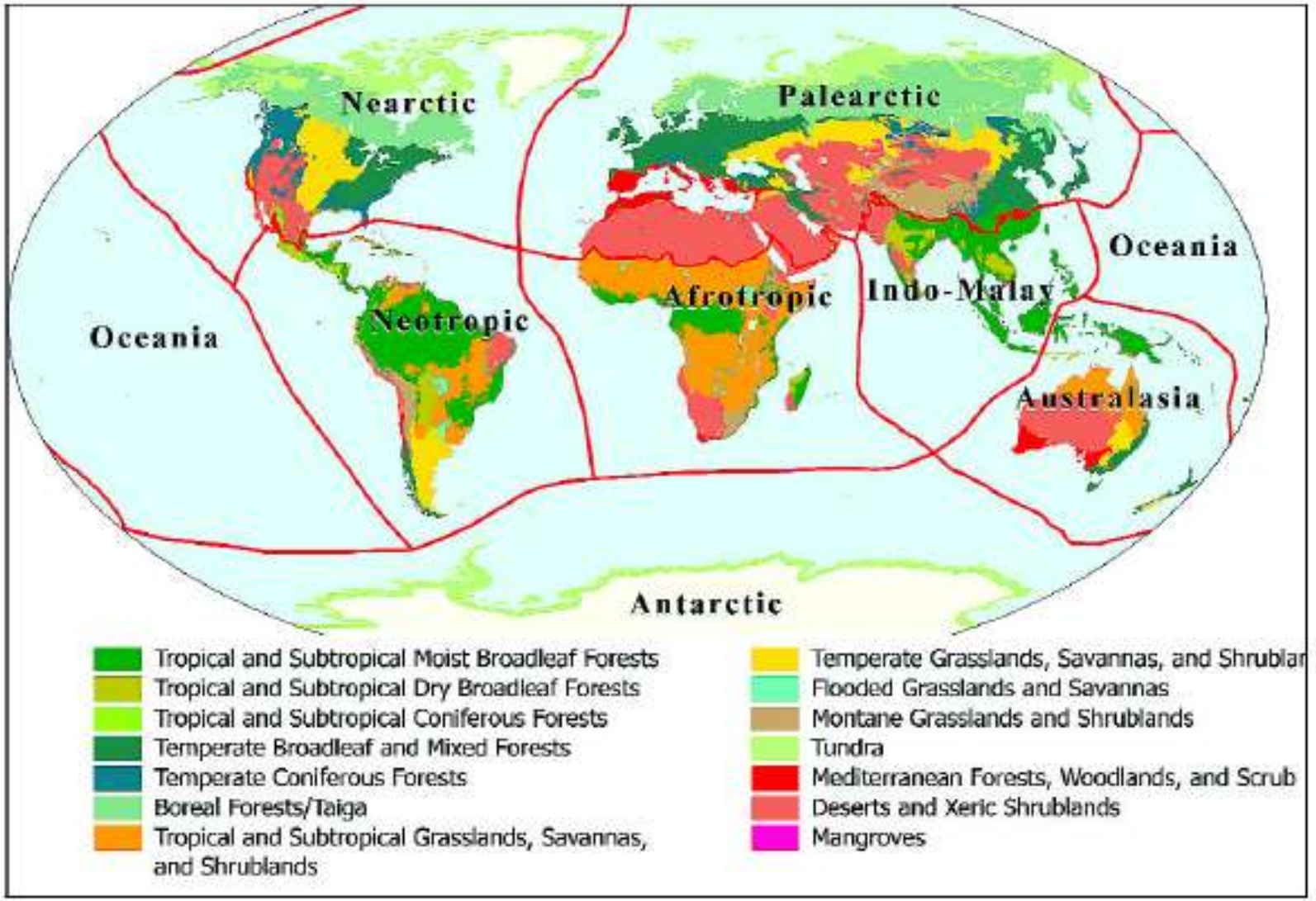


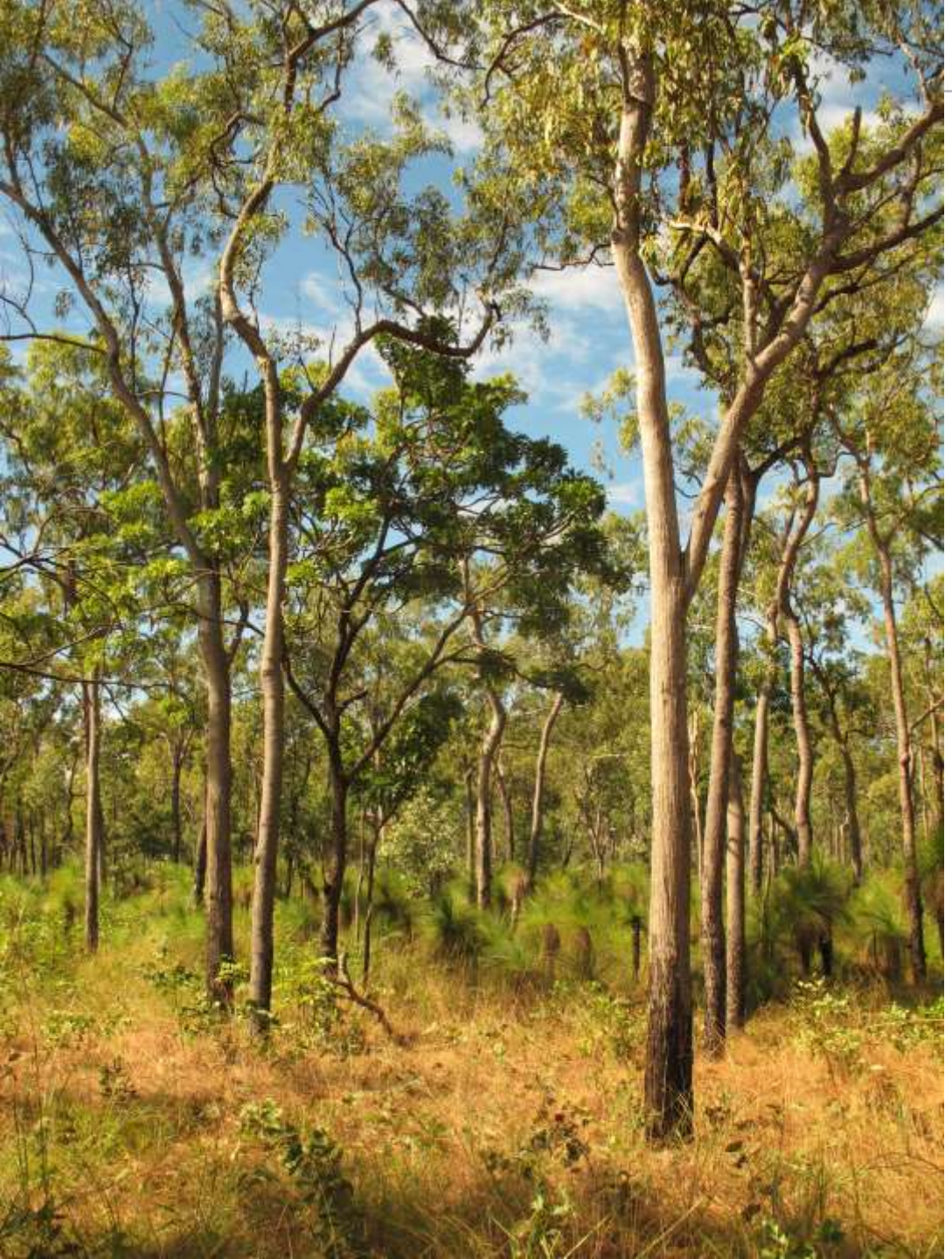
Figure 1. The ecoregions are categorized within 14 biomes and eight biogeographic realms to facilitate representation analyses.

Olson *et. al* 2001 Biosciences 51:933-38

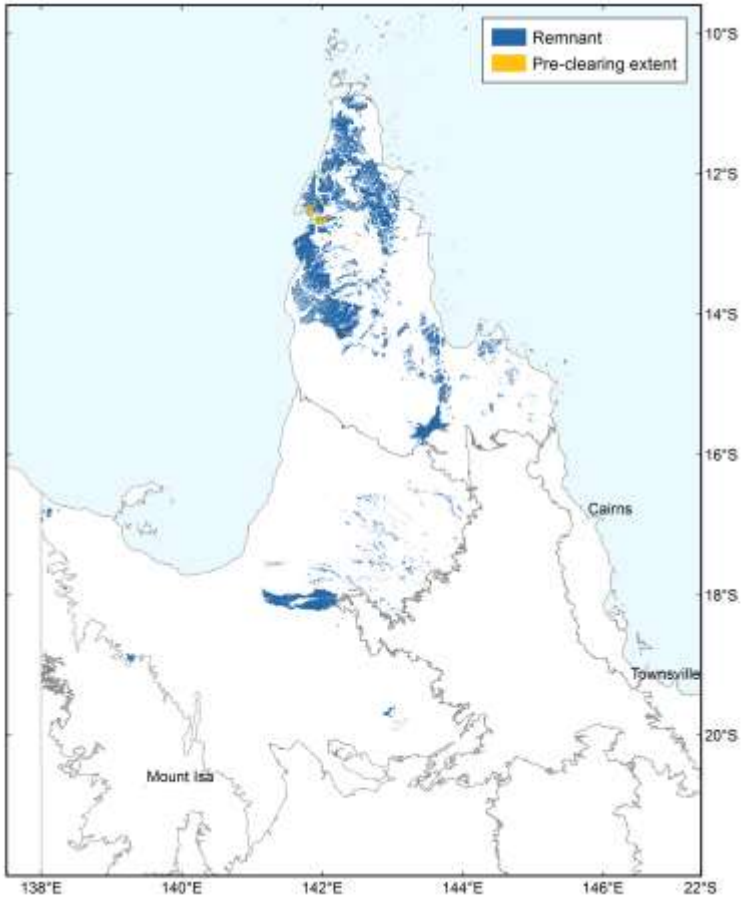
Rainfall ranges from >8000mm in Wet Tropics to <200mm in Simpson Desert in SW

Vegetation ranges from rainforest to arid ephemeral grasslands

Rainforests in the northeast Wet Tropics



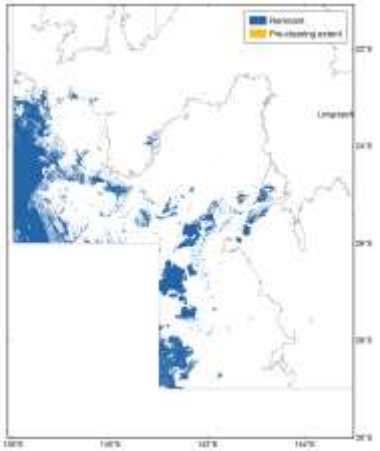
Tropical eucalypt woodlands in the north on Cape York Peninsula



Temperate eucalypt woodlands in the New England Tablelands

Queensland Government

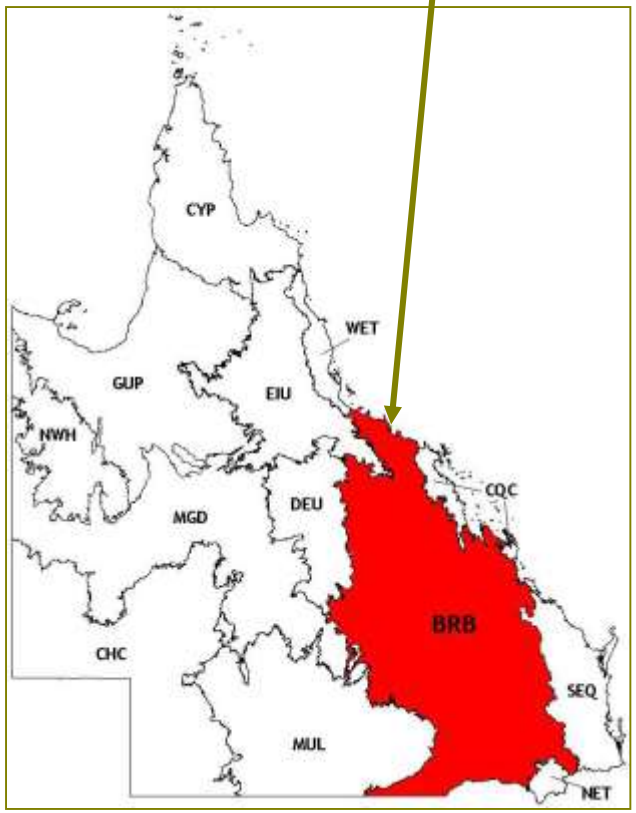
Hummock grasslands in arid southwest channel country

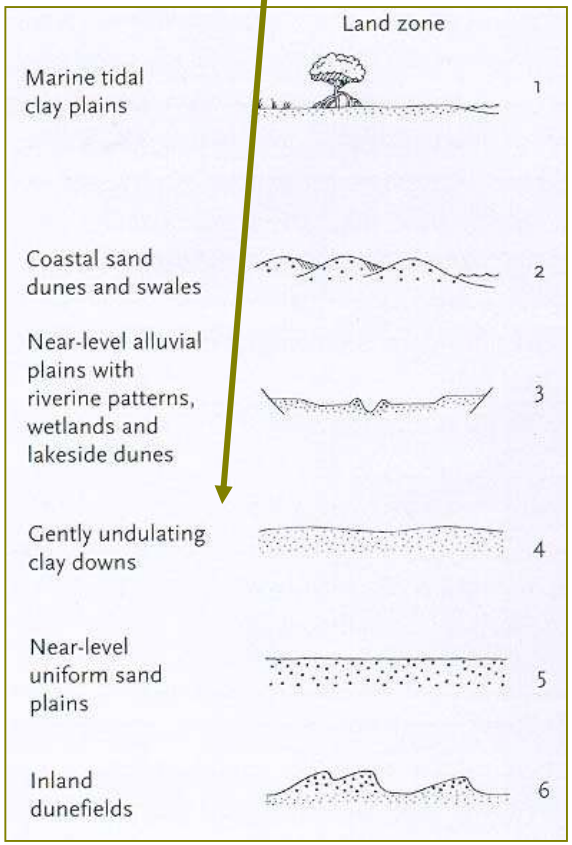


Regional Ecosystem Framework

RE 11.4.3 Brigalow-belah shrubby open forest

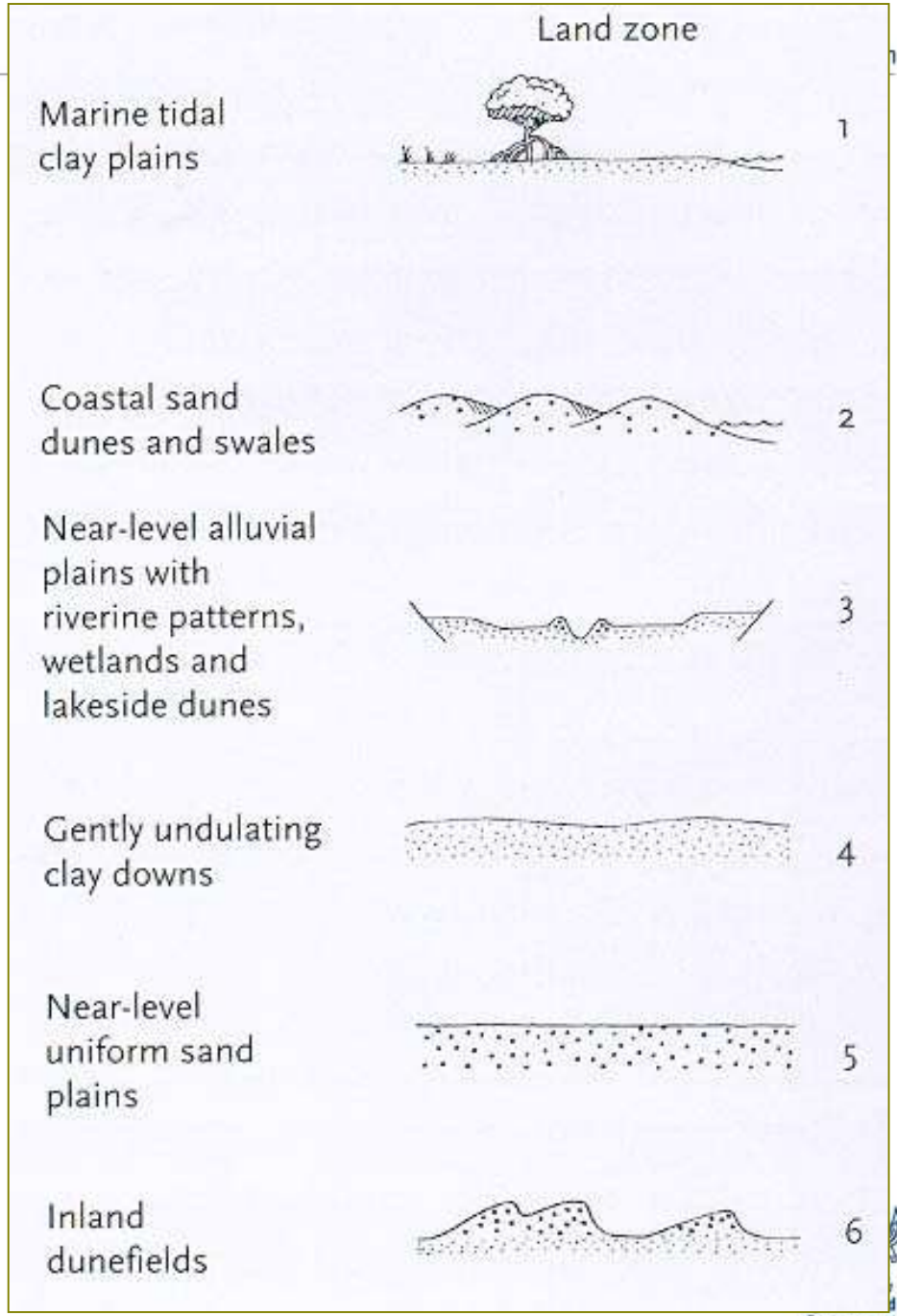
BIOREGION (11) LAND ZONE (4) VEGETATION COMMUNITY (3)





Landscapes within bioregions are classified into 12 land zones.

Land zones represent a significant difference in geology and associated landforms and soils.



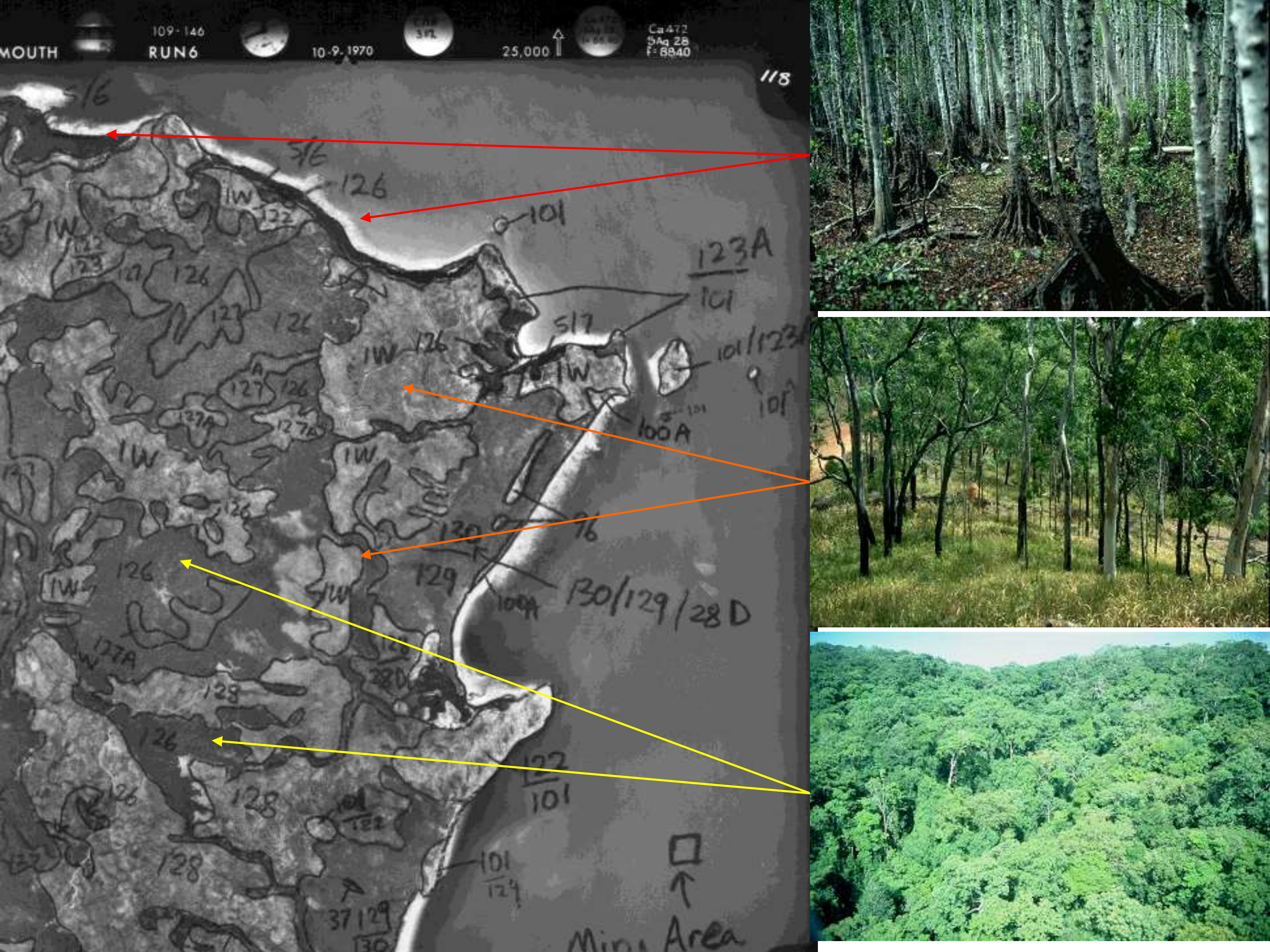
1

3

5

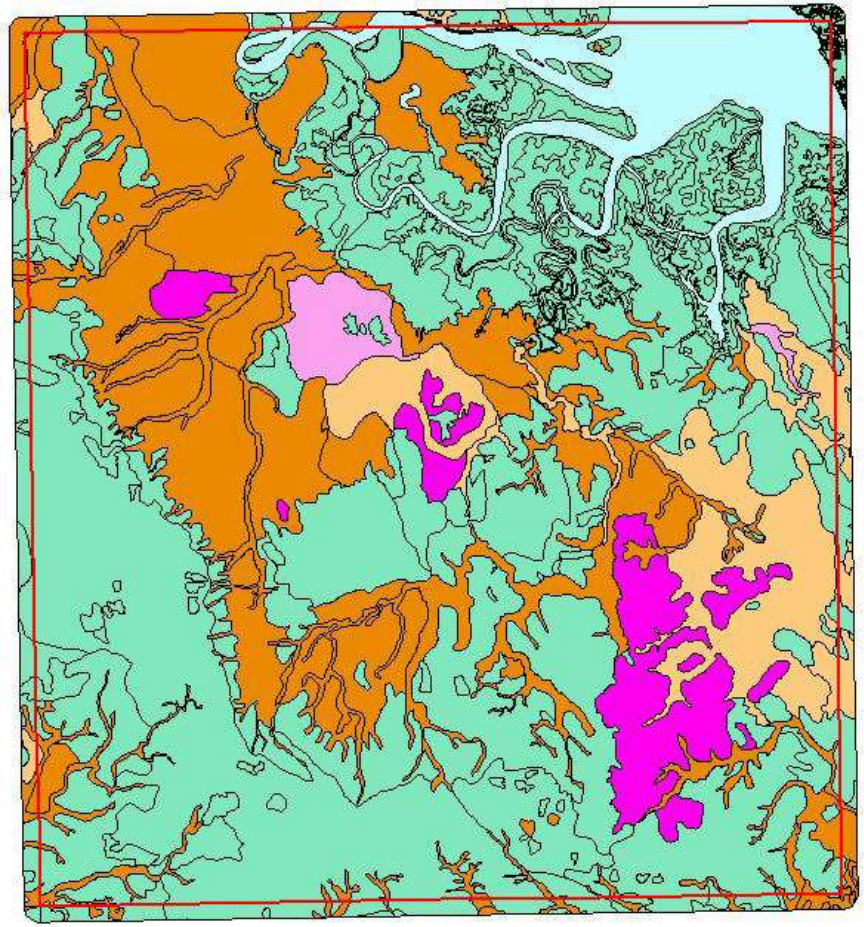
Land zone

Marine tidal clay plains		1
Coastal sand dunes and swales		2
Near-level alluvial plains with riverine patterns, wetlands and lakeside dunes		3
Gently undulating clay downs		4
Near-level uniform sand plains		5
Inland dunefields		6

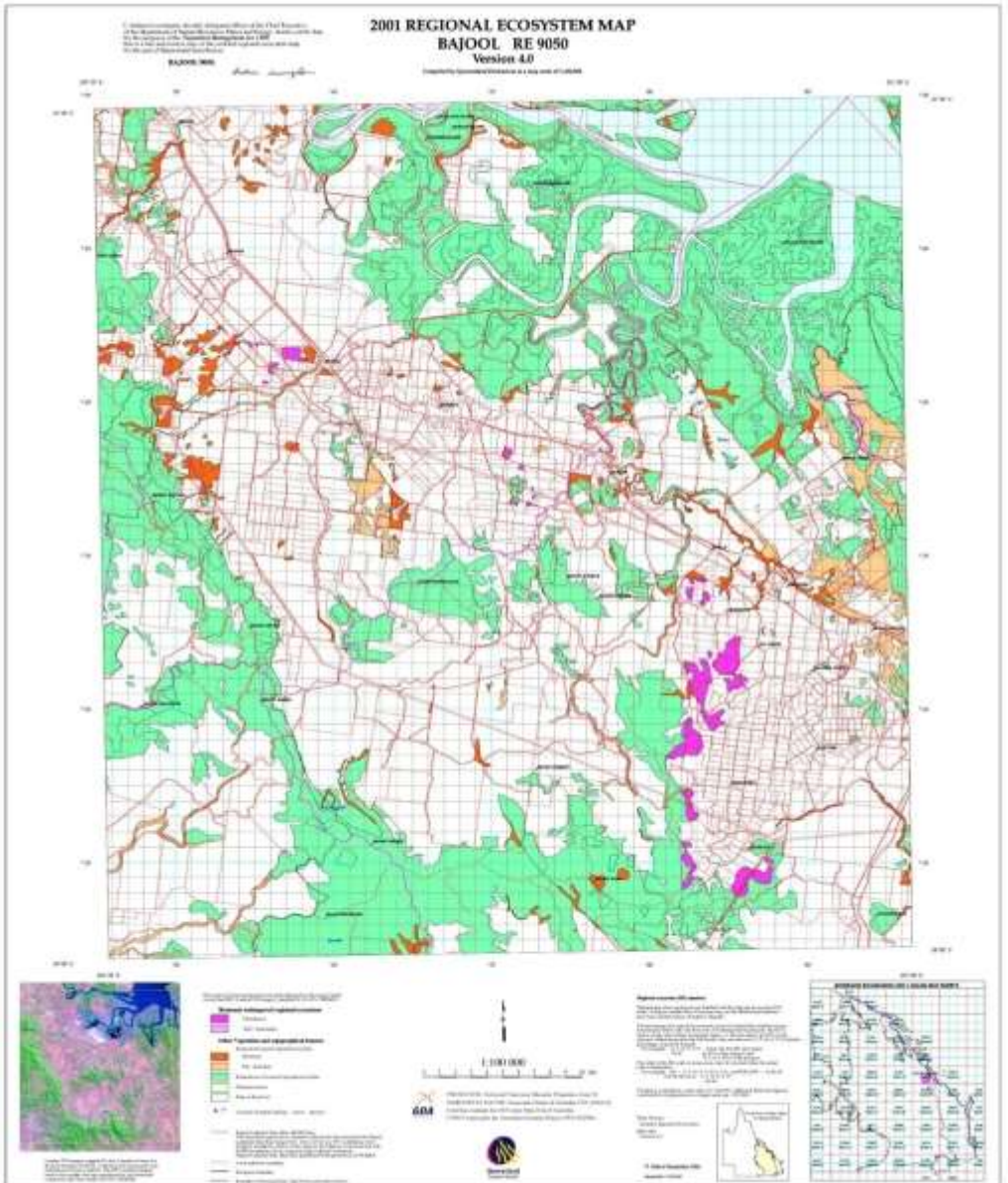


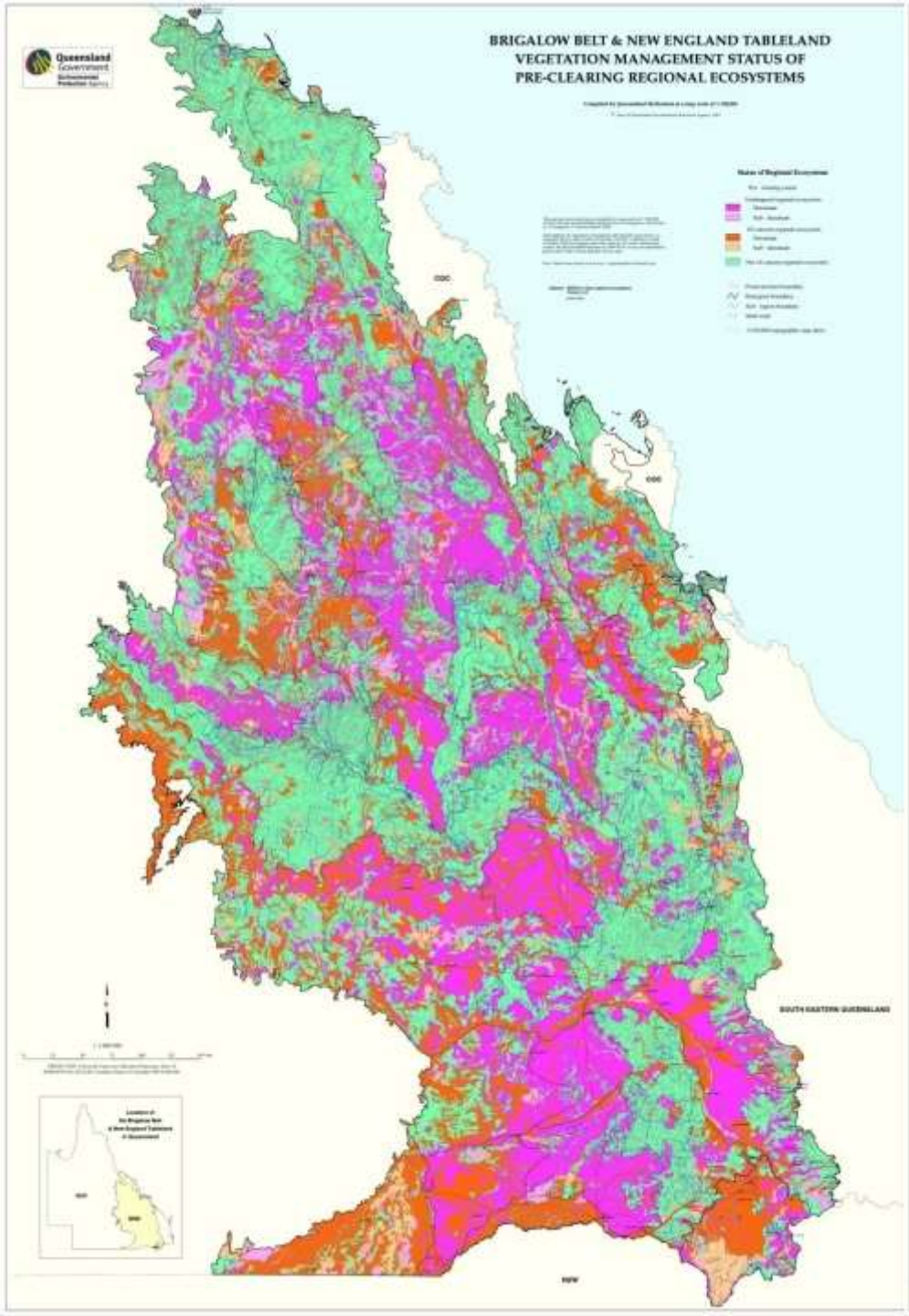
MOUTH
109-146
RUN6
10-9-1970
25,000
Ca 472
5Ag 28
F-8840
118
5/6
126
101
123A
101
517
IW
101/123A
101
100A
96
130
129
130/129/28D
127
127A
128
28D
122
101
101
124
Area

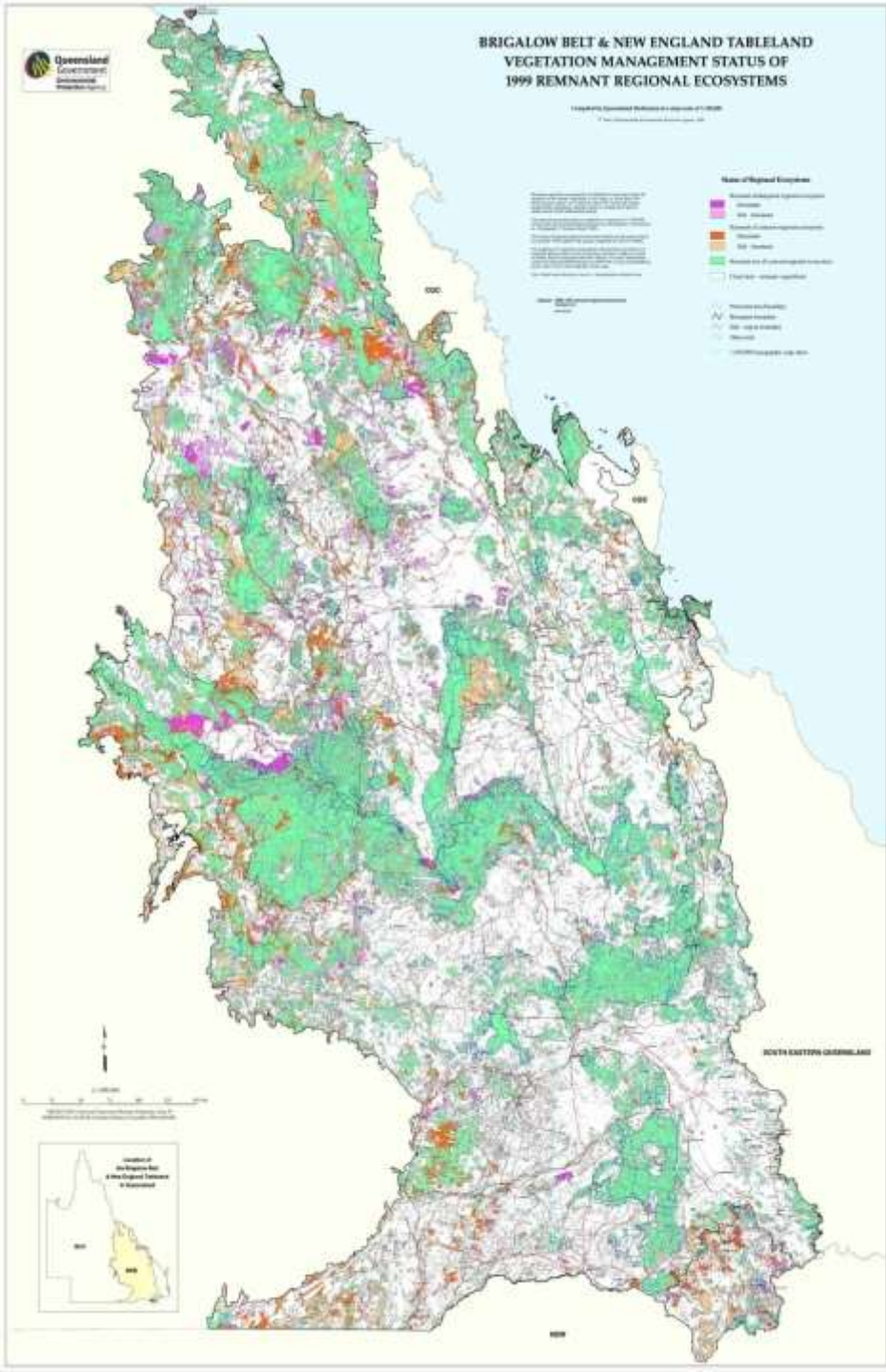
Bajool 1:100,000 Pre-clearing Regional Ecosystems

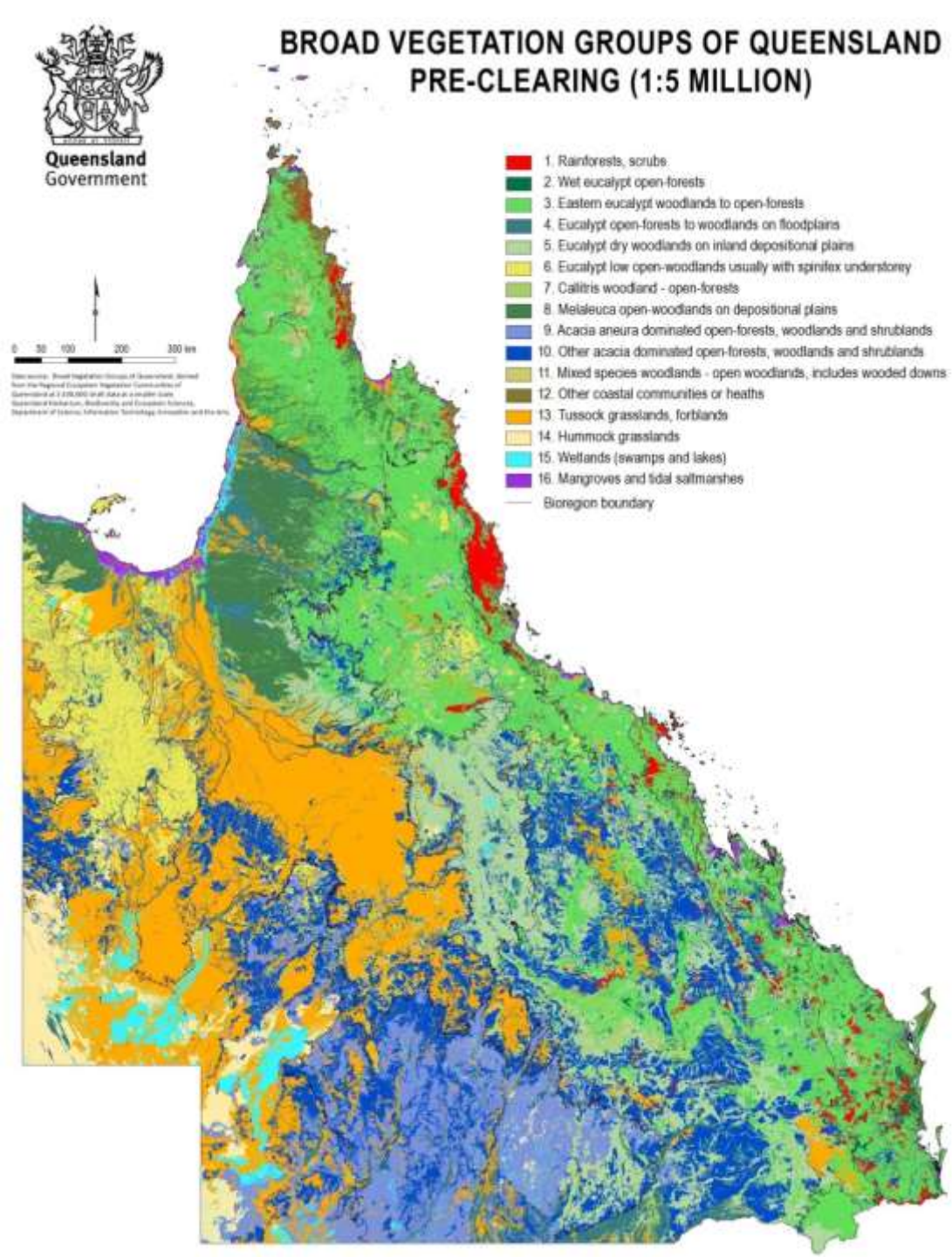


Remnant 2015 Regional Ecosystems




BRIGALOW BELT & NEW ENGLAND TABLELAND
VEGETATION MANAGEMENT STATUS OF
PRE-CLEARING REGIONAL ECOSYSTEMS
Queensland Government
Environmental Protection Agency
QLD
NSW
SOUTH EASTERN QUEENSLAND


BRIGALOW BELT & NEW ENGLAND TABLELAND
VEGETATION MANAGEMENT STATUS OF
1999 REMNANT REGIONAL ECOSYSTEMS
Queensland Government
Environmental Protection Agency
QLD
NSW
SOUTH EASTERN QUEENSLAND



Broad Vegetation Groups

1:5M scale 16 BVGs

1:1M scale 98 BVGs

Vegetation communities combined on the basis of floristic, structural and landscape criteria

The Vegetation of Queensland

Descriptions of Broad Vegetation Groups

Queensland Herbarium

Version 3

Forests of Queensland

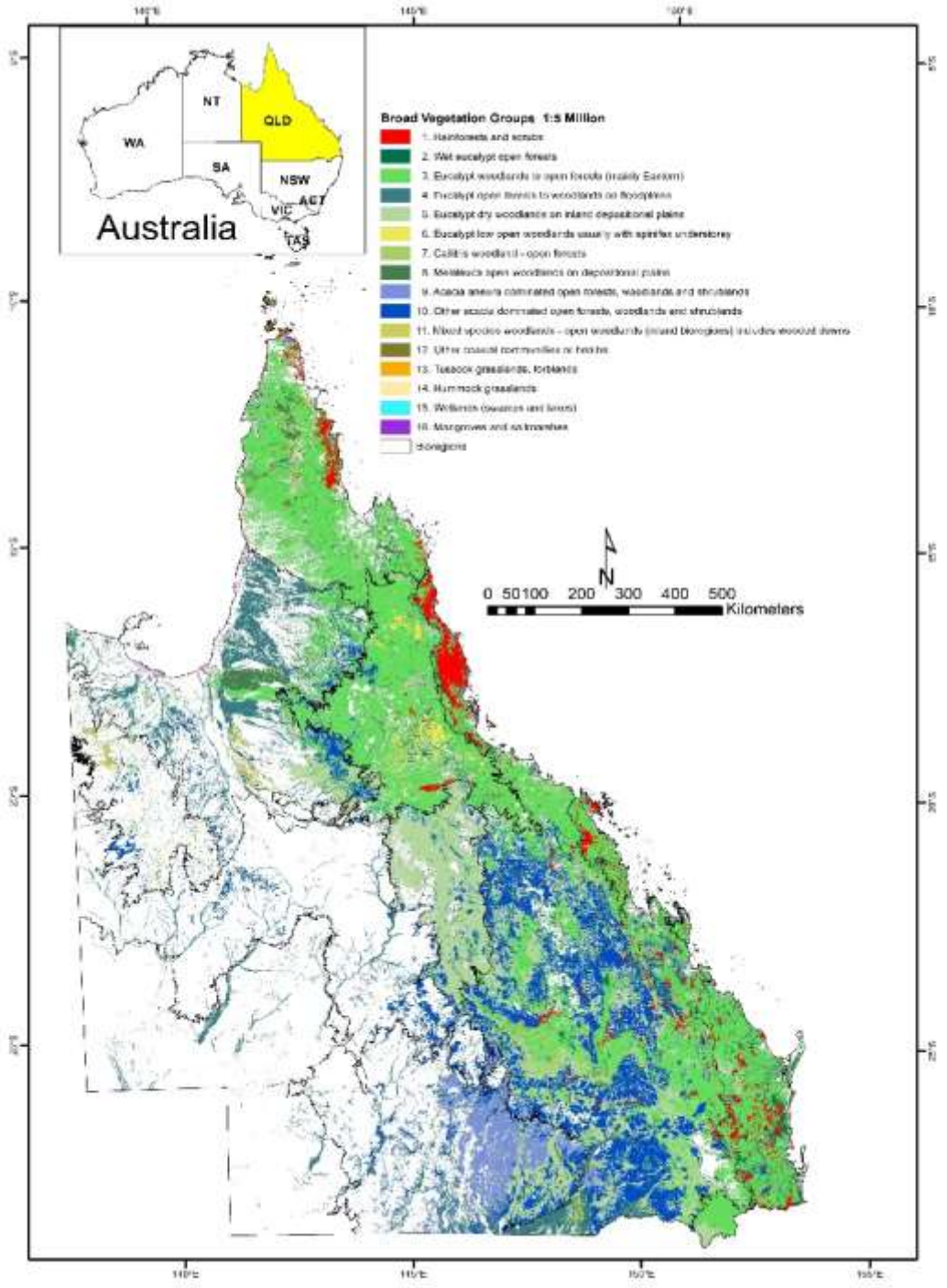
Australia's definition of forest specifies:
- a minimum existing or potential crown cover of 20% and,

- a minimum mature or potentially mature stand height of two metres

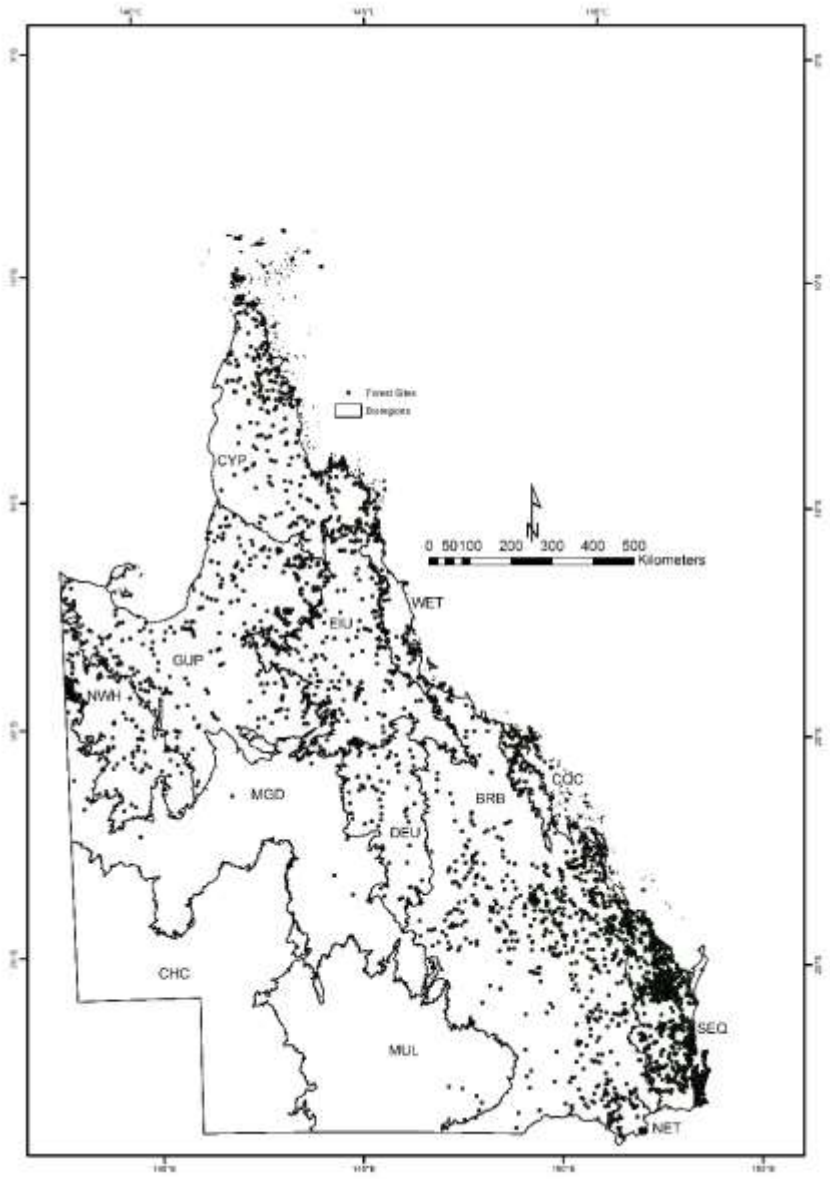
Pre-clearing area = 93.6 million hectares

Remnant 2015 = 62.7 million hectares

Of the 3420 recognised vegetation communities,
2325 meet the definition of forest



4797 CORVEG FOREST SITES



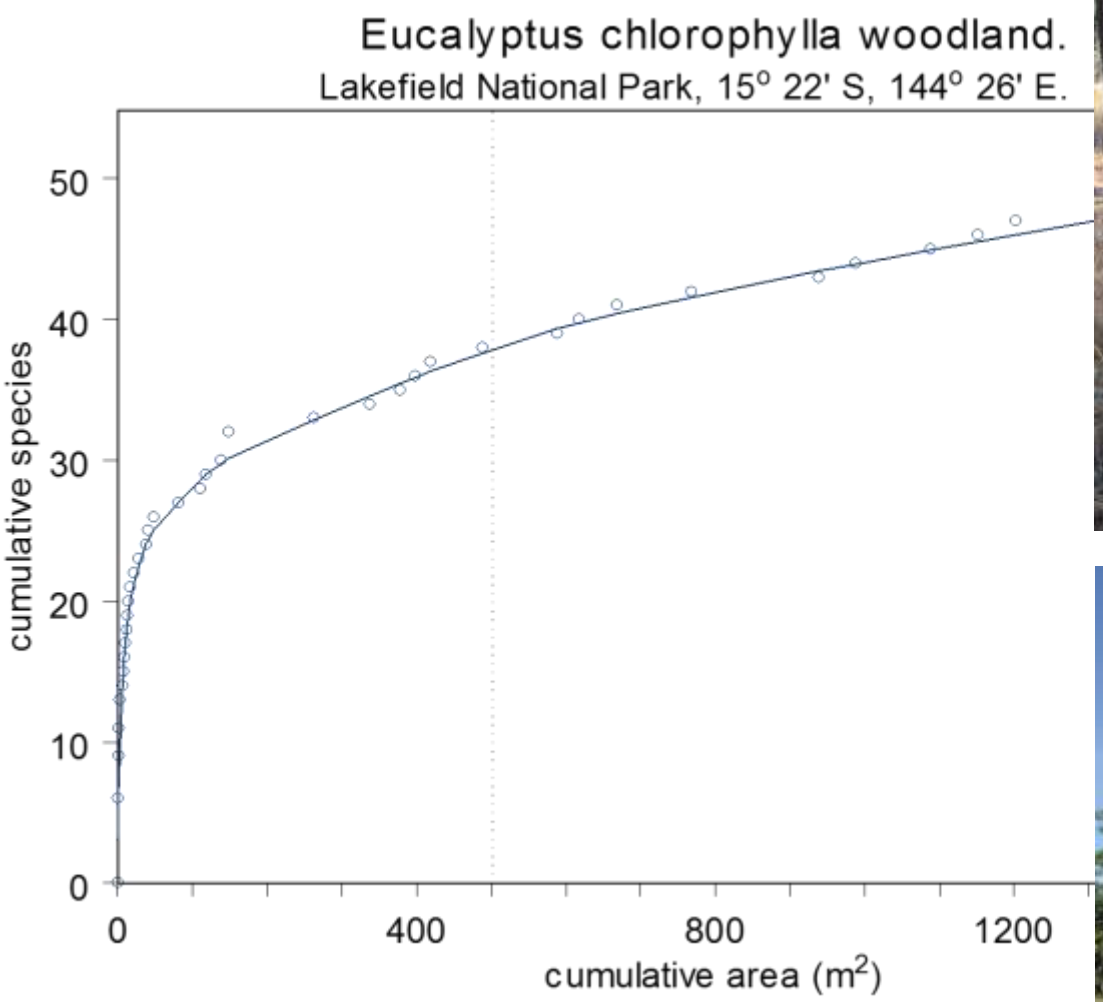
- Standard Methodology
- Floristic data
- Structural data
- Environmental data

Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland

Version 4.0

Access to remote areas is mainly by 4WD,
but also helicopter in savannas

CORVEG sites 50 x 10 m^2



RE 3.3.16

Multiple linear regression modelling

Response variables
Tree basal area (m^2/ha)
Tree species richness

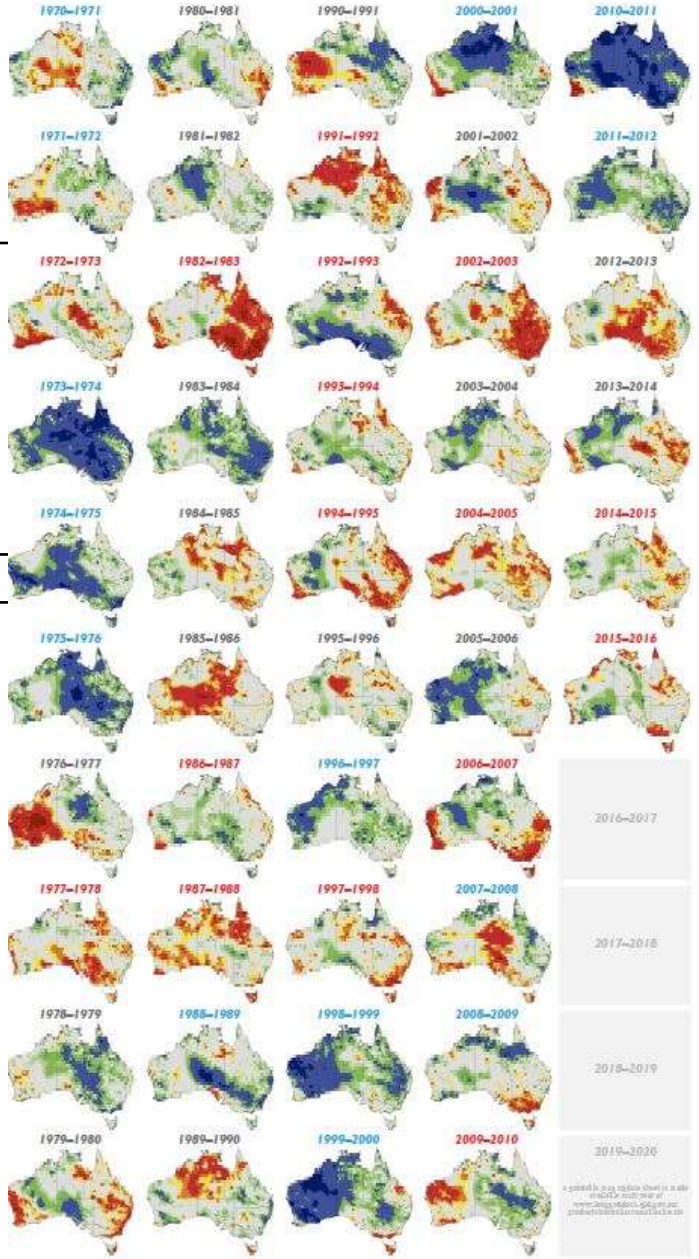
Soil variables
Soil organic carbon %
Soil total nitrogen %
Soil total phosphorus %
Soil clay content %
Soil available water mm^3/mm^3

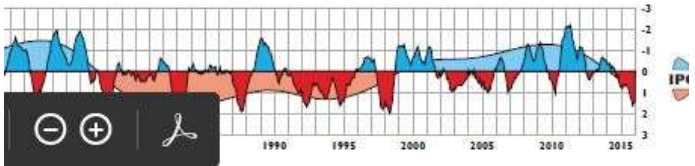
Annual Climatic variables (derived from 128 years)

- Mean annual rainfall
- Max annual rainfall
- Min annual rainfall
- Mean annual evaporation
- Max annual evaporation
- Min annual evaporation
- Mean annual moisture index
- Max annual moisture index
- Min annual moisture Index
- Mean Foley Index
- Max Foley Index
- Min Foley Index
- Mean of annual mean Maximum temperature
- Max of annual mean Maximum temperature
- Min of annual mean Maximum temperature
- Mean of annual mean Minimum temperature
- Max of annual mean Minimum temperature

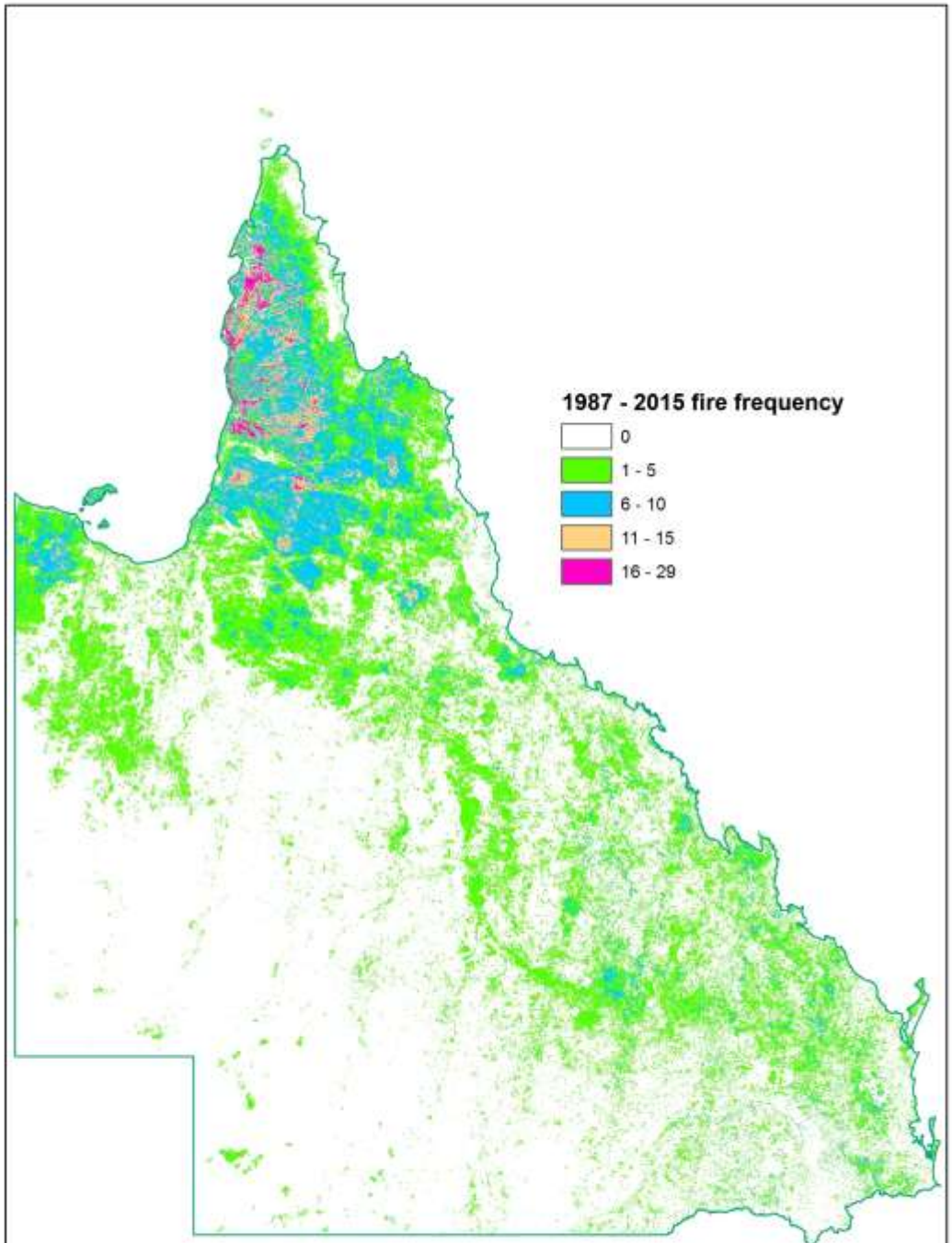
Monthly Climate (1536 months)

- Max monthly rainfall
- Min monthly rainfall
- Max monthly evaporation
- Min monthly evaporation
- Max Foley Index (any month, any year)
- Min Foley Index (any month, any year)
- Max of monthly maximum temperature
- Min of monthly maximum temperature
- Max of monthly minimum temperature
- Min of monthly minimum temperature





Fire frequency – number of years in the past 23, where a fire has occurred in a pixel. Goodwin and Collett (2014). Derived from analysis of Landsat imagery archive



BVG2 tall open forests

BVG3 eastern open forests

BVG5 dry woodlands

BVG6 low open woodlands

All Queensland forests basal area model

4779 sites
13 variables; R^2 53.3%

Soil organic carbon
Soil total nitrogen
Soil total phosphorus
Soil clay content
Fire frequency
Min annual mean max temperature
Min annual maximum rainfall
Max annual mean min temperature
Max annual evaporation
Min monthly maximum temperature
Max monthly minimum temperature
BVG_1M
LANDZONE

Eucalypt forests basal area model

3542 sites
6 variables; R^2 51.7%

Fire frequency
Min annual rainfall
Max annual evaporation
Max monthly evaporation
BVG_1M
LANDZONE

All Queensland forests species richness model

4779 sites
4 variables; R^2 54.2%

Fire frequency
Mean annual rainfall
BVG_1M
LANDZONE

Eucalypt forests species richness model

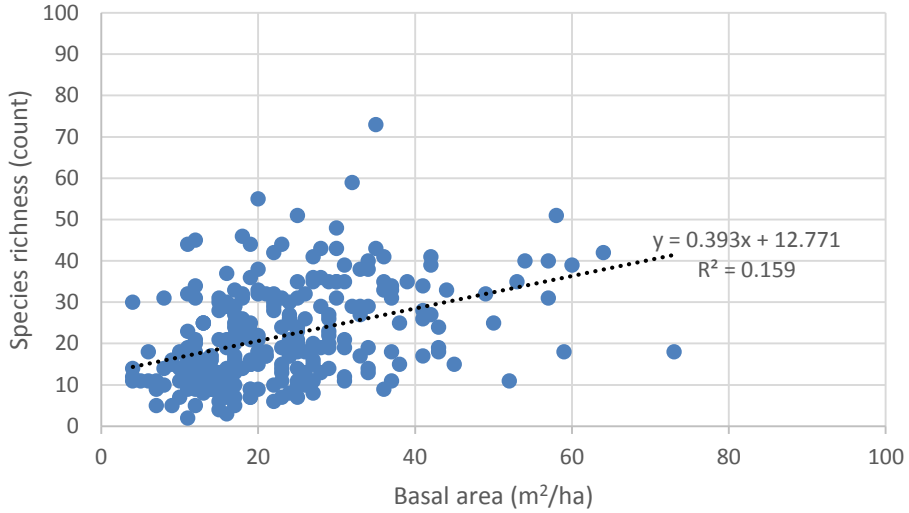
3542 sites
6 variables; R^2 31.0%

Soil organic carbon
Fire frequency
Min annual rainfall
Mean annual rainfall
Min annual moisture index
Min Foley index (monthly)
BVG_1M
LANDZONE

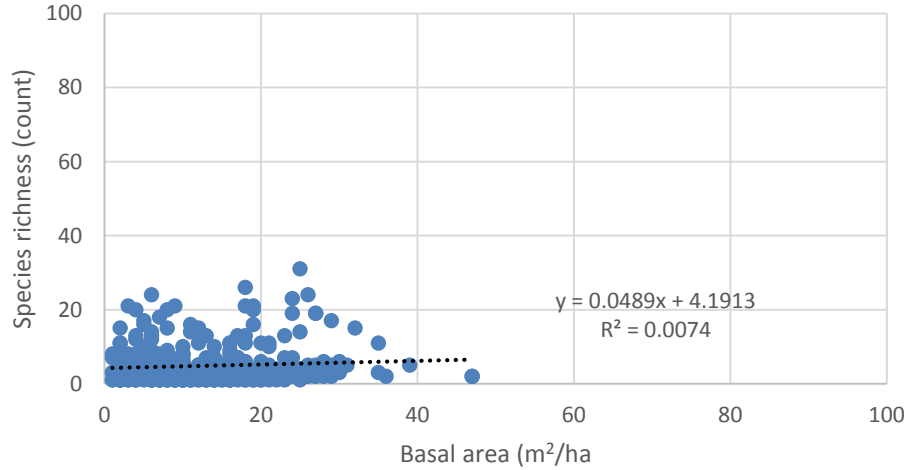
Conclusions

- Queensland's forests covered 93.6 million hectares ha (54.1% of Qld) preclearing, and 67% was in remnant condition in 2015.
- Measures of extreme temperatures, rainfall and evaporation, together with soil fertility attributes, are important explanatory variables of tree basal area
- Fire frequency, land zone and broad vegetation group are highly significant attributes for both tree basal area and tree species richness

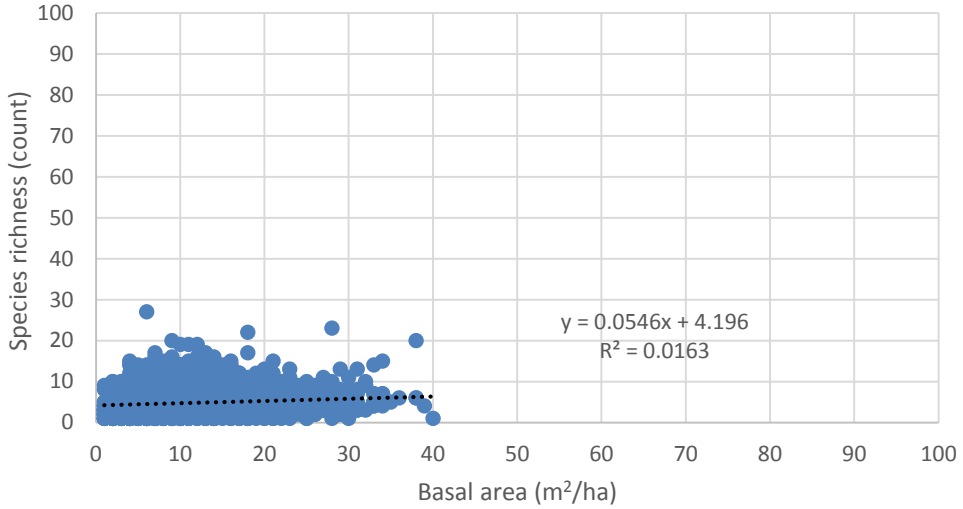
Rainforest



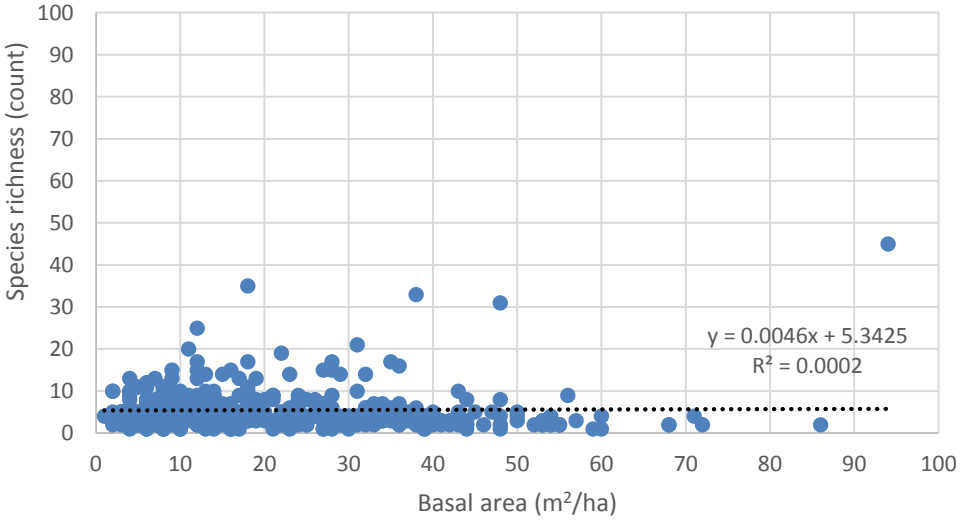
Acacia



Eucalypt



Melaleuca



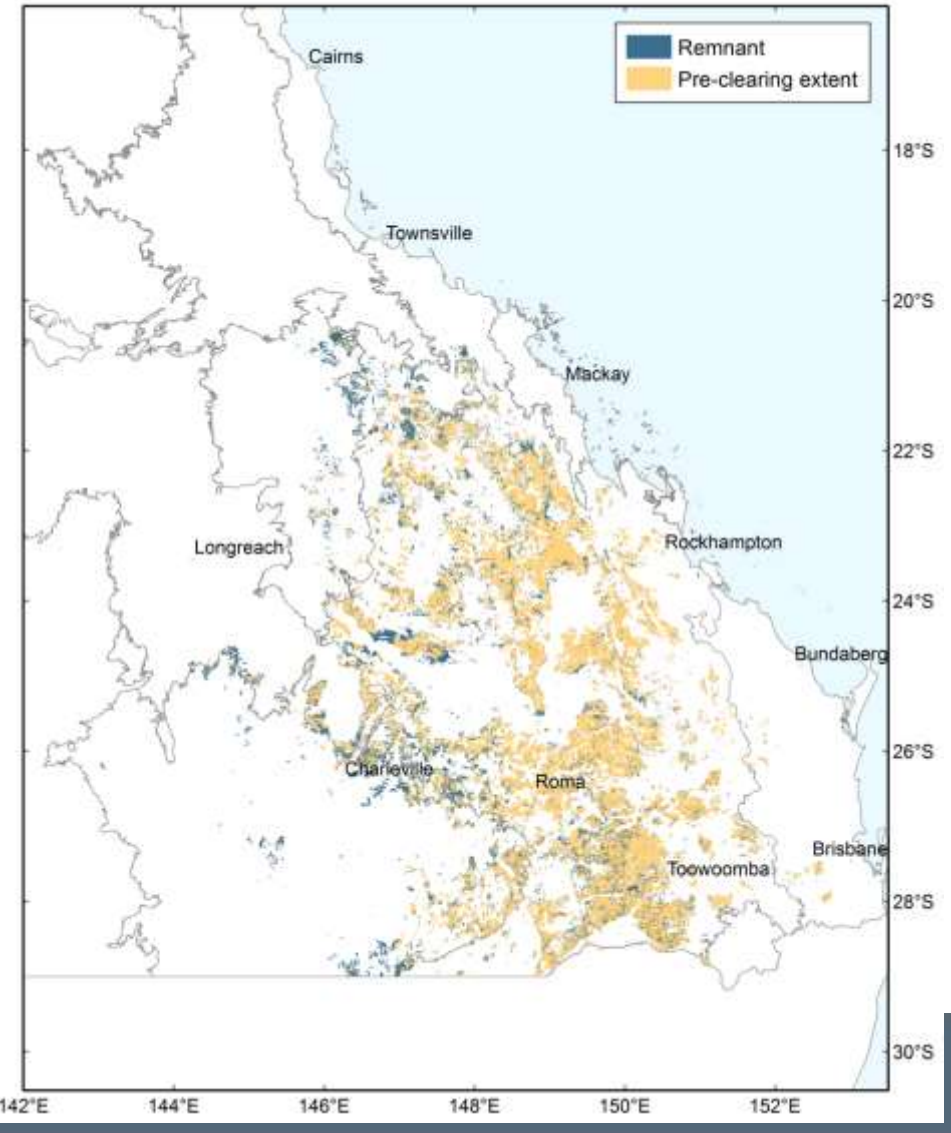
Conclusions

- This study found no clear relationship between the tree species richness and basal area in Queensland forests.

Available resources

- Queensland Herbarium section of the Environment, Land and Water website http://www.qld.gov.au/environment/plants-animals/plants/herbarium/
- Queensland's Regional Ecosystems Database http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/index.php
- For Regional Ecosystem Technical descriptions visit http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/technical_descriptions.html
- Broad vegetation groups http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/bvg.html
- CORVEG data is available through AEKOS http://www.aekos.org.au/collection/qld.gov.au/corveg
- Mapping coverages and publications relating to regional ecosystems are available at https://data.qld.gov.au/dataset/biodiversity-status-of-pre-clearing-and-2015-remnant-regional-ecosystems-queensland-series, and https://publications.qld.gov.au/dataset/redd respectively.

25a *Acacia harpophylla* (brigalow) open-forests to woodlands sometimes with *Casuarina cristata* (belah).



Defines the Brigalow Belt bioregion: 24% of bioregion, with 15% BVG 17a *Eucalyptus populnea* woodlands

Only 13% remnant vegetation

Open-forests in the east, ranging through to woodlands in the west.

Acacia harpophylla is dominant tree. *Casuarina cristata* is often co-dominant

Shrubs: *Eremophila mitchellii, Geijera parviflora, Alectryon oleifolius, Carissa ovata*

Grasses: *Aristida, Paspalidium, Sporobolus* spp.

Forbs: *Atriplex, Einadia, Sclerolaena, Sida spp., Trianthema triquetra*

EPBC listed EC for Brigalow Belt

25a *Acacia harpophylla* (brigalow) open-forests to woodlands sometimes with *Casuarina cristata* (belah).