RESEARCH REPORT

The Wet Sclerophyll and Adjacent Forests of North Queensland

A Directory to Vegetation and Physical Survey Data

G. N. Harrington, M. G. Bradford and K. Sanderson

Rainforest CRC

Cooperative Research Centre for Tropical Rainforest Ecology and Management

THE WET SCLEROPHYLL AND ADJACENT FORESTS OF NORTH QUEENSLAND

A DIRECTORY TO VEGETATION AND PHYSICAL SURVEY DATA

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(Top) Eucalyptus resinifera, feed trees of the Yellow-bellied glider, Windsor Tableland.
(Centre) Fire in wet sclerophyll on the Lamb Range.
(Bottom) Eucalyptus grandis with a dense ground layer of *Imperata cylindrica*, Windsor Tableland.

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ABSTRACT

This report is a directory to the maps of the wet sclerophyll forests that occur to the west of the rainforest areas in North Queensland. The maps were prepared from aerial photographs taken between 1990 and 1994. This report also includes tables that summarise the vegetation and physical measurement data collected from 3,224 plots located within the wet sclerophyll forests.

The 20m x 20 metre plots were arranged to facilitate sampling of the different classes of vegetation comprising the wet sclerophyll forests. Transects were located on the Mt. Windsor Tableland, Carbine Tableland, Lamb Range, Herberton Range, Longlands Gap, Koombooloomba, Kirrama, Wallaman Falls and the Paluma Range.

This study found that 48% of wet sclerophyll forest was invaded by rainforest at the time the aerial photos were taken and that *Eucalyptus grandis* forest proved most susceptible, with 80% of the area invaded.

ACRONYMS AND ABBREVIATIONS

AGR......Awned grasses (*Themeda triandra* dominant)

CT.........Carbine Tableland

DBH......Diameter Breast Height

F ....Ferns, e.g. *Pteridium* spp.

FBS ......Forbs

GRC .....Ground creepers, e.g. *Hardenbergia violacea*

HR ....Herberton Range

IC..........*Imperata cylindrica* and *Heteropogon triticeous*

KI ....Kirrama

KO ....Koombooloomba

LG.........Longlands Gap

LR.........Lamb Range

OS ....Other sedges, e.g. *Cyperus* spp.

PH ....Perennial herbs

PR ....Paluma Range

SGR......Other grasses, e.g. *Panicum* spp. and *Oplismenus* spp.

TS.........Tussock sedges, e.g. *Gahnia aspera*

V ....Vines, e.g. *Maesa dependens* var.*dependens*

WF........Wallaman Falls

WP........Woody plants

WT........Windsor Tableland

X ....Xanthorrhoeoids, e.g. *Lomandra* spp.

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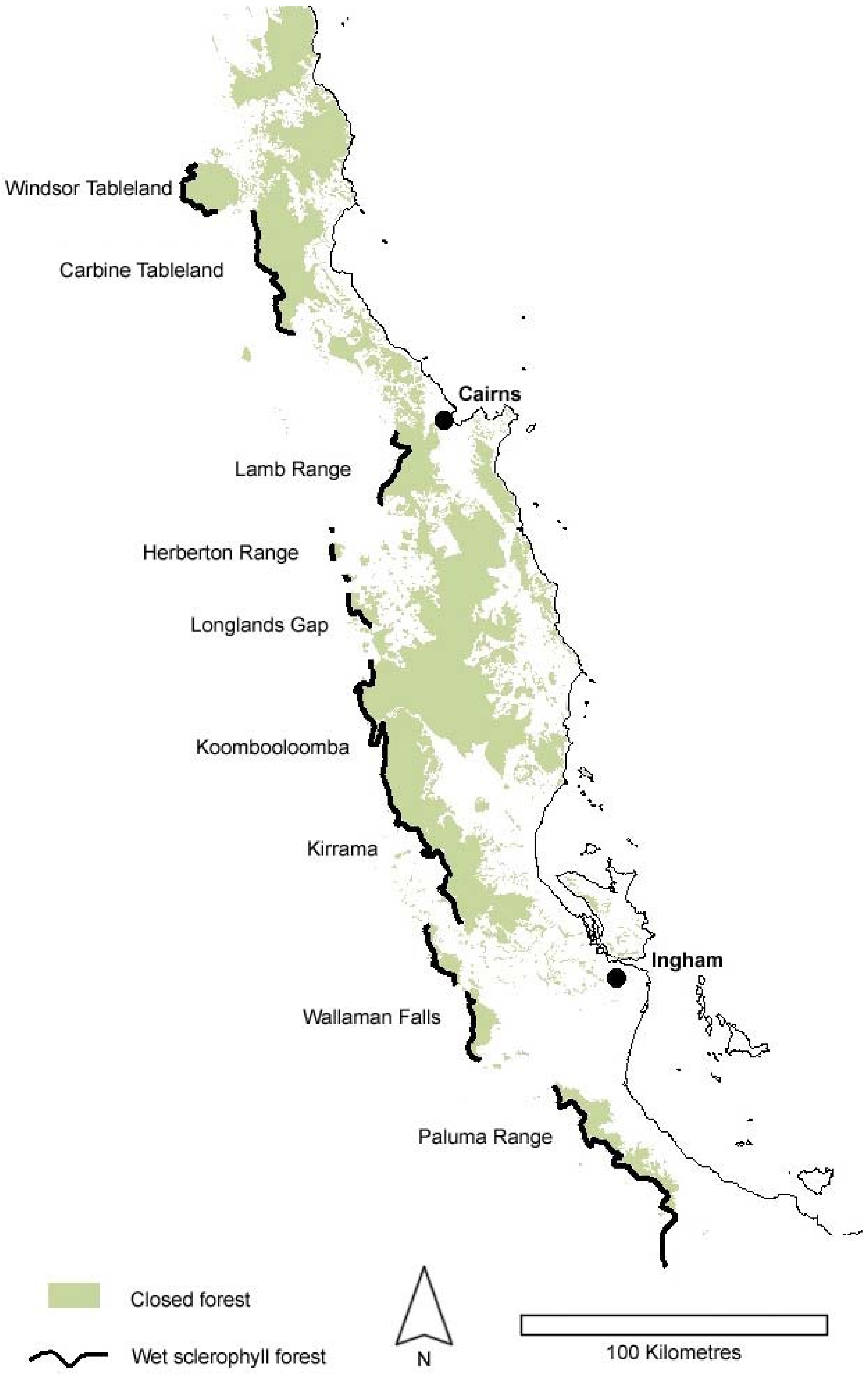

Figure 1. The Wet Tropics of North Queensland showing the area of wet sclerophyll forest on the western edge of the closed forest and the nine surveyed transects. (Map prepared by M. Bradford, CSIRO. Closed forest data provided by Wet Tropics Management Authority).

1. INTRODUCTION

This report was compiled to accompany and explain the Vegetation Type maps of the wet sclerophyll forests of North Queensland, initially prepared by the authors (Appendix 4, maps 1 to 26). It also provides a summary of the ground-truthed data available, and to describe how the maps and data were assembled.

These maps are supported by ground-truthed measurements of the vegetation and the sites' physical characteristics at 3,224 points within the area. For a complete description and analysis of the data outlined in this report refer to Harrington *et al*. (2000).

The area targeted was the vegetation ecotone along the western edge of the North Queensland rainforest. This area extends from the Mt. Windsor Tableland (Lat. 16° 08' S, Long. 144° 53' E) near Mossman in the north, to the Bluewater area (Lat. 19° 20' S, Long. 146° 30' E) north-west of Townsville in the south (Figure 1). The wet sclerophyll forest to the east of the coastal ranges was not included in this survey.

The maps presented here establish the boundaries of the Vegetation Types described by Harrington and Sanderson (1994) as they appeared on aerial photos acquired between 1990 and 1994. These maps provide a baseline against which future or past vegetation change can be assessed.

2. METHODS

We delineated the boundary between the rainforest and the open forest and also between distinguishably different vegetation patterns within the open forest and woodland communities on 1:25,000 aerial photographs that were taken between 1990 and 1994. The details of the photography used are available in Appendix 1.

We assigned the vegetation patterns to different vegetation classes as described by Harrington and Sanderson (1994). The structural and physical definition of these classes or vegetation types is described in Appendix 2 and summarised in Table 1.

The Vegetation Type boundaries were transferred from the aerial photographs onto two-dimensional 1:50,000 topographic map sheets using a Zoom Stereo Scope. These boundaries were then digitised into the ARCINFO GIS system installed at the CSIRO Tropical Forest Research Centre in Atherton.

Table 1: Summary of the Vegetation Types used in the study.

Vegetation Type	Description
Type 1	Tall wet sclerophyll forest with a *Eucalyptus grandis* dominated canopy and a grass/sedge ground layer.
Type 2	Tall wet sclerophyll forest with a *E. grandis* dominated canopy and a young rainforest understorey.
Type 3	Rainforest with *E. grandis* emergents.
Type 4	Mixed species tall wet sclerophyll forest with a grass/sedge ground layer.
Type 5	Mixed species tall wet sclerophyll forest with a young rainforest understorey.
Type 6	Mixed species tall wet sclerophyll forest with a sclerophyll understorey.
Type 7	Mixed species medium sclerophyll forest with a grass ground layer.
Type 8	Sclerophyll woodland.
Type 9	Tall wet sclerophyll forest where photo-interpretation cannot distinguish between Type 5 and Type 6.

2.1 AIR PHOTOGRAPH INTERPRETATION OF FOREST TYPES

The targeted area for interpretation and mapping was restricted to the band of wet sclerophyll forest and associated woodland that bordered the western edge of the rainforest (Figure 1).

The western cut-off point for interpretation was the open woodland, where there was little chance of the wetter eucalypt types occurring. To the east, interpretation ceased as the land fell in altitude toward the coast or where eucalypt forest occurred on the eastern side of the main rainforest block. In a small number of cases we mapped these eastern areas to show the continuation of some of the forest types. No attempt was made to predict the original vegetation type in disturbed areas where enough vegetation had been removed to cause sufficient doubt at to its type.

2.2 RAINFOREST / SCLEROPHYLL BOUNDARIES

The rainforest/sclerophyll boundary is usually easy to distinguish on aerial photographs. The rainforest canopy appears as a dense smooth image and is dark green in colour, while the *Eucalyptus* dominated sclerophyll forest appears as a taller, broken canopy structure, lighter green in colour and less dense in texture.

2.3 VEGETATION TYPES OF THE OPEN FOREST AND WOODLAND

Vegetation Types 1, 2 and 3 (Table 1) are distinguished from other Types by the visible white branches and fuzzy, pale pattern imposed by the foliage of the dominant *Eucalyptus grandis*. The herbaceous ground cover in Type 1 can be identified by the smooth, pale yellowish-green signature seen through the tree crowns and in canopy gaps. This contrasts with the rainforest understorey in Type 2 that provides a dark green, uneven background beneath the canopy. Type 3 is dominated by the dark green, dense canopy of the rainforest, however emergent *Eucalyptus grandis* crowns are visible because of their white branches and pale foliage. Type 3 becomes progressively more difficult to detect as the rainforest matures and *Eucalyptus grandis* trees die off. They frequently occur as small patches or single trees that may be overlooked in photo-interpretation. The boundary between *Eucalyptus grandis* dominated forest and other sclerophyll forest types is usually abrupt and can be delineated on aerial photographs with accuracy.

Vegetation Types 4, 5 and 6 (Table 1) are identified by a characteristically uneven canopy of large-crowned, tall (>35m) *Eucalyptus* trees with obvious emergents. *Eucalyptus grandis* may occur but its characteristic image never dominates the canopy or the emergents. Both the sizes of the tree crowns and the heights of the trees are clearly larger than in Type 7. It is more difficult to see the ground signature through the tree canopy in Types 4, 5 and 6 than it is in Type 1.

Grasses and sedges dominate the herbaceous layer in Type 4 (Table 1). These are seen as light green to yellow areas within canopy gaps that contrasts with the dark-green, uneven signature of the young rainforest in Type 5. This background is similar to that in Type 2. The transition from a grass/sedge understorey to a rainforest understorey is often difficult to pinpoint exactly on aerial photographs.

Type 6 is indistinguishable from Type 5 on aerial photos. To the human eye, the sclerophyllous shrub understorey provides a similar pattern to that of a rainforest understorey. However, if the area is remote from the rainforest boundary, the understorey is unlikely to be composed of rainforest species and may be classified as Type 6 with confidence – but as only a very small area was designated as Vegetation Type 6 in this study, no data on this type is included in this report (Table 1).

Type 7 is similar to Type 4 in colour and texture but the canopy is lower and emergents are rare, mostly confined to gullies. There is a transition between Types 4 and 7 as the emergent trees decrease in density; therefore the boundary between the two is arbitrary (Table 1).

Type 8 occurs at the driest end of the ecotone in this study. It is distinguished from Type 7 by the spaces between tree crowns and lower height of the trees. Again, the boundary between the two is arbitrary. The grassy ground layer is usually light yellowish-green and clearly visible through the discontinuous tree canopy. Type 9 classifies areas of tall forest where no differentiation could be made between the sclerophyll and rainforest understorey using the aerial photographs. No Type 9 lots were established (Table 1).

Areas where the canopy is dominated by *Acacia species* were mapped as *Acacia*. These areas were recognised from aerial photographs by a dense, smooth, homogenous light green image. No plots were established in these areas (Table 1).

2.4 ACCURACY OF AERIAL VEGETATION TYPE IDENTIFICATION

Boundaries between Vegetation Types were determined by the ability to distinguish them on aerial photos. Ground-truthing revealed that areas greater than approximately sixty metres across had been mapped separately. Below this size the area was included as a variation within the prevailing vegetation type.

Ground-truthing revealed that the boundary drawn between the rainforest and sclerophyll forest was accurate to an estimated ±10 metres, and between *Eucalyptus grandis* and mixed eucalypt tall forest to an estimated ±20 metres. Both these forest types are subject to invasion by rainforest. As this is a transitional process, the boundary drawn between invaded and non-invaded forest types has an accuracy of ±40 metres. The boundaries between Types 4 and 7, as well as Types 7 and 8 are less easily determined and can vary by up to ±75 metres.

2.5 FIELD SURVEY

We established nine transects for field surveys in order to quantify a set of physical and vegetation parameters associated with each Vegetation Type. Transects were located at:

1. Windsor Tableland (WT)
2. Carbine Tableland (CT)
3. Lamb Range (LR)
4. Herberton Range (HR)
5. Longlands Gap (LG)
6. Koombooloomba (KO)
7. Kirrama (KI)
8. Wallaman Falls (WF)
9. Paluma Range (PR)

Transects were positioned to sample the latitudinal range of wet sclerophyll forest in North Queensland (Table 2), and ran from the rainforest boundary westwards down the altitude/rainfall gradient through wet sclerophyll forest, medium sclerophyll forest and a few kilometres into the low sclerophyll woodlands. Transects were of various lengths depending on the steepness of the rainfall gradient at the location. The width of each transect varied from ten to twenty kilometres depending on road access. Within each transect, physical and vegetation measurements were made on the 20m x 20m plots. Plots were located along compass bearings that transected each mapped Vegetation Type polygon. The transect lines were decided without reference to contours or other physical features. The aim was to have approximately fifty plots per Vegetation Type on each transect.

Table 2: The nine transects mapped and ground-truthed in this study and their western, eastern, southern and northern limits (coordinates shown as AMG AGD 1966).

Transect No.	Transect Name	West	East	South	North
1	Windsor Tableland (WT)	280950	287208	8189480	8214900
2	Carbine Tableland (CT)	302520	309003	8177975	8183270
3	Lamb Range (LR)	341430	352700	8103430	8120125
4	Herberton Range (HR)	327270	338850	8082340	8091059
5	Longlands Gap (LG)	329651	340050	8069900	8081850
6	Koombooloomba (KO)	334900	350200	8018140	8033850
7	Kirrama (KI)	348200	369980	7980760	7999080
8	Wallaman Falls (WF)	367600	379950	7924925	7951920
9	Paluma Range (PR)	401940	410850	7894972	7908147

The field surveyor was allocated a polygon and the number of plots to be surveyed within it. The length of the line of plots across the polygon was measured and the mean distance between plots was calculated. Once in the field, the surveyor paced along the compass bearing establishing plots at the appropriate interval and at any major ridge tops or valley floors that were crossed, with the limitation that plots were to be set at least twenty metres apart. The aim was to locate the plots on hillsides, ridge tops and in valleys at approximately equal frequencies. This procedure provided 1,411 hill-slope plots, 894 ridge plots and 919 valley plots (Table 3).

Some Vegetation Types only occurred in small areas where it was not always possible to establish the desired number of plots (Table 4). A total of 3,224 plots were identified within an area of approximately 19,000 hectares of wet sclerophyll vegetation located in the Wet Tropics of North Queensland.

Table 3: The number of ridge, hillslope and gully plots in transects 1-9.

Topographic Position	Transect Number									
	1 (WT)	2 (CT)	3 (LR)	4 (HR)	5 (LG)	6 (KO)	7 (KI)	8 (WF)	9 (PR)	Total
Ridge	180	48	150	39	80	110	136	96	55	894
Slope	242	70	241	41	158	212	198	194	55	1411
Gully	174	50	152	40	88	99	149	112	55	919

The plots were recorded during the driest months (August to December) in 1994 and 1995. On pacing to the desired location, the centre and the four corners of the plot were temporarily marked with flagging tape. Plots were aligned to the cardinal points of the compass.

The following parameters were measured or estimated at each plot.

Physical

- latitudinal and longitudinal co-ordinates using a Global Positioning System
- altitude (m)
- aspect (degrees)
- slope (degrees)
- geology[1]
- topographic position (ridge top, hill-slope or valley)
- rock cover (%)[2]
- log cover (%)[2]

Ground Vegetation[3]

- vertical projected cover[2]
- modal height (m)
- percentage of total biomass provided by each of the twelve classes of ground
- vegetation[4]
- names of species contributing more than 10% of total biomass

Shrubs[3,5]

- vertical projected cover (%)[2]
- modal height (m)
- percentage of total shrub biomass by species

[1] Field staff recorded either granite, rhyolite, basalt or alluvium for the 20m x 20m plot only, based on soil and rock appearance.
[2] Field staff were trained to estimate cover by rocks, logs and vegetation so that there was less than 10% difference between observers. No assessment of accuracy was attempted.
[3] The absence of a particular plant species in this data does not mean it does not occur. The limitation of recording only species that contributed 10% or more of the biomass of herbs and shrubs meant that species present at low density were frequently not recorded.
[4] Species on the ground vegetation were assigned to functional groups: *Imperata cylindrical / Heteropogon triticeous*; awned grasses; grasses without awns; tussock sedges; other sedges; perennial forbs; annual forbs; creeping plants; vines; or xanthorrhoeoids. In most cases, *Imperata cylindrica* and *Heteropogon triticeous* could not be quickly separated using the survey techniques employed in the study. *Heteropogon triticeous* showed forms ranging from large clumps to single stems not unlike *Imperata cylindrical*. For this reason, the two species were assigned to the same functional group.
[5] Shrubs were identified as a species that is normally multi-stemmed; and/or is usually less than four metres in height and never becomes a tree; or a true tree species that is less than two centimetres dbh and more than thirty centimetres in height.

Trees[6]

- canopy structure (presence or absence of emergents, continuous or discontinuous upper canopy and continuous or discontinuous sub-canopy [see below]
- height of upper and lower leaf in canopy (m)
- number of stems in dbh size classes 2-9cm, 10-19cm and 20cm increments thereafter
- number of seedlings by species
- basal area of each species of tree as recorded from the centre of the plot using an X1 glass prism; this measure was not confined to the plot

Table 4: The number of plots in each Vegetation Type within each transect.

Vegetation Type	Transect Number									
	1 (WT)	2 (CT)	3 (LR)	4 (HR)	5 (LG)	6 (KO)	7 (KI)	8 (WF)	9 (PR)	Total
Type 1	76	13	47	24	52	56	55	64	21	408
Type 2	66	6	85	16	56	64	85	54	27	459
Type 3	2	0	3	5	7	9	6	29	12	73
Type 4	144	39	135	27	67	99	86	55	33	685
Type 5	98	42	83	15	53	63	121	71	27	573
Type 7	124	40	127	24	59	77	75	55	24	605
Type 8	86	28	63	9	32	53	5	74	1	421
Total	596	168	543	120	326	421	483	402	165	3224

2.6 COMPARISON WITH OTHER WET SCLEROPHYLL FOREST VEGETATION CLASSIFICATIONS IN THE WET TROPICS

Vegetation Types 1, 2 and 3 in this classification equate to the Tracey (1982) Type 14a. Types 2 and 3 indicate the degree of rainforest maturity that was referred to but not mapped by Tracey (1982). Type 3 equate to Tracey's Type 13c. Vegetation Types 4 and 5 in this study equate to Tracey's Type 14b and 14c. Type 5 indicates the replacement of a 'grassy' ground layer by rainforest trees, again referred to by Tracey (1982) but not mapped.

Type 7 is a medium height, open-forest with a continuous canopy of less than 35 metres in height. Emergents are absent except where ground moisture is available. Vegetation Type 7 in the current classification does not have a counterpart in the Tracey classification but would mainly be mapped as Type 16 (medium and low woodland), however Tracey's classification also includes Vegetation Type 8 of this study which is low sclerophyll woodland.

[6] Emergent trees were defined as trees taller than the main canopy and not providing more than five percent overall cover. The chance of emergent trees being located in the plot itself was small, so this measure was applied to one hectare (approximate) around the plot. Present of continuous upper- or sub-canopy was affirmed if we estimated that gaps between tree crowns did not exceed thirty percent of total cover.

The disparity arises because Tracey has placed emphasis on floristic differences obtained from field surveys, whereas in this study the classification is according to whether the tree canopy was continuous (forest) or the tree crowns were clearly separated with a crown cover of less than seventy percent (woodland) (Walker and Hopkins 1990).

The Stanton (2004) vegetation classification of Wet Tropics vegetation is based on the Tracey (1982) publication with local variations within Tracey's types recognised and added to the classification. Stanton does not differentiate the openness or degree of development of the understorey but does discuss the subject. Comparisons to our vegetation types are shown in Table 5.

The Vegetation Types defined in this project are related to, but differ from, the Goosem *et al*. (1999) and Goosem *et al*. (2005) Wet Tropics Bioregional Ecosystem classification. Their system is a tripartite classification that is based on bioregion, geology and floristics. All of the wet sclerophyll forests in our study fall into bioregion 7 (Wet Tropics classification) but the forests and woodlands with a similar image on aerial photos can cover more than one geological system and vary substantially in the abundance ratios of tree species present.

Thus several Goosem classes can equate to a single class in the current classification. Conversely, Goosem *et al.* (1999) do not distinguish between wet sclerophyll forests with a grass or shrub understorey and those having a rainforest understorey. Comparisons to our vegetation types are shown in Table 5.

Table 5: A comparison of the Vegetation Types of this study with the Goosem *et al*. (2005) Regional Ecosystems and Stanton (2004) approach to vegetation classification.

Vegetation Type (this study)	Regional Ecosystems (Goosem *et al.* 2005)		Vegetation Type (Stanton 2004)	
1, 2, 3	7.8.7x1	7.12.21	14a	13c
			56	
4, 5, 6	7.3.19	7.3.20	14b	14c
	7.5.1	7.5.2	58	70
	7.8.7x2	7.8.8		
	7.11.13	7.11.14x1		
	7.11.16x2	7.12.21		
	7.12.22	7.12.25		
	7.12.27	7.12.29x1		
7	7.3.12x1	7.3.19	16	30
	7.3.20	7.5.1	32	58
	7.5.2	7.5.3	61	67
	7.5.4	7.5.5	113	
	7.8.7	7.8.7x2		
	7.8.8	7.8.10		
	7.8.10x1	7.11.13		
	7.11.16x2	7.11.16x5		
	7.11.19	7.12.22		
	7.12.22x1	7.12.22x2		
	7.12.24	7.12.26		
	7.12.26x1	7.12.27		
	7.12.29x1			
8	7.3.12x1	7.3.14	16	30
	7.3.20	7.3.21x1	34	55
	7.5.2	7.5.3	60	69
	7.5.4	7.5.5	91	113
	7.5.6	7.8.7x2	155	157
	7.8.9	7.8.10x1		
	7.11.16x2	7.11.16x5		
	7.11.16x8	7.11.19		
	7.11.21	7.11.21x2		
	7.11.21x4	7.12.21x1		
	7.12.22x2	7.12.23x4		
	7.12.24	7.12.26x1		
	7.12.27x1	7.12.28x3		
	7.12.29	7.12.21.1		
	7.12.30	7.12.30x1		
	7.12.34	7.12.35		

3. RESULTS

3.1 DATA SUMMARY AND COMMENTARY

The total area of each Vegetation Type is shown in Table 6. Rainforest invaded 48% of wet sclerophyll forest at the time the aerial photos were taken, leading to classifications of Types 2, 3 or 5. *Eucalyptus grandis* forest proved most susceptible, with 80% of the area invaded. Of the somewhat drier *Eucalyptus resinifera / Corymbia intermedia / Syncarpia glomulifera* subsp. *glomulifera* forest, 41% was invaded by rainforest.

Table 6: Area of different types of wet sclerophyll forest as mapped from aerial photographs. Note that Type 8 (low sclerophyll woodland) is not included in this table because the total area of that Vegetation Type has not been mapped.

Vegetation Type	Area (km^2)	Percentage of Total Area
Type 1	29	1.5
Type 2	112	6.0
Type 3	9	0.5
Type 4	401	21.0
Type 5	277	15.0
Type 7	1068	56.0
Total	1896	100

Inspection of the maps reveals that areas of this forest type, where rainforest understorey occurs, are located on the wetter eastern side of the distribution. It may be inferred that rainforest seedlings from the mature rainforest in the east establish on a broad front that advances in a westerly direction down the precipitation gradient until it is halted by fire or lack of sufficient moisture.

Table 7 shows the altitudinal limits of each vegetation type for each transect covered in the survey. Spatially, rock cover was highly variable. Table 8 is of assistance to those looking for rocky habitats in wet sclerophyll forest. Large logs are significant habitat for some fauna, and Table 9 shows that large logs may be found in all Vegetation Types. This parameter is available separately for each transect.

Most wet sclerophyll forest occurs on granite protrusions through the surrounding basaltic lava flows. In some areas rhyolite replaces granite. A few areas show wet sclerophyll forest established on basaltic, alluvial or metamorphic soils. The number of plots on each geological type is roughly in proportion to the area of the geological types. Table 10 shows the number of plots on each of the geology types encountered.

Table 7: The altitudinal limits (metres) of each Vegetation Type in each transect.

		Vegetation Type						
Transect	**Altitude**	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 7**	**Type 8**
1. Windsor Tableland (WT)	*Min*	1030	1030	1160	960	1075	860	1000
	Max	1220	1310	1240	1360	1360	1300	1230
2. Carbine Tableland (CT)	*Min*	690	1060	NA	1020	900	920	700
	Max	1140	1150	NA	1200	1190	1090	990
3. Lamb Range (LR)	*Min*	750	620	910	620	650	590	420
	Max	1160	1200	1110	1170	1190	1120	850
4. Herberton Range (HR)	*Min*	980	970	1000	950	990	960	970
	Max	1290	1200	1140	1240	1120	1260	1160
5. Longlands Gap (LG)	*Min*	930	850	1030	960	900	850	860
	Max	1200	1140	1120	1220	1180	1120	1140
6. Koombooloomba (KO)	*Min*	640	690	10	660	380	700	580
	Max	870	850	810	900	900	950	930
7. Kirrama (KI)	*Min*	500	470	570	440	510	450	450
	Max	800	900	40	780	820	860	690
8. Wallaman Falls (WF)	*Min*	500	480	500	490	420	450	480
	Max	610	620	660	640	650	680	700
9. Paluma Range (PR)	*Min*	760	690	810	680	780	630	580
	Max	880	895	890	900	1000	850	830

Table 8: Cover by rock expressed as a percentage of the total area.

Vegetation Type	**Transect**									
	1 (WT)	2 (CT)	3 (LR)	4 (HR)	5 (LG)	6 (KO)	7 (KI)	8 (WF)	9 (PR)	Mean
Type 1	7.6	1.8	7.1	8.5	0.4	0.9	2.5	3.9	0.3	3.7
Type 2	8.0	5.5	8.2	12.4	5.0	1.0	3.5	0.0	3.4	5.2
Type 3	0.5	NA	8.0	0.0	0.0	2.3	0.0	0.0	0.7	1.3
Type 4	5.9	11.0	10.6	6.9	4.5	4.2	2.9	1.7	2.7	5.6
Type 5	5.8	9.0	11.3	6.1	2.6	6.5	3.6	0.8	3.7	5.5
Type 7	10.7	5.2	15.6	19.8	4.4	1.9	13.5	3.0	12.6	9.6
Type 8	18.2	20.7	14.3	25.4	11.2	6.2	4.4	0.3	12.5	12.6

Table 9: Mean cover (percentage) by large logs in each Vegetation Type.

Vegetation Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Percentage of Cover	0.7	1.0	1.3	0.7	1.1	0.6	0.3

Table 10: The number of plots within different basal rock-types.

Geology	**Vegetation Type**							
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8	Total
Granite	292	399	39	570	468	458	280	2506
Rhyolite	78	53	33	95	100	139	125	623
Basalt	39	3	0	19	0	3	0	64
Metamorphic	0	0	0	0	0	3	13	16
Alluvial	0	3	1	0	4	2	1	11
Not Recorded	0	1	0	3	1	1	2	8

Table 11: Mean cover by ground layer expressed as a percentage of the total area of the plots over all transects.

Vegetation Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Percentage of Cover	31.9	7.3	4.3	29.2	11.2	31.2	31.9

3.2 HERBACEOUS VEGETATION

The projected vertical cover by the live herbaceous (ground) layer expressed as a percentage of the total area is summarised in Table 11. This measure excludes both standing litter and litter lying on the ground. The Vegetation Types with a rainforest understorey (Types 2, 3 and 5) have less ground vegetation than other Types.

Table 12 indicates the variation in occurrence of the classes of herbaceous vegetation between the Vegetation Types. Table 13 indicates the distribution of the more common ground layer species amongst the Vegetation Types.

Table 12: Frequency of occurrence of each herbaceous vegetation class expressed as a percentage of all plots. To be recorded as *present* in a plot, a vegetation class had to contribute at least twenty percent to the total volume of the ground vegetation in a plot.

Vegetation Type	Vegetation Class (See Key Below)											
	IC	AGR	GR	TS	OS	BS	PH	WP	F	X	V	GRC
Type 1	58.9	27.6	20.0	35.0	0.2	11.2	0.2	7.3	13.2	1.7	8.6	0.5
Type 2	5.9	0.3	0.7	48.1	0.4	0.4	1.7	21.4	7.6	1.7	9.8	0.2
Type 3	0.0	0.0	1.4	32.9	1.4	0.0	0.0	30.1	12.3	0.0	0.0	0.0
Type 4	33.6	64.9	27.1	36.1	1.2	3.2	6.3	4.1	13.1	17.2	2.2	0.4
Type 5	5.1	8.0	15.4	9.1	1.9	0.2	4.5	20.6	8.6	9.1	9.6	0.2
Type 7	17.2	86.6	16.3	18.3	1.5	2.3	1.8	2.8	6.4	29.0	0.7	0.3
Type 8	8.8	90.0	13.8	6.7	2.1	0.0	1.4	3.8	3.1	32.8	0.2	0.5

Key to Table 12:

IC.............*Imperata cylindrica* and *Heteropogon triticeous*
AGR.........Awned grasses (*Themeda triandra* dominant)
SGR.........Other grasses, e.g. *Panicum* spp. and *Oplismenus* spp.
TS............Tussock sedges, e.g. *Gahnia aspera*
OS ....Other sedges, e.g. *Cyperus* spp.
FBS ....Forbs
PH ....Perennial herbs
WP...........Woody plants
F ....Ferns, e.g. *Pteridium* spp.
X ....Xanthorrhoeoids, e.g. *Lomandra* spp.
V ....Vines, e.g. *Maesa dependens* var.*dependens*
GRC ....Ground creepers, e.g. *Hardenbergia violacea*

Table 13: The frequency of the most common plant species in the ground vegetation, expressed as a percentage of the number of plots in each Vegetation Type. To be recorded as *present* in a plot, a species had to contribute at least ten percent to the total mass of ground vegetation in that plot.

Species	Vegetation Type						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Poaceae							
– *Arundinella nepalensis*	11	2	0	8	1	10	14
– *Entolasia stricta*	1	1	0	7	4	13	13
– *Heteropogon triticeous / Imperata cylindrica*	64	8	0	48	8	42	33
– *Panicum effusum* var. *simile*	24	7	3	18	9	5	4
– *Themeda triandra*	18	2	0	63	8	88	93
Cyperaceae							
– *Exocarya scleroides*	0	3	11	0	6	0	0
– *Gahnia aspera*	18	19	10	12	24	8	2
– *Gahnia sieberiana*	12	16	7	7	18	2	0
– *Lepidosperma laterale*	12	15	3	19	34	12	5
– *Scleria sphacelata*	19	26	18	20	32	9	3
Dennstaedtiaceae							
– *Pteridium esculentum*	24	4	1	18	4	12	9
Xanthorrhoeaceae							
– *Xanthorrhoea johnsonii*	1	1	0	10	7	26	36
– *Lomandra longifolia*	20	2	0	34	8	18	15
Asteraceae							
– *Helichrysum rupicola*	14	1	0	9	0	5	1
Other							
– Rainforest tree spp.	8	21	29	3	21	1	0

3.3 SHRUBS

Shrub cover tends to be suppressed by fire and shade. Rainforest trees less than two centimetres dbh were classified as shrubs and increased rapidly in the absence of fire (Type 5) (Table 14). *Eucalyptus* species less than two centimetres dbh appeared immediately after a fire but required a fire-free period of several years to establish. True shrub species including *Lantana camara* appeared to increase in cover with the length of the fire-free period but were susceptible to shade from the tree canopy (Table 15).

Table 14: Mean cover by shrubs in each Vegetation Type expressed as a percentage of the total plot area.

Vegetation Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Percentage of Cover	10.7	16.6	11.1	6.9	17.9	4.6	2.3

Table 15: Frequency of the most common shrub species expressed as a percentage of the number of plots in each Vegetation Type. To be recorded as *present* in a plot, a species had to contribute at least ten percent to the total mass of shrubs in that plot.

Species	**Vegetation Type**						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Acacia flavescens	0	0	0	3	1	18	15
Allocasuarina torulosa	25	7	3	55	15	41	22
Banksia aquilonia	9	2	0	10	4	9	4
Corymbia intermedia	15	0	0	15	1	14	15
Eucalyptus grandis	14	2	0	1	0	1	0
Hakea plurinervia	0	0	0	0	0	5	16
Hibbertia melhanioides	1	3	1	8	12	10	3
Lantana camara var. *camara*	7	2	0	8	5	6	1
Maesa dependens var. *dependens*	19	8	0	4	8	2	0
Melastoma malabathricum	15	1	0	5	2	4	4
Rhodomyrtus canescens	17	8	4	6	8	1	0
Rubus moluccanus var. *moluccanus*	12	1	0	4	0	1	1
Syncarpia glomulifera subsp. *glomulifera*	6	3	0	19	8	14	9
Xanthorrhoea johnsonii	0	0	0	1	0	11	11
Rainforest spp.	75	97	99	42	91	16	6

3.4 TREES

Vegetation architecture is one determinant of the distribution and density of fauna, particularly those that fly. Table 16 summarises the variation in canopy architecture of the Vegetation Types, which should be read in conjunction with the upper height of the tree canopy (Table 17).

The height of the trees is greatest at the wettest end of the gradient (Types 1, 2 and 3) and then falls as the rainfall decreases through Types 4 and 5, then Type 7 and finally Type 8, the dry woodland class (Table 17). The mean basal area of trees also declines with decreasing rainfall, however basal area in those Types invaded by rainforest (Types 2, 3 and 5) is usually greater than their un-invaded counterparts (Types 1 and 4) (Table 18).

The distribution of tree species is also affected by rainfall gradient (Table 19) and some species show the influence of the rainforest invasion process (Types 2, 3 and 5). The size class structure for the most common tree species is illustrated in the sample histograms (Figures 2 to 7).

Table 16: Number of plots in each canopy structure class in each Vegetation Type expressed as a percentage of the number of plots in that type.

Canopy Structure*	**Vegetation Type**						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Class 1	15	45	29	18	51	9	1
Class 2	9	25	37	10	14	2	2
Class 3	31	11	1	41	25	39	7
Class 4	40	7	4	29	5	48	90
Class 5	2	10	29	1	2	0	0
Class 6	1	2	0	0	1	0	0
Class 7	2	1	0	1	1	1	0

* Canopy Structure

- Class 1 has a continuous canopy at all heights. (*Continuous* is defined as when viewed from above, tree crowns cover more than seventy percent of the area [after Walker and Hopkins 1990]).
- Class 2 has a discontinuous upper canopy but a continuous lower canopy.
- Class 3 has a continuous upper canopy but a discontinuous lower canopy.
- Class 4 has a discontinuous canopy at all heights.
- Classes 5, 6 and 7 all have emergent trees but are otherwise similar to classes 1, 2 and 3 respectively.

Table 17: Mean upper height of tree canopy in each Vegetation Type (metres).

Vegetation Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Mean Height (m)	42.1	46.4	46.3	34.6	37.7	26.6	22.4

Table 18: Mean basal area in each Vegetation Type in each transect (m^2/ha). (No Vegetation Type 3 was encountered within transect 9).

Transect	**Vegetation type**						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
1	25	24	35	28	27	21	17
2	24	31	45	23	30	17	13
3	25	33	25	30	31	25	16
4	27	31	38	26	28	17	10
5	24	31	43	29	27	26	17
6	27	32	41	27	32	23	17
7	27	33	32	24	33	24	17
8	15	32	33	26	35	20	18
9	28	33	0	30	32	28	16
Mean	25	31	36	27	31	22	16

Table 19: Mean basal area of the most common tree species in each Vegetation Type across all transects (m^2/ha).

Species	**Vegetation type**						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7	Type 8
Acacia celsa	0.2	1.0	1.4	0.0	0.8	0.0	0.0
Allocasuarina torulosa	4.8	3.2	0.6	9.5	5.7	5.3	1.6
Banksia aquilonia	0.5	0.4	0.2	0.5	0.7	0.0	0.1
Corymbia intermedia	2.8	1.9	0.5	4.3	2.5	3.6	3.0
Eucalyptus portuensis	0	0	0	0	0	0.8	0.9
Eucalyptus grandis	9.3	7.5	4.7	0.7	1.4	0.1	0
Eucalyptus reducta	0.1	0	0	2.3	0.1	2.7	2.0
Eucalyptus resinifera	0.5	1.0	0.2	3.1	3.7	1.6	0.2
Eucalyptus tereticornis	0.2	0.1	0	0.8	0.2	0.5	0.8
Syncarpia glomulifera subsp. *glomulifera*	0.8	2.3	2.8	2.8	4.1	0.2	0.6
Rainforest spp.	1.6	10.7	24.1	0.6	7.6	0.1	0.0
Dead trees	1.7	2.4	2.0	1.8	2.4	1.8	1.5

Allocasuarina torulosa

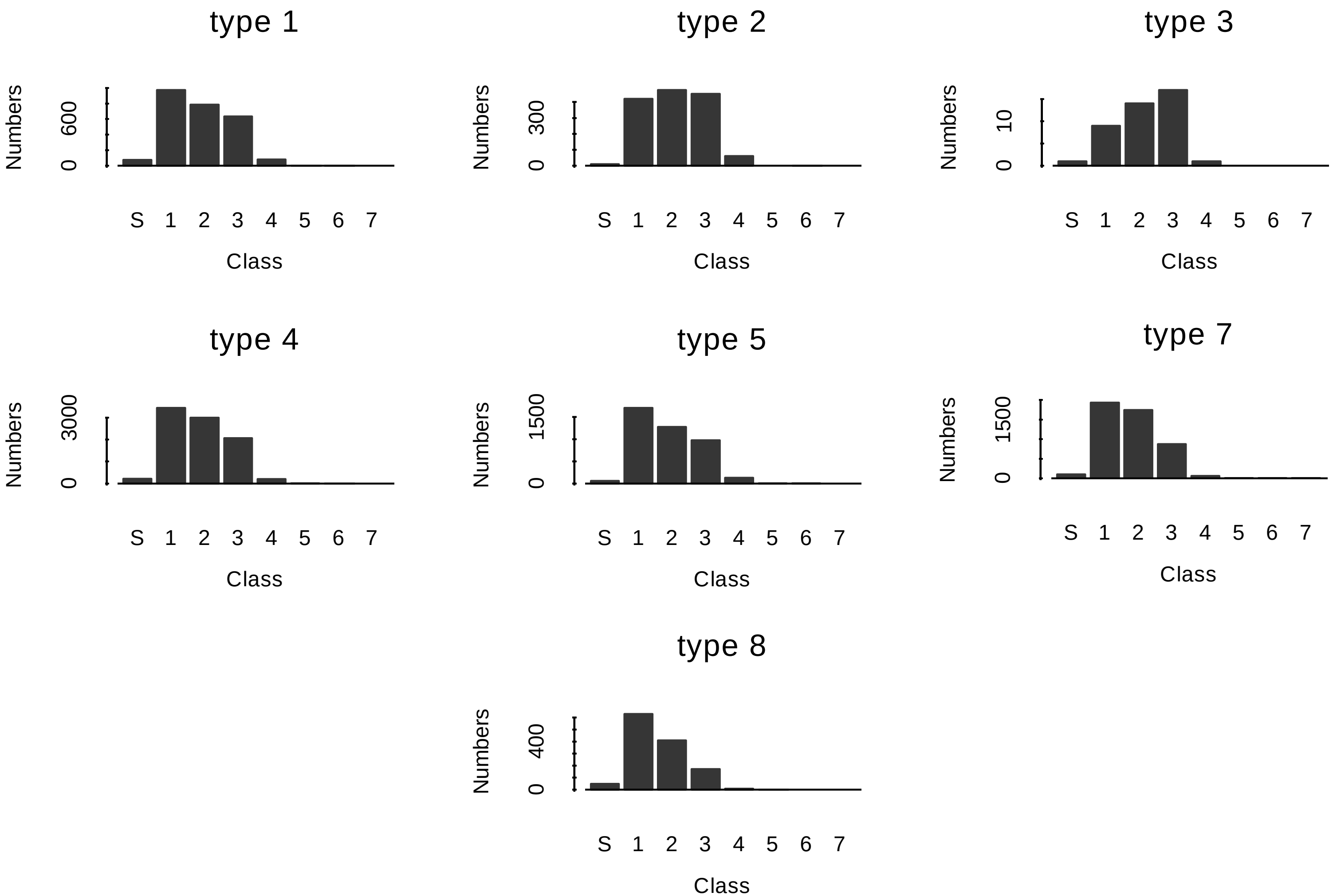

Figure 2: Size class structure of *Allocasuarina torulosa.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

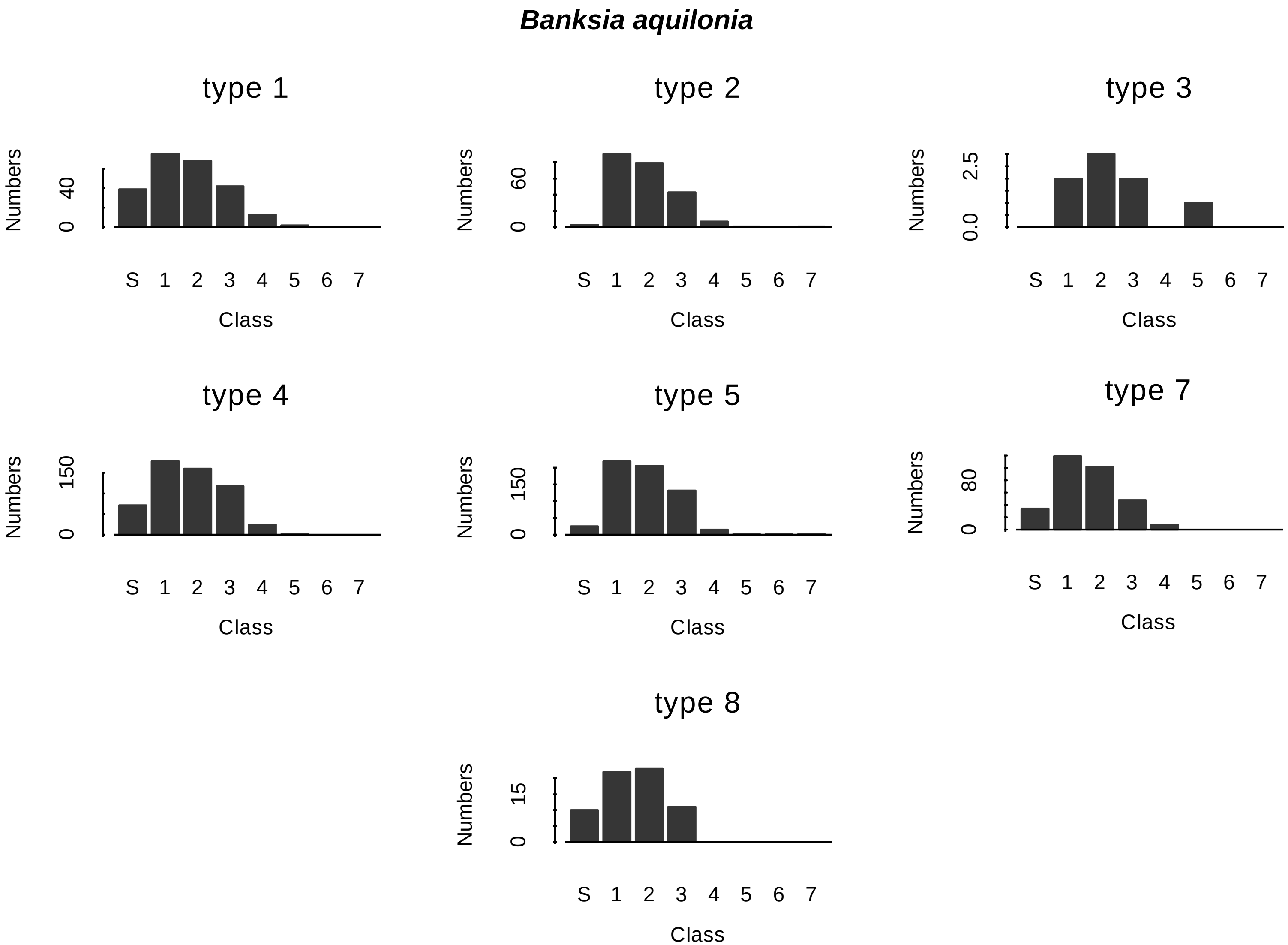

Figure 3: Size class structure of *Banksia aquilonia.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

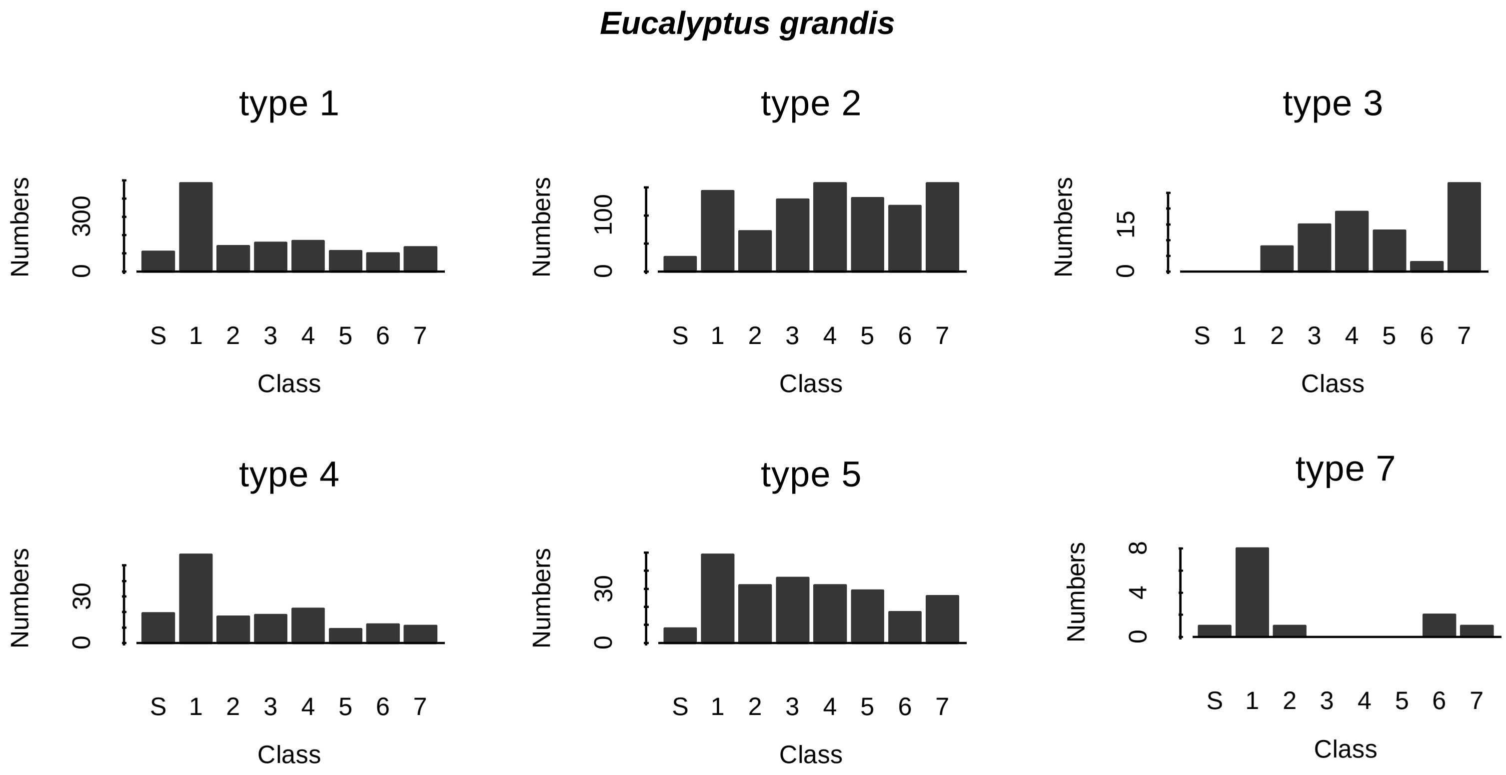

Figure 4: Size class structure of *Eucalyptus grandis.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

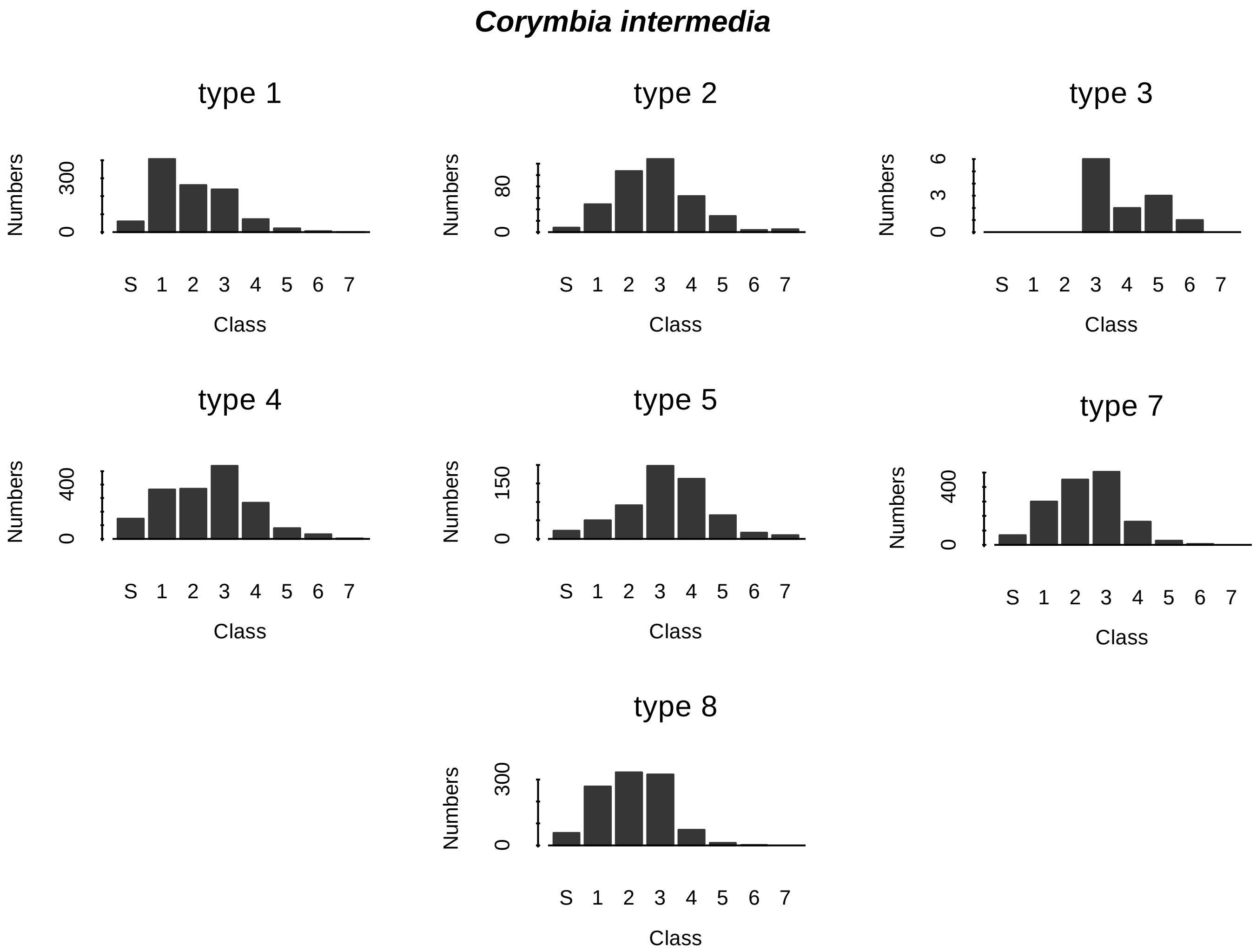

Figure 5: Size class structure of *Corymbia intermedia.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

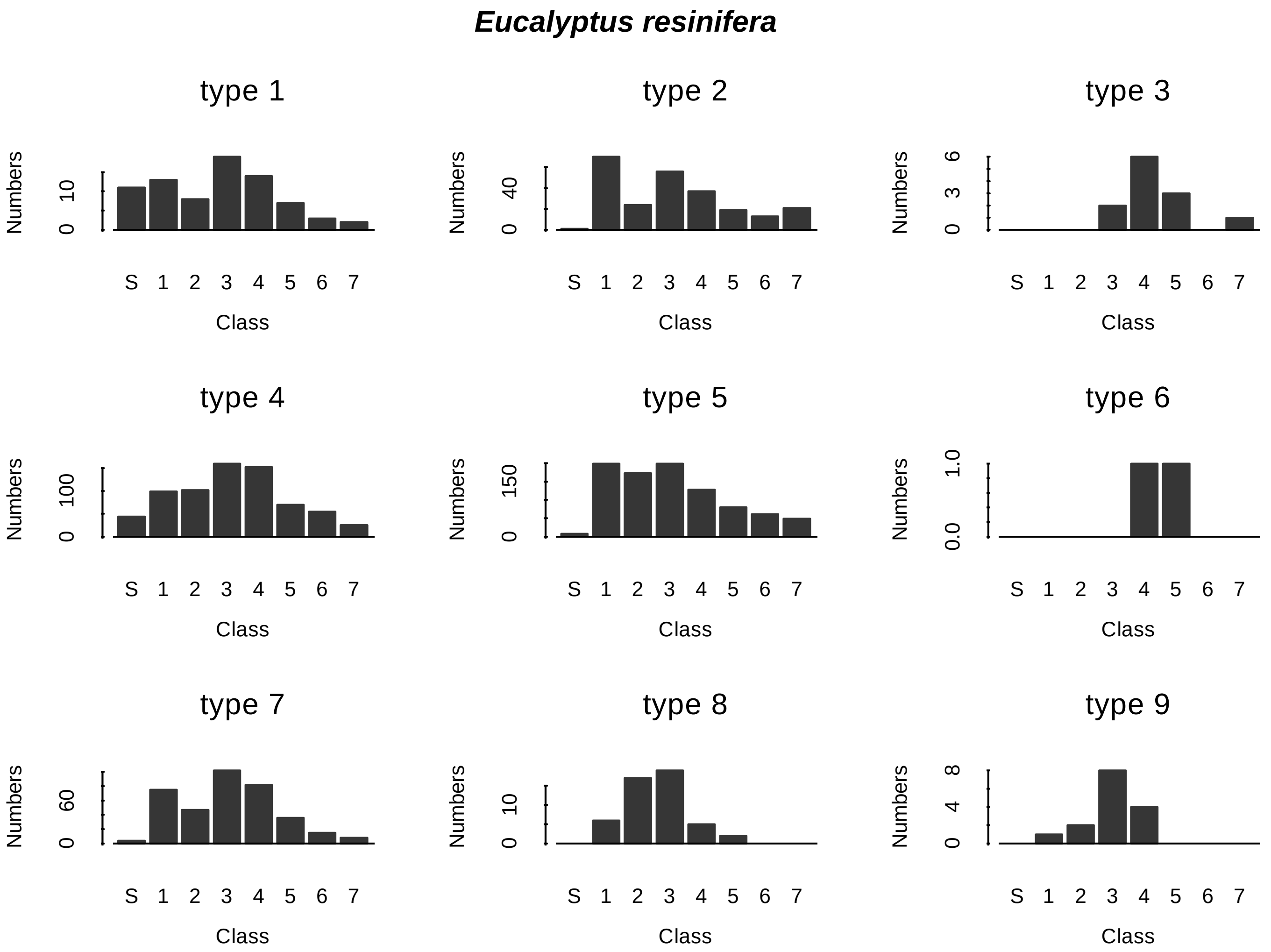

Figure 6: Size class structure of *Eucalyptus resinifera.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

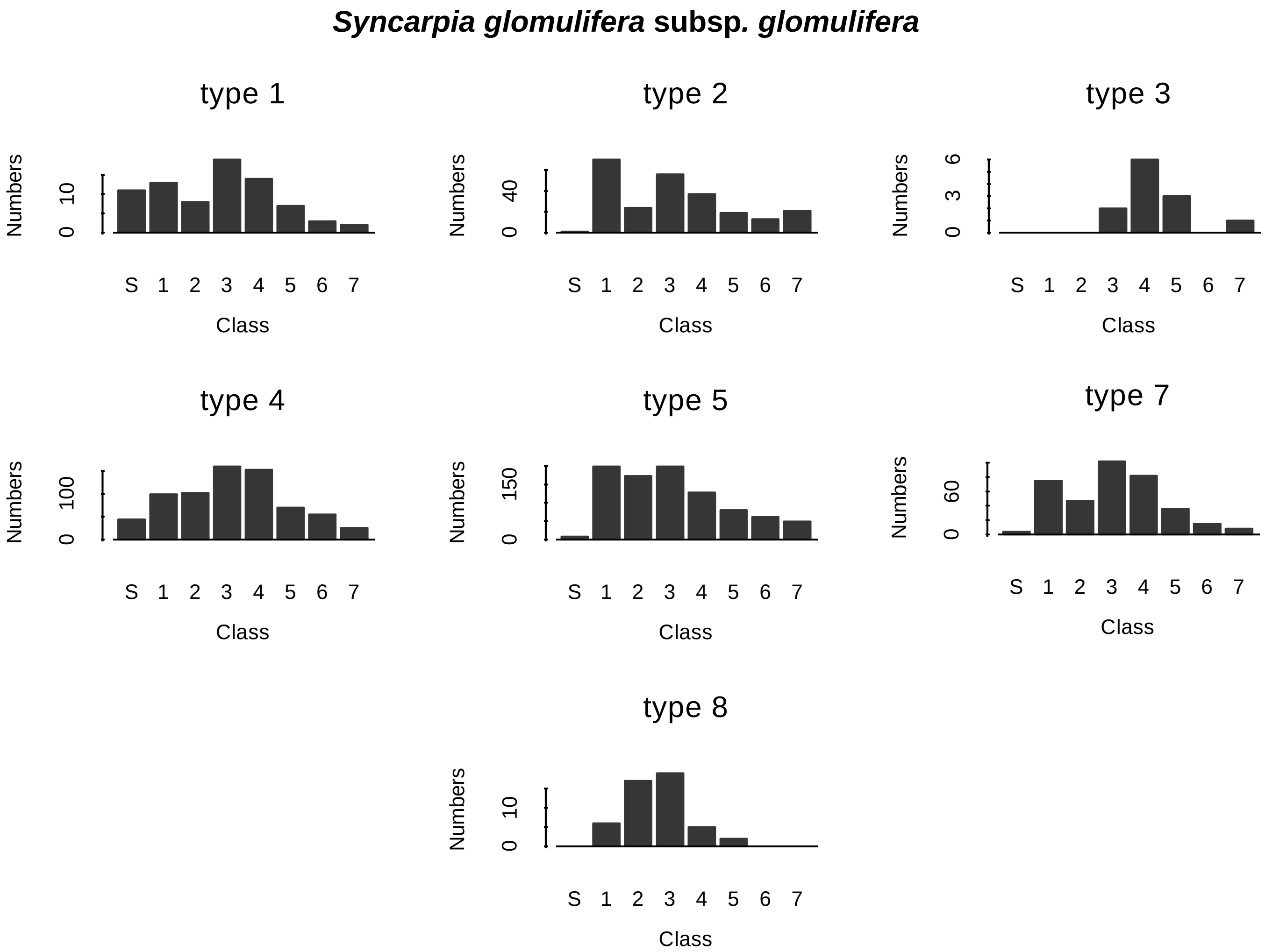

Figure 7: Size class structure of *Syncarpia glomulifera.* S = seedling, 1 = 2-9 cm, 2 = 10-19 cm, 3 = 20-39 cm, 4 = 40-59 cm, 5 = 60-79 cm, 6 = 80-99 cm and 7 = >100 cm dbh (Source: Harrington *et al.* 2000).

4. INFORMATION ON USE OF MAPS

4.1 NOTES FOR USERS

A full set of A4 vegetation maps (1:200,000) showing the wet sclerophyll areas mapped in this report and representing the area covered by the 1:50,000 map sheets are presented in this report (Appendix 4, Maps 1-26). Figure 8 shows the location index of the 1:50,000 map sheets covered in this study. On request, this data can be reproduced at the original mapping scale of 1:50,000. On these maps we have included significant features including the boundary of the Wet Tropics World Heritage Area, major roads and the position of each field survey plot. The data for all or any suite of plots can be accessed via a Geographic Information System (GIS). Plots are not permanently marked on the ground and can be relocated within the accuracy of a GPS instrument.

4.2 AVAILABILITY OF DATA

These data are available on a GIS at the CSIRO Tropical Forest Research Centre, Atherton and are summarised here. It is possible to overlay the survey information on other environmental and cadastral data within the GIS.

The data and maps can be supplied to legitimate users who may apply through the CSIRO Tropical Forest Research Centre enquiries service (email: tfrc-enquiries@csiro.au; web address: http://www.tfrc.csiro.au). Specific questions regarding spatial subsets of the data or correlations between environmental parameters may also be requested.

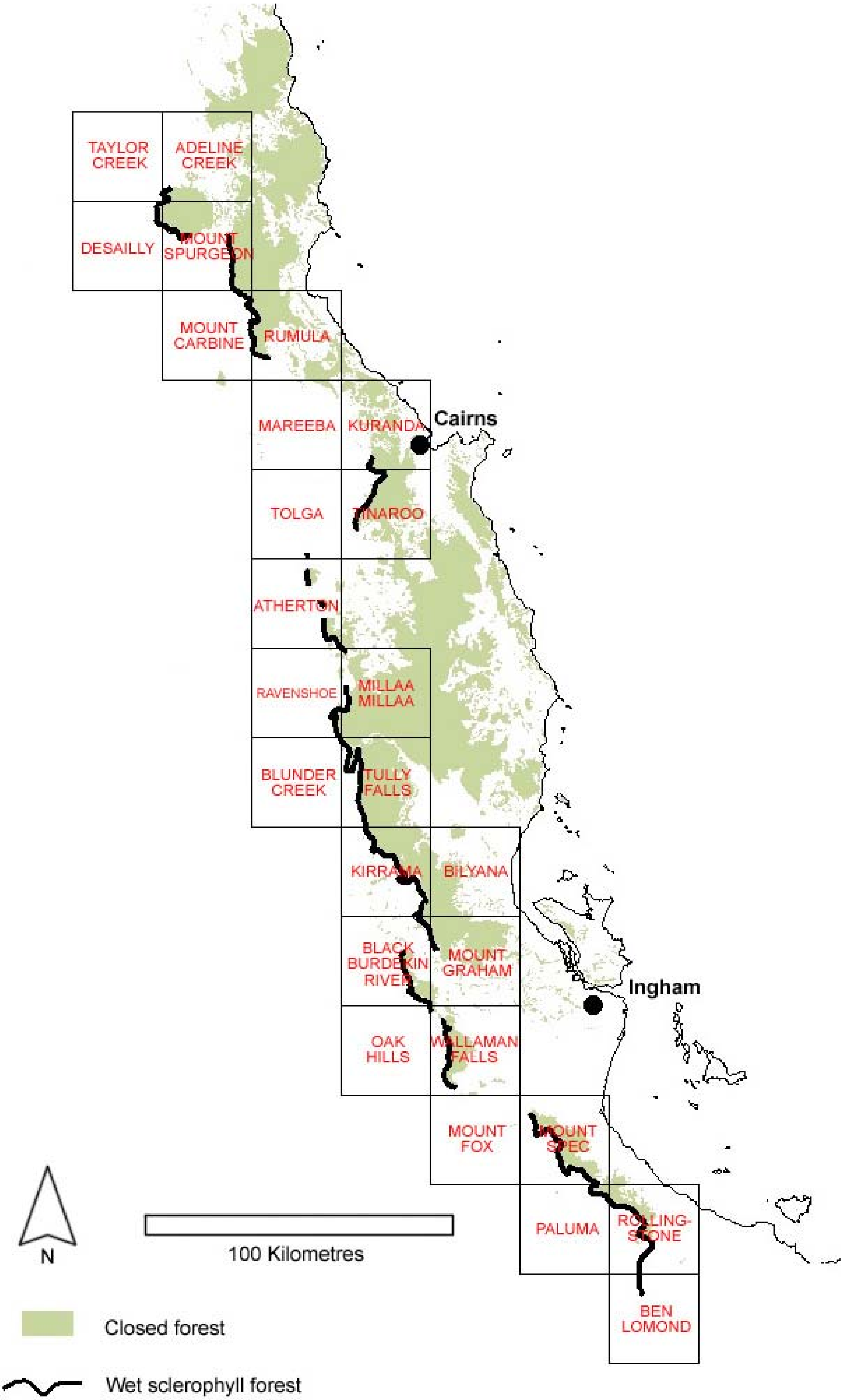

Figure 8: Index map to the 1:50,000 map sheets used to show the wet sclerophyll mapping in Appendix 4, Maps 1-26.

5. REFERENCES

Goosem, S., Morgan, G. and Kemp, J. E. (1999) *Wet Tropics*. In: The Conservation Status of Queensland's Bioregional Ecosystems. (Eds. P. Sattler and R. Williams) Environmental Protection Agency, Queensland Government.

Goosem, S., Morgan, G. and Kemp, J. E. (2005) Regional Ecosystems of the Wet Tropics. Environmental Protection Agency, Queensland Government.

Harrington, G. N. and Sanderson, K. D. (1994) Recent contraction of wet sclerophyll forest in the wet tropics of Queensland due to invasion by rainforest. *Pacific Conservation Biology* 1, pp. 319-327.

Harrington, G. N., Thomas, M. R., Bradford, M. G., Sanderson, K. D. and Irvine, A. K. (2000) Structure and plant dominance in North Queensland wet sclerophyll forests. *Proceedings of the Royal Society of Queensland*. 109: pp. 59-74.

Queensland Herbarium (2002) Names and Distribution of Queensland Plants, Algae and Lichen. (Ed. R. J. F. Henderson) Queensland Herbarium.

Stanton, J. P. and Stanton, D. J. (2004) Wet Tropics Vegetation Mapping Project, 1998-2002. A Report to the Wet Tropics Management Authority, Cairns.

Tracey, J. G. (1982) The Vegetation of the Humid Tropical Region of North Queensland. CSIRO, Melbourne.

Walker, J. and Hopkins, M. S. (1990) *Vegetation*. In: Australian Soil and Land Survey (Eds. R. C. McDonald, R. F. Isbell, J. G. Speight, J. Walker and M. S. Hopkins) Inkata Press, Melbourne. pp. 44-67.

APPENDIX 1

PHOTOGRAPHS USED IN AERIAL PHOTOGRAPH INTERPRETATION

Map Sheet	Scale	Year Flown
Rumula	1:25,000	1992
Cairns	1:25,000	1994
Bartle Frere	1:25,000	1990 / 1994
Atherton	1:25,000	1992
Tully	1:25,000	1992
Kirrama	1:25,000	1992
Ingham	1:25,000	1993 / 1994
Kangaroo Hills	1:25,000	1993
Rollingstone	1:25,000	1993 / 1994

APPENDIX 2

FIELD DESCRIPTIONS OF WET SCLEROPHYLL FOREST TYPES

Vegetation Type 1: Tall wet sclerophyll forest with a *Eucalyptus grandis* dominated canopy and a grass/sedge ground layer (Plate 1).

A continuous tree canopy in which large *Eucalyptus grandis* (> 35 metres) are common (30-100% crown cover, but commonly 50-70%). Other tree species occur, mainly at 25-35 metres but sometimes to 50 metres. These include *Corymbia intermedia* and *Syncarpia glomulifera* subsp. *glomulifera*, and less commonly *Eucalyptus resinifera* with *Allocasuarina torulosa, Banksia aquilonia, Acacia celsa* and *Acacia melanoxylon* in the subcanopy. Shrubs and young trees occur in varying amounts but not to the exclusion of the ground layer, which is always dominated by grasses and sedges.

Vegetation Type 2: Tall wet sclerophyll forest with a *Eucalyptus grandis* dominated canopy and a young rainforest understorey (Plate 2).

As for Vegetation Type 1, but young rainforest trees dominate the ground layer and/or the subcanopy. Grasses/sedges are sparse or absent (< 10% cover).

Vegetation Type 3: Rainforest with *Eucalyptus grandis* emergents (Plate 3)

Mature rainforest trees with *E. grandis* emergents. *C. intermedia, E. resinifera, S. glomulifera* subsp. *glomulifera* and *A. torulosa* can be present but not as regenerating trees.

Vegetation Type 4: Mixed species tall wet sclerophyll forest with a grass/sedge ground layer (Plate 4).

A continuous sclerophyll canopy with 30-100% crown cover by trees > 35 metres, which may include, but are not dominated by *E. grandis*. Common tall trees include *E. resinifera, C. intermedia, Eucalyptus tereticornis, Eucalyptus pellita, Eucalyptus reducta, S. glomulifera* subsp *glomulifera, Lophostemon suaveolens* and sub-canopy species *A. torulosa, B. aquilonia.* Rainforest and sclerophyll shrubs may occur but never to the exclusion of a continuous grass and sedge layer.

Vegetation Type 5: Mixed species tall wet sclerophyll forest with a young rainforest understorey (Plate 5).

As for Vegetation Type 4 but young rainforest trees dominate the ground layer and/or subcanopy. Grasses/sedges are sparse to absent (<10% ground cover).

Vegetation Type 6: Mixed species tall wet sclerophyll forest with a sclerophyll understorey (Plate 6).

Similar tree stratum to Vegetation Type 4 with an understorey that is dominated by sclerophyll shrubs reminiscent of heath, e.g. *Acrotriche aggregate, Phebalium longiflolium*, *Hibbertia melhanioides, Hovea nitida* and *B.aquilonia*. Grasses sparse or absent, sedges usually present. This type is usually found in the areas distant from the rainforest and is impossible to differentiate from Type 5 on aerial photographs.

Vegetation Type 7: Mixed species medium sclerophyll forest with a grass/sedge ground layer (Plate 7).

A continuous canopy with crown cover > 70%. Trees are 25-30 metres high with few emergents. Few shrubs and always a continuous grassy ground layer. Sedges sometimes present. Common tree species include *C. intermedia, E. resinifera, E. teretecornis, Corymbia citriodora, E. reducta, Eucalyptus portuensis, Eucalyptus cloeziana, Corymbia tessellaris, L. suaveolens, A. torulosa* and *Allocasuarina littoralis.*

Vegetation Type 8: Sclerophyll Woodland (Plate 8).

Discontinuous crown cover (< 70%). Trees less than 25 metres high. Shrubs never dominant over grassy ground layer. Common tree species include *Eucalyptus crebra, Corymbia clarksoniana, C. citriodora, E. portuensis,* E*. reducta, C. tessellaris, Eucalyptus platyphylla, A. littoralis* and *Melaleuca viridiflora.*

Plate 1: Vegetation Type 1. *Eucalytus grandis* dominated canopy with an *Imperata cylindrica* and *Helichrysum rupicola* ground layer (Windsor Tableland).

Plate 2: Vegetation Type 2. *Eucalyptus grandis* canopy with a young rainforest understorey dominated by pioneer species such as *Neolitsea dealbata* and *Acacia melanoxylon* (Herberton Range).

Plate 3: Vegetation Type 3. Rainforest with *Eucalyptus grandis* emergents. The foreground shows mature rainforest trees with an old *E. grandis* emerging from the canopy (Herberton Range).

Plate 4. Vegetation Type 4. Tall open forest with *Eucalyptus resinifera* as the dominant canopy species and *Allocasuarina torulosa* in the sub-canopy. The ground layer is dominated by *Themeda triandra* and *Imperata cylindrica* (Windsor Tableland).

Plate 5: Vegetation Type 5. Tall open forest with a young rainforest understorey. *Eucalyptus resinifera* and *Syncarpia glomulifera* subsp. *glomulifera* dominate the canopy with *Acacia melanoxylon* and *Polyscias murrayi* in the subcanopy (Windsor Tableland).

Plate 6: Vegetation Type 6. Tall open forest with a sclerophyll understorey. The canopy is dominated by *Syncarpira glomulifera* subsp. *glomulifera* and *Eucalyptus resinifera* with *Acrotriche aggregata* in the understorey and *Gahnia aspera* in the ground layer (Herberton Range).

Plate 7: Vegetation Type 7. Medium sclerophyll woodland shown one week after a fire. The canopy is dominated by *Corymbia intermedia* with *Allocasuarina torulosa* and *Lophostemon suaveolens* in the subcanopy. *Themeda triandra* and *Xanthorrhea johnsonii* dominate the ground layer (Wallaman Falls).

Plate 8: Vegetation Type 8. Sclerophyll woodland dominated by *Eucalyptus reducta* and *Allocasuarina littoralis*. *Themeda triandra* dominates the ground layer with *Xanthorrhoea johnsonii* present (Windsor Tableland).

APPENDIX 3

MASTER SPECIES LIST WITH AUTHORS AND FAMILIES

From Queensland Herbarium (2002).

Species and Authors	Family
Acacia celsa Tindale	Mimosaceae
Acacia flavescens A. Cunn. ex Benth.	Mimosaceae
Acacia melanoxylon R. Br.	Mimosaceae
Acrotriche aggregate R. Br.	Epacridaceae
Allocasuarina littoralis (Salisb.) L. A. S.Johnson	Casuarinaceae
Allocasuarina torulosa (Aiton) L. A. S.Johnson	Casuarinaceae
Arundinella nepalensis Trin.	Poaceae
Banksia aquilonia (A. S. George) A. S. George	Proteaceae
Corymbia citriodora (Hook.) K. D. Hill and L. A. S.Johnson subsp. *citriodora*	Myrtaceae
Corymbia clarksoniana (D. J.Carr and S. G. M.Carr) K. D. Hill and L. A. S. Johnson	Myrtacae
Corymbia intermedia (R. T. Baker) K .D. Hill and L. A. S.Johnson	Myrtaceae
Corymbia tessellaris (F. Muell.) K. D. Hill and L. A. S.Johnson	Myrtaceae
Entolasia stricta (R. Br.) Hughes	Poaceae
Eucalyptus cloeziana F. Muell.	Myrtaceae
Eucalyptus crebra F. Muell.	Myrtaceae
Eucalyptus grandis W. Hill	Myrtaceae
Eucalyptus pellita F. Muell.	Myrtaceae
Eucalyptus platyphylla F. Muell.	Myrtaceae
Eucalyptus portuensis K. D. Hill and L. A. S.Johnson	Myrtaceae
Eucalyptus reducta L. A. S.Johnson and K. D. Hill	Myrtaceae
Eucalyptus resinifera Sm.	Myrtaceae
Eucalyptus tereticornis Sm.	Myrtaceae
Exocarya scleroides (F. Muell.) Benth.	Cyperaceae
Gahnia aspera (R. Br.) Spreng.	Cyperaceae
Gahnia sieberiana Kunth	Cyperaceae
Hakea plurinervia (F. Muell.) ex Benth.	Proteaceae
Hardenbergia violacea (Schneev.) Steam	Fabaceae
Helichrysum rupicola D C	Asteraceae
Heteropogon triticeus (R. Br.) Stapf	Poaceae
Hibbertia melhanioides F. Muell. var. *melhanioides*	Dilleniaceae
Hovea nitida I. Thomps..	Fabaceae
Imperata cylindrica (L.) Raeusch.	Poaceae
Lantana camara L. var. *camara*	Verbenaceae
Lepidosperma laterale R. Br.	Cyperaceae
Lomandra longifolia Labill	Xanthorrhoeaceae

Lophostemon suaveolens (Sol. ex Gaertn.)Peter G. Wilson and J. T. Waterh.	Myrtaceae
Maesa dependens F. Muell. var. *dependens*	Myrsinaceae
Melaleuca viridiflora Sol. Ex Gaerth	Myrtaceae
Melastoma malabathricum L. subsp. *malabathricum*	Melastomataceae
Neolitsea dealbata (R.Br.) Merr.	Lauraceae
Panicum effusum var. *simile* (Domin) B. K. Simon	Poaceae
Phebalium longiflolium (S. T. Blake)	Rutaceae
Polyscias murrayi (F. Muell.) Harms	Araliaceae
Pteridium esculentum (G. Forst.) Cockayne	Dennstaedtiaceae
Rhodomyrtus canescens C. T. White and W. D. Francis	Myrtaceae
Rubus moluccanus L. var. *moluccanus*	Rosaceae
Scleria sphacelata F. Muell.	Cyperaceae
Syncarpia glomulifera (Sm.) Nied. subsp. *glomulifera*	Myrtaceae
Themeda triandra Forssk.	Poaceae
Xanthorrhoea johnsonii A. T. Lee	Xanthorrhoeaceae