RESEARCH REPORT

The CSIRO Rainforest Permanent Plots of North Queensland

Site, Structural, Floristic and Edaphic Descriptions

Compiled and Edited
by Andrew W. Graham

Rainforest CRC

CSIRO

THE CSIRO RAINFOREST PERMANENT PLOTS OF NORTH QUEENSLAND

SITE, STRUCTURAL, FLORISTIC AND EDAPHIC DESCRIPTIONS

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Cover photographs:
(*Top*) On the access road to Plot 7 (EP29) Mount Fisher.
(*Centre*) Measuring a Leichhardt Pine (*Nauclea orientalis*) at Plot 18 (EP42) Iron Range.
(*Bottom*) Tower view east to the coastal range, Plot 3 (EP4) Little Pine Creek.

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CONTENTS

ABSTRACT

Between 1971 and 1980, twenty research plots were established in the rainforests of northeastern Australia to provide long-term ecological and growth data. Plot sites were located opportunistically, with most being unlogged and undisturbed by European activities. Eight plots were variously affected by cyclones after establishment. Radiocarbon dating of soil charcoal indicated that fires occurred on five sites since 2000 BP. In early 2006, prior to the passage of Cyclones Larry and Monica, all plots were accessible with data records spanning periods of 24 to 31 years.

Most plots (seventeen) were located between 145° 04' E to 145° 50' E and 16° 08' S to 18° 30' S in a wide range of annual rainfall settings from 1400 mm to >3000 mm. Twelve plots were located above 700 m altitude. Only five plots were located on soils of high or moderately high fertility.

At plot establishment, all trees with stems ≥10 cm diameter were positioned, identified and measured for diameter and height. Semi-quantitative data on understorey species composition within subplots were also collected. Plots were remeasured every two years for the first ten years, and then at three or four yearly intervals, with diameter, recruits and deaths recorded. Heights generally were remeasured only in 1998.

To assist with future analyses and interpretation of the plot data, this report presents descriptions of the biophysical settings, disturbance histories, structures, physiognomies and floristic compositions of the plots using information compiled from all available sources and limited new sampling programs. Inconsistencies with previous descriptions are noted where appropriate. Descriptions of landforms and soil profiles are supplemented with quantitative data on soil bulk density, particle size, soil moisture characteristics and chemical analyses, together with methodological details. Illustrations show plot locations, key site features and forest profiles. As detailed analyses will be presented elsewhere, this review gives only a general data summary for stem density (plot range 408 to 1170 stems ha^{-1}) and basal area (plot range 28.6 to 69.8 m^2 ha^{-1}). Plant species richness on the plots varied from 84 to 189.

ACKNOWLEDGEMENTS

This review is based on the archived CSIRO research records of the project set up by Dr Geoff C. Stocker (present postal address PO Box 188, Malanda, Queensland 4885). All of the contributors acknowledge his foresight and persistence in establishing the research plots.

We also acknowledge the assistance of the then Queensland Forest Service in the provision of permission and assistance in development of the project. On behalf of all who will derive benefit from this long-term research effort and commitment, the compiler wishes to thank the wide range of Commonwealth staff who have established, maintained and measured the plots over the past thirty years. The compiler wishes to make particular mention of the field contributions of Jim O'Farrell, Tom Risley, Don Fitzsimon, Ron Knowlton Roy Phelps and Neville Starkey in this regard. John Williams and Roger Penny from the then CSIRO Division of Soils in Townsville provided key advice on appropriate soil physical analytical methods. Graham Harrington and Mike Hopkins galvanised staff into collation of the data for preparation of this report. Bob Hewett, Matt Bradford and Bronwyn Bayly assisted greatly by organising and re-entering many of the data sets for this publication. Caroline Bruce undertook and provided advice on AGD 1966 to GDA 1994 conversions of location data. Staff of the Environmental Protection Agency provided advice on the 2006 tenures of the plots. Matt Bradford has given invaluable help throughout the data discovery and writing up process, and completion of this report would not have been feasible without his consistent interest and assistance. The support of Dave Hilbert during the later stages of writing up was greatly appreciated. Peter Green and David Jones assisted with constructive suggestions after reading the final draft, and the comments and commitment of the manuscript reviewers (Dan Metcalfe and Peter Green) were greatly appreciated.

This long-term project has been funded by the CSIRO and, in more recent years, partially by the Cooperative Research Centre for Tropical Rainforest Ecology and Management. Over the last two decades, activities associated with this project have been carried out under permits from both the Queensland Department of Natural Resources and Mines and the Environmental Protection Agency.

Contributors wish to acknowledge the contributions of Shannon Hogan and her team in production of this report.

INTRODUCTION

A. W. Graham

It is now evident that many plants of tropical rainforests are long-lived, particularly those regarded as "mature phase" species. In the absence of intense disturbances such as storms, floods or landslides, most significant changes in forest structure and composition take place at rates that often may be discernable only at decadal or longer timescales. This has been demonstrated in a 32-year record from North Queensland by Connell and Green (2000), and the value of such long-term studies is widely acknowledged (Rees *et al.* 2001). Despite all the conceptual and technological advances in biology, the use of permanent plots remains the most practicable way of observing and predicting the directions and rates of floristic and structural changes in natural systems, whether derived from incremental or catastrophic changes. To be truly useful, plots must have (a) an accurately known location, (b) a series of measures of various and appropriate kinds, and (c) a record of time (Hopkins and Johnson 1995). Standards for the establishment and enumeration of the plots must also be well documented and consistent (Condit 1998). As in most natural plant communities, plot-based studies of plant community dynamics in rainforest ecosystems require four essential sets of data – details of the physical forest structure, the floristic composition, the demographic patterns for each species, and some information on the environmental setting such as the local climate, geomorphology and soils.

For such plots, the costs of establishment and maintenance are typically high, particularly if the locations are in "natural" settings largely unaffected by human disturbance. The immediate return on the substantial investment comes in the form of the initial floristic and structural descriptions from characterised sites. In the longer term, the value of subsequent time-series data could be regarded as "periodic interest", with the accumulated understanding of the processes leading to forest changes being the "capital growth". Novel applications for either the plot or the datasets may lead to "windfall gains". Two North Queensland examples of the latter may be found in recognition of the role that long-term permanent plots may play in monitoring changes in World Heritage values in the Queensland Wet Tropics (Hopkins and Johnson 1995), and in provision of quality data for a multi-national project, coordinated by Professor Oliver Phillips of the Centre for Biodiversity and Conservation, University of Leeds, which is aimed at identifying world-wide trends in rainforest dynamics.

In 1971, about one hundred years after the first European commercial exploitation of rainforests in North Queensland, work commenced on the first, in a series of specifically planned, long-term research plots designed to examine natural processes in rainforests rather than responses to, or suitability for, timber extraction. This work was carried out by the Atherton-based staff of the Forest and Timber Bureau within the Commonwealth Department of National Development, under the leadership of a research forester, Geoff Stocker, whose motivation and dedication made initiation of this remarkable data set possible (see acknowledgements). While the plots were necessarily opportunistically located and had some explicit bias towards occurrences of commercially attractive timber species, the project nevertheless represented a major investment for basic plant ecology in Australian rainforests. Subsequently, CSIRO staff from a number of Divisions maintained this project and all available records are now held by CSIRO Sustainable Ecosystems in Atherton, North Queensland.

Several versions of descriptions of this series of plots exist, but none have been formally reviewed or published previously. The few publications based on the plot data suffer to some degree from incorrect interpretations or insufficient detail on the forest types and environmental settings. This report provides additional site description, forest dynamics and soil data (both chemical and physical), and also corrects a number of errors and misinterpretations given in earlier published and unpublished accounts, as well as in the file records. Examples include more accurate location references, important changes in descriptions of soil parent materials (rock types), new descriptions of geomorphology, and corrections to the allocations to rainforest physiognomic types based on the terminology of Webb (1959, 1968). Critical data on European disturbance regimes has also been included, including records of minor logging activities in a few of the plots and of intense human disturbance on Plot 1 (EP2) Downfall Creek. Previous published accounts have asserted that all data were derived from “unlogged sites” (West *et al.* 1988). In some previous documentation, data tabulations included sclerophyll forest plots that are not considered in this review.

PROJECT OBJECTIVES AND STRATEGY

A. W. Graham (from the archival records of G. C. Stocker) and G. L. Unwin

The aims and objectives of this project are given most succinctly in the earliest draft of the proposed technical memorandum on the permanent plots (file record, date ca. 1991): "To record and analyse patterns of tree growth and stand dynamics in a broad range of permanently reserved plots in rainforest and associated forest types of north Queensland."

That document continues, "The basic task of the long-term plot series is to build a comprehensive database of rainforest tree growth, extending over a useful range of sites and a biologically meaningful span of years. To provide for analysis and interpretation, the growth record needs to include descriptions of forest structure, floristic composition and stand changes in response to environmental disturbance. This requires a high standard of repeated mensuration and continuity, in a variety of rainforest sites whose location is definable in terms of major environmental gradients."

As many of the plots were expected to be representative samples of undisturbed rainforest surrounded by logged forest, the researchers anticipated that "The series of plots will therefore prove most useful in comparative studies of tree growth, regeneration and species diversity both among sites and between logged and unlogged rainforest communities" (Summary notes for EP3 and EP31, G. L. Unwin, 6 June 1977).

A more detailed project description (unpublished file record, dated prior to 1985) stated, "The main question confronting forest ecologists working in management research has changed from 'What kind of disturbance will promote wood growth on desirable species?' to 'What are the floristic and structural consequences of a given type of disturbance?'"

The strategy specified in that document was:

> "(a) To establish a series of 0.5 ha reference plots where the growth, recruitment and mortality of component species could be monitored for long periods. Where possible, these plots have been located in generally representative, unlogged forest.
> (b) To study the reproductive biology and early growth characteristics of the major (ecologically and numerically) species found in the permanent plot series.
> (c) To use data from (a) and (b) to develop models which will predict floristic and structural change in different forest types subjected to disturbances varying in nature, frequency and degree.
>
> The alternative approach, i.e. the direct study of disturbed areas, was not adopted for the following reasons:
>
> (a) It was considered advantageous to first examine forest dynamics in situations where complex disturbance patterns due to logging were absent.
> (b) The area of available unlogged forest was receding rapidly and it appeared desirable to commence studies in these areas as soon as possible. Logged areas would always be available and could be studied at some time in the future.
> (c) The Queensland Department of Forestry already possessed a large volume of data on aspects of growth and regeneration in logged rainforest, but data for only one plot in an unlogged area."

In assessing this strategy of opportunistic location of plots it is essential to realise that, even "at the beginning of the study, it was apparent that at the then current logging rate, the whole of the accessible forest in State Forest Reserves would soon have been logged" (Stocker *et al.* 1977 cited in Stocker 1983). Plots were not established in National Parks "primarily because of the additional administrative problems associated with undertaking research in these areas" (unpublished file record, dated prior to 1985).

This document also records that "a few of the early plots were deliberately located in forest types containing *Flindersia* species in order to obtain autecological data on this commercially important group of species. However, this group of species is also numerically important in many north Queensland rainforest types, and our subsequent experience indicates that these early plots are representative of several widespread forest types."

METHODS

DATA SOURCES AND PLOT NUMBERING

A. W. Graham

The primary sources used in preparation of this report were a wide range of records and data that are held in the Permanent Plot Files at the CSIRO Tropical Forest Research Centre, Atherton. This information included project descriptions, plot establishment proposals, plot establishment reports, a series of duplicated plot descriptions typically with site, stem, basal area and species summary data, typed plot notes (headed *Notes on Species in Structural Groups*), file records (usually field observations made during plot remeasurements), floristic lists, Queensland Regional Station (QRS) Herbarium records, site maps, soil description summaries and previously untabulated data from several soils laboratory notebooks . Other material referred to included summary reports prepared for seminars, conferences or field trips, and preliminary report drafts prepared by Keith Sanderson (general plot descriptions and floristic lists) and Ron Knowlton (soil data). Geoff Stocker and Greg Unwin contributed greatly to the early phase of development of the long-term plots project. Their unpublished research theses (Stocker 1983, Unwin 1983) were two important sources of information. During this compilation, it was evident that some key data were not formally recorded, as in the case of patch death observations. Where possible, the appropriate researchers and past staff were contacted and all available documentation was obtained and placed on the file records. There have been relatively few publications dealing directly with the permanent plots, and to date none have provided full location or descriptive details for the complete series of twenty plots.

During 2000 and 2001, Andrew Graham, Matt Bradford and Bob Hewett visited thirteen of the twenty plot locations (Table 1) to check and augment the existing descriptions. These thirteen plots and the other seven remaining plots were revisited for enumeration during 2002, 2004 or 2005 (Table 2). Andrew Ford assisted by completing the supplementary species list at Plot 13 (EP35) Whyanbeel, as well as reviewing all of the floristic lists for misidentifications and to update nomenclature. J. G. Tracey assisted in a reassessment of the structural forest typing of the plots.

Throughout this report, both the sequential plot number and the corresponding EP (Experimental Plot) number are used consistently so that easy cross-reference may be made to existing documentation in CSIRO records and Queensland Government departmental files, as well as to herbarium voucher specimens. It should be noted that the numbering systems used in some publications referring to the plot series (e.g. Beadle 1981) do not correspond to the established sequential plot numbering system.

SITE ESTABLISHMENT AND REMEASUREMENT PROCEDURES

A. W. Graham, G. L. Unwin, K. D. Sanderson and M. G. Bradford

Site Selection Criteria and Forest Disturbance

The twenty plots are located in North and Far North Queensland, with the majority located within a two-hour drive from Cairns (Table 1, Table 1a, Figure 1, Figure 2). Most sites were selected opportunistically, usually without any prior classification of forest structure or typology. The general position for each plot was determined by the vehicular access available at the time, by the progress of logging activities, and in consultation with staff of the Queensland Department of Forestry (QDF). At each site, the 0.5 ha plot and its surrounding 20 m wide buffer zone were positioned intuitively to provide, as far as possible, a sample that was structurally and floristically similar to surrounding forest (prior to logging, if applicable). At establishment, few of the selected sites showed signs of any recent large-scale natural disturbance such as cyclone or storm damage, even where such disturbance was often evident in the general locality (e.g. Plot 9 (EP31) Woopen Creek).

In most cases, the enumerated 0.5 ha plot areas were not directly affected by logging activities, either prior to establishment or subsequently. However, at four sites, early versions of plot descriptions (in the plot file records) specify or suggest that the enumerated areas were logged prior to plot establishment (i.e. Plot 3 (EP4) Little Pine Creek, Plot 4 (EP9) Robson Logging Area (LA), Plot 14 (EP37) Eungella and Plot 15 (EP38) The Crater). At some locations, snig tracks or logging roads pass through a section of the 20 m wide buffer zone surrounding the enumerated plot area, as at Plot 1 (EP2) Downfall Creek and Plot 4 (EP9) Robson Logging Area.

At least the first four plot sites were selected with a particular regard for the occurrence of species of *Flindersia* spp. (Letter dated 27 April 1972, G. C. Stocker to Director, Forest Research Institute, Forestry and Timber Bureau; Plot 4 (EP9) file). During the 1970s, the autecology of this genus was a focus of research interest at Atherton.

Plot Establishment Procedure

Boundaries, Buffer Zones and Position

Plot boundaries were surveyed with prismatic compass, 50 m steel survey band and Abney level. All distance measurements were corrected for slope. The slope-corrected dimensions of all plots were 100 x 50 m, enclosing a projected plan area of 0.5 ha. *It is particularly important to note that, because the topographic settings of the plots are highly variable (from flat to steeply sloping), the actual land surface areas of the plots differ to varying extents*. The four plot corners were permanently marked with yellow painted, copper-chrome-arsenate treated wooden pegs, each 760 x 75 x 50 mm. Where logging activities were scheduled to occur in the future, a buffer zone (typically not less than 20 m wide) was established around the plot. Trees within the buffer were marked with painted yellow or orange rings at or a little above eye level, with an emphasis on commercial tree species. This area was to be protected from future logging or disturbance by agreement with the QDF.

All plots were subdivided into sixteen subplots (A to P), each 25 x 12.5 m (Figure 3). Each subplot corner was marked with a painted peg (760 x 35 x 25 mm). The orientation of the four rows of subplots varied between plots, although the sequence of subplots within the rows was consistent: A-D, E-H, I-L and M-P. For example, at Plot 1 (EP2) Downfall Creek, the commencement point (Subplot A) was at the left-hand end of the 100 m side of the plot. In contrast, the subplot layout at Plot 4 (EP9) is a mirror image of that at Plot 1, as the commencement point (Subplot A) was at the right-hand end of the 100 m plot edge. This inter-site variation in subplot layout should be considered in any computerised mapping or site-related analysis of the data.

When feasible, the plots were accurately located by tying in the site with QDF survey lines. Detailed maps of locations and access-routes have been filed in the project records.

Location and Enumeration of Trees ≥ 10 cm

The initial assessments of tree trunks ≥10 cm diameter at breast height (dbh) were made at breast height (1.3 m) where possible. On sloping sites, this measure was taken on the uphill side of the tree. Where trees had high buttresses or deformities, the position for measurement of the dbh was raised to the lowest suitable height. At the time of plot establishment, the dbh lines were painted on all trees ≥10 cm dbh. The lines were about 25 mm wide and perpendicular to the direction of the trunk. Each dbh measure was taken to the nearest millimetre on the centre of the painted line with the tape following the line around the trunk. Any changed or abnormal measurement positions were repainted on the trunks at the time of remeasurement and the alteration was coded (see below) and recorded on the subplot field sheet.

The positions of all trees ≥10 cm dbh were located on the plot with an accuracy of ±0.5 m by using a six-digit coordinate system. In this system, the external corner peg of Subplot A was designated as "000 000", with the first three digits representing distances along the 100 m axis (00.0 to 99.5 m), and the last three digits indicating distances along the 50 m axis (00.0 to 49.5 m). Using Figure 3 as an example, the coordinates for the internal corner of Subplot A are 250 125, and those of the external corner of Subplot P (diagonally opposite the origin) are 995 495. Because all locations were recorded with ±0.5 m accuracy, a tree on the plot boundary immediately adjacent to the peg marking the external corner of Subplot P would have location coordinates of 995 495. In a few cases, smaller trees growing close together may have identical coordinates. Calculations and interpretations based on the tree location coordinates must take account of both the accuracy limit as well as the variations in layout format.

In situations where trees were very close to the plot boundaries, particular attention was paid to determine if the stem fell within the plot, or if it was to be excluded. The criterion for these decisions was the relative location of the breast height section of the trunk. If the majority of this dbh section lay outside the boundary, the stem was excluded. Where the majority of the dbh section lay inside the boundary, the stem was included. In those rare cases where no discernible bias could be detected, such stems were alternately included and excluded as the initial survey proceeded along the plot boundary. It should be noted that the form and visual appearance of these stems near the boundary might have changed since establishment.

Individual tree trunks ≥10 cm dbh were numbered using an alphanumeric code that represented both the subplot (A to P) and the number of the trunk within that subplot, i.e. in Subplot A: A1, A2 ... … A35, A36, up to a potential maximum of A99; and similarly for Subplot B: B1, B2 … … B35, B36 up to B99. This code was painted on each enumerated tree.

Trees that were branched below the dbh measurement position, either as a branch or as a "twin" or "multi-stem" at ground-level, were identified and recorded using an additional numeral placed in the "hundreds" position in front of the number allocated to the "main" trunk. For example, at Plot 1 (EP2) Downfall Creek, the main trunk (≥10 cm dbh) of an *Acronychia laevis* J. R. Forst. and G. Forst. in Subplot P was numbered P5, the first branch ≥10 cm dbh arising below the dbh position was numbered P105, and the second branch ≥10 cm dbh was numbered P205. Similarly, at Plot 15 (EP38) The Crater, the main trunk of a *Pullea stutzeri*

(F.Muell.) Gibbs in Subplot F was numbered F10, while the branch arising below the dbh position was numbered F110.

This numbering system was also used in enumeration of *Ficus* spp. with multiple aerial roots ≥10 cm dbh. For example, at Plot 15 (EP38) The Crater, in Subplot B, the three stems (each ≥10 cm dbh) of a *Ficus pleurocarpa* F.Muell. were recorded as B4, B104 and B204. Similarly, at Plot 14 (EP37) Eungella, in Subplot B, the two stems (each ≥10 cm dbh) of a *Ficus destruens* F.Muell. ex C. T. White were recorded as B18 and B118.

This enumeration and reference number system has resulted in small discrepancies between the ≥10 cm dbh stem count and the actual number of ≥10 cm enumerated individuals on the plots.

Epiphytic Trees and Large Vines

Epiphytic trees, or the aerial roots of such trees, were not enumerated when <10 cm dbh, regardless of the size of the tree in the canopy. Where appropriate, these epiphytic tree species were recorded on the supplementary species list of the plot. For example, at Plot 12 (EP34) Russell River, in Subplot B, stem B12 (*Alstonia scholaris* (L.) R.Br.) was enveloped by a strangling fig but the numerous small root stems <10 cm dbh were not recorded. This feature was recorded in the plot field notes, but does not appear in the plot data records. It is likely that a number of similar situations involving epiphytic trees such as *Ficus* spp. or *Schefflera actinophylla* (Endl.) Harms will not be recorded in the data sets.

Vines were not enumerated, even if ≥10 cm dbh, but were noted on the plot supplementary species list. (In Plot 14 (EP37) Eungella, the record of an unidentified vine appears to be the single exception to this rule.)

Height Measurements

At the time of plot establishment, height estimates for all trees ≥10 cm dbh were recorded. These estimates were based on, and regularly validated by, actual measurements of canopy heights of the tallest tree and randomly selected subcanopy individuals in each subplot using the triangulation method (base distance and slope angle) with clinometer and measuring tape. No further height measures were taken until 1998 when the heights of all stems in the eighteen plots remeasured that year were accurately measured either by the triangulation method or by direct readings using a Bushnell Laser Rangefinder. Tree heights were also measured on Plot 14 (EP37) Eungella in 2001.

Other Data Records

At a number of plots, the positions, sizes and identities for stems <10 cm dbh but ≥2 m, or sometimes ≥3 m in height of all *Flindersia* species were recorded and, in some cases, every *Flindersia* stem so enumerated was marked with a small white peg. During 2000, some of these pegs were still evident at several plots. In at least one case, all *Flindersia* seedlings ≥500 mm high (or possibly ≥250 mm high) were identified and marked with a white peg and counted but not numbered, and all *Flindersia* seedlings < 500 mm high down to cotyledon stage were also enumerated. The eight available *Flindersia* sapling and seedling data sets are held both in the plot files and in the electronic project archive, representing Plot 2 (EP3) Mountt Haig, Plot 3 (EP4) Little Pine Creek, Plot 4 (EP9) Robson Logging Area, Plot 5 (EP18) Mount Lewis, Plot 6 (EP19) Garrawalt, Plot 7 (EP29) Mountt Fisher, Plot 8 (EP30) Agapetes Logging Area and Plot 13 (EP35) Whyanbeel.

Paint Types Used for Tree-marking and Pegs

From 1971 to 1990, trees and pegs were painted using the standard lead-based tree marking paint used by the QDF. From 1991 onwards, conventional acrylic lead-free paint was used.

Forest Structural Descriptions

In this report, the terminology for descriptions of forest structure (cf. forest structural typology, described below) follows Walker and Hopkins (1984). Soon after establishment of each plot, forest structural profiles were drawn to scale representing a 100 x 5 m transect based on the long axis of each plot commencing from the corner peg of Subplot A. The height and canopy form of all trees ≥10 cm dbh along the transect were recorded. Trees <6 m in height were not included.

Plot Remeasurements

Schedules and Procedures

The years of establishment and remeasurement, together with the number of years of records for each of the plots, are given in Table 2. Plots were remeasured every two years for a minimum of ten years, after which period the time frame for further assessments was reviewed. After 1990, remeasurements generally were carried out every five years. At the time of each remeasurement, general maintenance of painted tree markings was carried out, and records and maps were made of tree deaths, deformities and disturbances. If a tree became enmeshed in an immovable vine or strangling fig and the dbh could not be practically measured, the previous dbh was used and adjusted up slightly. Codes used on the field sheets were: *D* (dead); *BT* (broken top); *BND* (bloody near dead); *S* (sick); *DBHR* (dbh raised, with the measurements (usually) recorded from the old and new line); *L* (leaning); *DS* (dead side); and *DT* (dead top). These codes have not been incorporated into any database. Any discrepancies found in the database must be referenced back to the original field forms. For example, a tree with a decreased dbh may have *BND*, *S*, *DBHR* or *DS* written next to the measurement in the field sheet. All of the old field sheets are stored in the Permanent Plot Files.

Previously Recorded Stems ≥ 10 cm

The dbh of each existing individual stem was re-measured and, where new deformities or buttress growth occurred at the original diameter mark, the point of measure was adjusted by either raising or lowering it to suit future measurements. Diameter measurements were then recorded from both the original and new markings for tree growth calculations. Tree deaths and canopy disturbances were also noted.

New Recruits in the ≥ 10 cm dbh Size Class

All new recruits into the ≥10 cm diameter category were taxonomically identified, located in terms of plot coordinates, numbered and measured for both dbh and height. Voucher specimens were collected for any enumerated species not previously encountered on the plot.

PLOT DISTURBANCE HISTORY

General Physical Disturbances

K. D. Sanderson

Throughout the project, brief descriptions were made of both current and past disturbances (e.g. condition of the forest at plot establishment, management procedures, activities such as mining, or natural events including cyclones or major tree falls). Locations of large-gap tree falls or of multiple tree-falls caused by cyclones were mapped.

"Patch Death" Phenomena

B. N. Brown and K. D. Sanderson

The extent, development and recovery of "patch death" phenomena were also noted at affected sites. At some sites where this feature was encountered, soil samples were collected and forwarded to the QDF forest pathology laboratory in Brisbane. At the QDF laboratory, standard "baiting" techniques were used to detect the presence of the root-rot fungus *Phytophthora cinnamomi* Rands that is commonly associated with this forest dieback.

Historic and Pre-historic Fire

A. W. Graham, R. K. Hewett, E. Lawson, E. Bruce, U. Zoppi and Q. Hua

During field inspections in 2000 and 2001, soil samples were collected to refine estimates of forest biomass and carbon stocks at ten of the thirteen revisited plots listed in Table 1 (Plot 14 (EP37) Eungella, Plot 11 (EP33) Curtain Fig and Plot 12 (EP34) Russell River excluded). While these new biomass and carbon stock data will be published elsewhere, the associated observations of relict soil charcoal extracted from soil cores are relevant to the site histories of the plots and are presented in this report. At each site, six soil cores were taken in a stratified random sampling design that included each of the major landform elements present on the site. The corer was constructed of stainless steel tubing of 47 mm internal diameter. Cores were partitioned by depth intervals of 0-50, 50-100 and 100-200 mm, with the total volume of each core being 0.000347 m^3 (347 cm^3). For each depth interval, soil samples were washed over a 1 mm sieve and all charcoal fragments retained on the sieve were removed and bagged. The charcoal was oven dried at 70°C for 48 hrs and then weighed. Individual charcoal fragments were then sent for radiocarbon dating by Atomic Mass Spectrometry (AMS) from those sites that met the following criteria:

a) Charcoal at the site should be *in situ* (thus excluding Plot 17 (EP41) Oliver Creek);
b) The site had no known or suspected intensive disturbance of post-European age (thus excluding Plot 1 (EP2) Downfall Creek); and
c) There were no on-site or adjacent data relating to relict charcoal (thus excluding Plot 2 (EP3) Mount Haig, where abundant relict *Eucalyptus* charcoal was already known – see Hopkins *et al.* 1993).

Taxonomic determinations could not be undertaken due to the small size of the charcoal fragments.

In 1995, small charcoal samples were collected from soil pits at Plot 11 (EP33) Curtain Fig as part of a regional vegetation history project. In 2003, these samples were re-examined and two fragments of charcoal were selected for AMS dating. Again, no taxonomic determinations were possible.

The charcoal samples from these two sampling regimes were radiocarbon dated at the AMS facility of the Australian Nuclear Science Technology Organisation (Lawson *et al.* 2000). After physical removal of macroscopic contaminants such as roots and rootlets, samples were chemically pre-treated by using the AAA method (Mook and Streurman 1983). The chemical pre-treatment consisted of the following steps:

a) Washing in HCl 2M at 60°C for 2.5 hours to remove carbonate and infiltrated fulvic acids;
b) Washing in NaOH 2% at 60°C for 3-4 hours to remove humic acids; and
c) Washing in HCl 2M at room temperature for 2 hours to remove any atmospheric CO_2 absorbed during the alkali step.

Between steps, samples were washed with de-ionised water (DIW). Finally, all pre-treated samples were washed with DIW and oven-dried at 60°C for 2 days before being converted to CO_2 by combustion at 900°C for 5 hours in a sealed tube in the presence of pre-cleaned CuO and Ag wires. Graphite targets were prepared by reducing CO_2 using zinc (400°C) and iron (600°C) catalysts in the presence of a small amount of hydrogen. This reaction lasted for 6-10 hours. The technical details of these methods are described in Hua *et al.* (2001).

For all samples the $^{14}C/^{13}C$ isotopic ratio was measured relative to the internationally accepted HOxI standard material (Stuiver 1983). Corrections were then applied for the spectrometer background, for the contamination incorporated during the preparation of the graphite target and for the isotopic fractionation. Using the corrected radioisotopic ratio, the conventional radiocarbon age was calculated.

In conversion of the radiocarbon dates to calendar years, first an offset of 24±3 years was subtracted from the measured radiocarbon age to account for the incomplete atmospheric mixing between the two hemispheres (Stuiver *et al.* 1998a). The amended age was then calibrated using the CALIB 4.0 software (Stuiver and Reimer 1993) and the tree ring data set of Stuiver *et al.* (1998b).

GEOLOGY, LANDFORMS AND SOILS

I. S. Webb, R. W. Knowlton, K. D. Sanderson, A. Beech, S. Farr, M. G. Bradford, R. K. Hewett and A. W. Graham

Geology and Landform

At the time of plot establishment, descriptions of site geology were based on regional 1:250,000 map sheets (e.g. de Keyser *et al.* 1972). Where possible, those initial assessments now have been supplemented by or referred to more recent and more detailed descriptions (e.g. Willmott *et al.* 1988a,b). The terminology of the detailed geomorphological descriptions follows Speight (1984). The geological and geomorphic settings of a few sites are complex and some confusion is evident in past descriptions, both published and unpublished. Previous descriptions of the geology and geomorphology of the 13 sites visited during 2000 and 2001 (Table 1) were checked and updated. In 2005, the site and adjacent creek lines of Plot 6 (EP19) Garrawalt were inspected for rock outcrops during enumeration and rock samples were collected from Plot 9 (EP31) Woopen Creek.

Soil Sampling and Analysis

Because of changing research directions over time, the range of physical and chemical data collected varied between sites. The nature of the available data sets is summarised in Table 3. Three sets of soil analysis data have been collected from the CSIRO Permanent Plots.

Initial Soil Survey

The initial survey aimed to determine the general characteristics and broad-scale differences between the 19 sites established at that time. These analytical data were derived from bulked samples spanning the depth interval 0.0-0.3 m at the intersections of Subplots ABEF, CDGH, IJMN, KLOP and FGJK. All soil analyses were conducted at the analytical laboratory in Atherton and the details of the methods are reproduced directly from West *et al.* (1988).

“Soil pH was determined with a glass-calomel electrode using a 1:5 soil:water suspension. Organic carbon was determined by rapid titration (Walkley and Black 1934) and a correction factor of x1.32 applied (Teakle 1950). Total nitrogen was determined by the Honda (1962) modification of the semi-micro Kjeldahl digestion procedure and total phosphorus by the colorimetric method of Murphy and Riley (1962) using a perchloric-nitric acid digest (Baseden, Wooley and Moody 1974). Exchangeable basic cations (Ca, Mg, Na and K) were extracted with normal (pH 7) ammonium acetate and determined by atomic absorption spectroscopy. Cation exchange capacity was determined after cation extraction with ammonium acetate and replacement of the ammonium with 0.1M hydrochloric acid and titration (Chapman 1965). No values were determined for sodium in four plots. These missing values were estimated using the method of Beale and Little (1975).”

Second Soil Survey

Subsequently a second, more detailed and systematic soil survey was undertaken, though not all plots were re-sampled due to changing research priorities. In this second survey, within each plot, soil samples for chemical analyses were sub-sampled from bulked samples collected at five randomly located positions using four adjacent auger holes (i.e. a total of 20 holes per plot). The standard sampling intervals were 0-0.05, 0.05-0.1, 0.1-0.2, 0.2-0.3, 0.3-0.6, 0.6-0.90, and 0.9-1.20 m.

When possible, a soil pit site was selected adjacent to the plot boundary in an area representative of the aspect and slope of the plot. These pits were excavated to a depth of 2 m and the morphology of the profile was described. For the earliest plots, these descriptions were prepared in collaboration with Ray Isbell of the CSIRO Division of Soils, Townsville. Field texture classes were assigned according to Northcote (1979) and colour descriptions were made using the Munsell nomenclature following Soil Survey Staff (1951). For determinations of saturated hydraulic conductivity (K_S) and bulk density, soil samples were taken using a modified Ramset nail gun by firing a thin walled brass cylinder (50 mm long by 74 mm internal diameter, volume 0.215 l, internal cross sectional area 0.004301 m^{-2}) vertically into "steps" cut at various depths in the walls of the pits in the exposed profile. Soil bulk densities, moisture retention characteristics and hydraulic conductivities were determined in the Atherton analytical laboratory.

In the laboratory, the determination of Saturated Hydraulic Conductivity (K_S) was determined with an external, constant-head method using the soil "cores" in the brass cylinders. Detailed descriptions of the equipment and methods employed are given at the end of Appendix 2. Soil samples in the cylinders were saturated over a period of at least 24 hours prior to assessment by capillary action into the soil sample from the base of each cylinder. The determination of K_S was also carried out by upward infiltration from the base of the sample.

Following Loveday (1974, p 85, 10-15), for measurements made with constant head,

hydraulic conductivity $K = (Q*l) / (A*t*h)$,

where:
Q = volume of water passing in time t;
A = cross-sectional area of the sample;
l = the length of the test sample; and
h = mean hydraulic head difference (Ø2-Ø1, see Appendix 1 Figure 1).

After determination of the K_S values, the same soil samples were used for bulk density determinations, the values being recorded as the mean of four samples at each designated depth.

Soil moisture retention characteristics were determined using standard pressure plate techniques. Full procedural details are given at the end of Appendix 1.

All soil analyses from the second survey were also conducted at the analytical laboratory in Atherton. Soil pH was measured in 1:5 soil/water, 1:5 soil/1N KCl and 1:5 soil/0.01M $CaCl_2$ suspensions using a glass electrode with calomel electrode reference. Organic carbon was determined using Walkey and Black (1934) wet oxidation method. Total nitrogen was measured using a modification of the Kjeldahl method (Honda 1962). In the initial survey only, Total P was determined by a rapid perchloric acid digestion procedure (Sommers and Nelson 1972). The method of Gillman (1979) was used for an estimation of CEC and exchangeable cations. Cations of Ca, Mg, K and Na were extracted with 0.1M $BaCl_2$. Acidity and Al extracted by KCl were determined by the method of Yuan (1959).

Particle size analysis was carried out by the sieve and pipette method (Coventry and Fett 1979) with size limits based on the International System (silt 2 µm to 20 µm, fine sand 20 µm to 200 µm). Particle density analysis utilised the methods specified by Blake (date unknown, Paper No. 4949 of the Scientific Journal Series, Minnesota Agr. Exp. Sta., St. Paul following the procedures set out in Am. Soc. Testing Mater., 1958, p.80 and U.S. Dept. Agr., 1954, p.122). Full details of these methods are recorded in the soil records section of the Permanent Plot files.

Recent Soil Data Collection

The third set of soil chemical analytical data was obtained in 2000 from Plot 15 (EP38) The Crater. This site has a complex geomorphic setting and a stratified sampling was undertaken specifically to address possible confusion relating to the soil nutrient status, rock outcrops and the forest structural typology. The chemical analyses were conducted at the CSIRO Land and Water facilities at Townsville, North Queensland, and in Glen Osmund, South Australia using the standard techniques (the alpha-numeric code reference) of Rayment and Higginson (1992): pH by a 1:5 soil/water suspension [4A1]; electrical conductivity in a soil/water suspension [3A1]; exchange acidity (hydrogen and aluminium) by 1M potassium chloride [15G1], Yuan (1959); exchangeable bases and cation exchange capacity by compulsive exchange [15E1], 0.1M $BaCl_2$/0.1M NH_4Cl (Gillman and Sumpter 1986); bicarbonate-extractable phosphorus [9B2], 0.5M $NaHCO_3$ (Colwell, 1963), and colorimetric finish based on method of Murphy and Riley (1962). Total organic carbon was determined by a 1994 Leco CNS-2000 high temperature resistance furnace with infrared detection of total carbon only [cf. 6B3]. Total nitrogen was determined using a Leco CNS-2000 high temperature resistance furnace using thermal conductivity for the detection of nitrogen after the sample is combusted in the high temperature resistance furnace (see Etheridge *et al.* 1998, Matejovic 1997). More details of the CNS-2000 multi-functional analyser are given in Appendix 1.

In July 2002, soil bulk density was sampled at Plot 15 (EP38) The Crater from the walls of five small pits located just outside the four corners of the plot and at its centre. Samples were taken at depths of 0.0-0.05, 0.10-0.15, 0.25-0.30 and 0.50-0.55 m by driving thin walled stainless steel cylinders (50 mm long by 73 mm diameter, volume 0.209 l) into the exposed profile using a heavy hammer as lack of vehicle access precluded use of the sampling gun.

In August 2003, samples for soil particle size analysis were collected from Plot 19 (EP43) Mount Baldy to provide a more complete description of the rhyolitic soil profile that is typical of much of the highland area south of Atherton.

CLIMATIC RECORDS AND DATA

K. D. Sanderson and D. W. Hilbert

In the early stages of this project, annual rainfall values at the 20 plots were estimated intuitively from available long-term records and publications. These estimates were recorded in the site summaries in the plot files. For this review, climatic data for those plots located within the Wet Tropics region were derived from both the ANUCLIM climatic model (McMahon *et al.* 1995) and from a later refinement by Turton *et al.* (1999) based on an 80 m digital elevation model.

CSIRO staff obtained field records of rainfall for limited periods from sites adjacent to Plot 1 (EP2) Downfall Creek, Plot 2 (EP3) Mount Haig, Plot 4 (EP4) Little Pine Creek and Plot 11 (EP33) Curtain Fig. Some datasets were obtained on a fortnightly basis using recording pluviographs located in nearby clearings, while others were taken with automatic electronic weather stations. Thermohygrograph records of temperature and humidity were made at Plot 2 (EP3) Mount Haig between June 1974 and December 1978. All available data are from these sources are stored in the Permanent Plot Files. Other rainfall data were collected by staff of the QFS, as at the “Harvesting and Marketing Barracks” on the Windsor Tableland. Copies of rainfall data sheets from this location, spanning the period October 1978 to January 1987, are held in the scientific archive papers (Windsor Tableland section) of Francis Crome at the CSIRO Tropical Forest Research Centre, and a summary is held in the Permanent Plot electronic climate archives. Other notes and climatic summaries, including brief regional weather system summaries for the period 1974 to 1977, are also held in the Permanent Plot Files.

FOREST TYPOLOGY

J. G. Tracey and A. W. Graham

In February 2000, J. G. Tracey determined the rainforest structural type of each site in a desktop exercise using the updated and corrected locations, biophysical datasets and the forest structural descriptions and profiles for all 20 plots. The classification and terminology follow Webb (1959, 1968, 1978) and the typology within the humid tropics region follows the criteria of Tracey and Webb (1975) and Tracey (1982). The assessments then were validated, firstly by recognition of key species from the floristic list (Appendix 2) of each plot (an approach justified, for example, by Williams and Tracey (1984)), and subsequently by field inspection of the sites visited in 2000 and 2001 (Table 1).

FLORISTIC IDENTIFICATIONS, VOUCHERS AND LISTS

B. P. M. Hyland, K. D. Sanderson, R. K. Hewett and A. J. Ford

Enumerated Trees

All enumerated trees ≥10 cm dbh were identified. When necessary, leaf samples were collected and bark surface, bark blaze and stem features (such as buttresses or fluted stems) were recorded. For each recognised species within each plot, reference voucher specimens were prepared and formally determined. In addition, a field reference leaf collection was established for each plot.

Saplings, Shrubs and Other Life Forms

At all plots, the floristic composition of each subplot was recorded for all plants >0.25 m high but <10 cm dbh at establishment, recorded as presence or absence in two height classes, firstly for one or more individuals 0.5 to 3 m high, and secondly for one or more individuals >3 m high but <10 cm dbh. The qualitative version of this floristic data has been incorporated in the tables of Appendix 2. Some of the semi-quantitative data was used by Stocker (1983) as the basis of "regeneration stocking" assessments for "important species" as presented in his Tables 10 to 28, and for Plots 5 (EP18) Mount Lewis, Plot 11 (EP33) Curtain Fig and Plot 13 (EP35) Whyanbeel) in Tables 3 to 5 of West *et al.* (1988).

Species lists for these understorey plants were compiled by subplot at the time of establishment. Reference voucher specimens of those understorey species not already encountered as trees were collected and determined. Other life forms such as epiphytic trees, vines, herbs, ferns, and epiphytes present within the plot were recorded on a supplementary species list and reference voucher specimens collected when feasible.

Nomenclature and Voucher Specimens

A master reference list was prepared for tree and shrub species found within the 20 plots. Over time the nomenclature was updated (e.g. following Hyland and Whiffin 1993, Hyland *et al.* 1999). For this report all nomenclature follows Queensland Herbarium (2002).

All voucher specimens from the 20 plots are stored in the Queensland Regional Station (QRS) Herbarium at the CSIRO Tropical Forest Research Centre, Atherton. This research herbarium is a branch of the Australian National Herbarium in Canberra and is maintained by staff of CSIRO Plant Industry.

FLORISTIC RELATIONSHIPS BETWEEN THE PLOTS

A. W. Graham and J. Kanowski

Floristic relationships amongst the twenty rainforest plots were examined using the classification techniques in the PATN pattern analysis package (Belbin 1993a,b). Qualitative (presence/absence) and quantitative (abundance) datasets for the enumerated trees (i.e. of stems $\geq$10 cm dbh) were utilised for the analyses using the Czekanowski and Bray-Curtis association measures, respectively. Classifications were conducted using an agglomerative fusion algorithm (UPGMA). The quantitative data were log (x+1) transformed.

DATA STORAGE AND ARCHIVE ARRANGEMENTS

D. W. Hilbert and M. G. Bradford

All available mensuration data are stored at the CSIRO Tropical Forest Research Centre, Atherton, in both hardcopy and electronic form. Field data sheets and descriptive records (including site maps) for each plot are filed on a plot-by-plot basis. All requests for access to, or use of, any data from the CSIRO Permanent Plot Files should be addressed to the Officer in Charge, CSIRO Tropical Forest Research Centre, PO Box 780, Atherton, Queensland 4883, Australia.

DESCRIPTIONS AND DATA SETS

A. W. Graham

DETERMINATION OF PLOT LOCATIONS

The locations of the plot sites were determined by two methods. The positions of the earlier plots (Plots 1 to 3 at least) were determined from surveys by K. Sanderson. The positions of the later plots were located using the most detailed available topographic maps (typically 1:50,000 scale in either the Commonwealth or Queensland Forest Service Series) and, in some cases, aerial photography. In the vicinities of the plots, the dense rainforest canopies generally inhibited the use of handheld global positioning system (GPS) in accurate determinations of plot locations. However, where possible, GPS readings were attempted at the plots or taken from nearby features to refine the position estimates for the unsurveyed locations. Overall, the accuracy of plot locations is considered to be ± 100 m.

For modelling purposes, it is suggested that particular attention should be paid to the location of the plots in relation to the relevant landform elements rather than to precise grid references, to ensure that the data are most appropriately related to their topographic setting.

The locations of the plot sites in terms of the current Geocentric Datum of Australia 1994 (GDA 1994) is given in Table 1. The data of Table 1 were calculated from the earlier Australian Geodetic Datum 1966 (AGD 1996) grid references as listed on Table 1a that also shows the sources of the maps that were used to determine the locations for the unsurveyed plots.

Within the detailed descriptions of some of the plots, grid references are provided for locations that are useful for navigation to the plot or of relevance to site descriptions. To allow easy use of the older maps held within the project files and to facilitate future GPS navigation, these grid references are given in both the original AGD 1966 and current GDA 1994 formats.

BIOPHYSICAL SETTINGS OF THE SITES

The plot sites were selected on an opportunistic basis that was determined largely by the history of logging and agricultural development, in the Wet Tropics region at least. It is therefore important to define, as fully as possible, the range of topographic, edaphic and climatic settings represented by the sites in order to maximise their usefulness in ecological studies. An outline of the geological and geomorphic settings of the 20 plots is given in Table 4 and the key climatic parameters for each of the plots are set out in Table 5.

Upland and highland settings characterise 14 of the sites, with 10 of these being on acidic igneous rocks. Model estimates of mean annual rainfalls at the sites span a range from 1266 mm (close to the lower limit for closed forests at this latitude) to more than 3400 mm. At many of the upland and highland sites, these rainfall totals will be augmented by cloud, as commonly observed at Plot 19 (EP43) Mount Baldy. In the Wet Tropics region, estimates of the mean annual temperatures represented vary from 18.3°C (Plot 7 (EP29) Mount Fisher, 1200 m asl) to 25.3°C (Plot 17 (EP41) Oliver Creek, 15 m asl) and, as is usual, this variation is strongly correlated with site altitude.

DISTURBANCE HISTORY

Any interpretation of the stand structure or of the floristic, growth or mortality data of rainforest plots must take account of disturbance history. Some of the historical factors that might be relevant include relatively recent geomorphologic changes (e.g. landslides, erosion) as well as various processes determining community composition and gap dynamics. Many of these changes are often driven by climatic events (e.g. storms, lightning strikes and fire, cyclonic winds, torrential rainfalls or droughts), sometimes in combination with pathogens (e.g. *Phytophthora cinnamomi*).

Direct and indirect human disturbances may also be superimposed on the broad scope of natural perturbations (e.g. mining excavations, walking tracks, cattle grazing, logging disturbances, anthropogenic fire). A summary of recent disturbances inferred or recorded at each of the plot sites up to the end of 2005 is presented in Table 6. The widespread disturbance effects on the plot series from Tropical Cyclone *Larry* (20 March 2006) and Cyclone *Monica* (19 April 2006) are not presented in this report.

It is most likely that Plot 1 (EP2) Downfall Creek was grossly disturbed during World War II, resulting in the anomalous successional or regrowth stand structure at this site. Logging at a very low relative intensity is recorded as occurring within the 0.5 ha enumeration area at two sites, Plot 4 (EP9) Robson Creek and Plot 15 (EP38) The Crater, and possibly at Plot 14 (EP37) Eungella and Plot 3 (EP4) Little Pine Creek. Cyclonic damage was observed on six plots prior to the 1998 enumerations, and at four plots subsequently up to the end of 2005. The development of an extensive canopy gap associated with a lightning strike was observed at Plot 5 (EP18) Mount Lewis after 1987. At Plot 6 (EP19) Garrawalt, the plot records span much of a development and recovery cycle for a patch death phenomenon associated with the confirmed presence of the root-rot fungus *Phytophthora cinnamomi*. At Plot 18 (EP42) Iron Range, meander migration has removed a substantial section of the original 0.5 ha area. More detailed accounts of these disturbances are given the detailed plot descriptions.

No systematic assessment was made of relict soil charcoal encountered in the plot soil pits, though field staff recalled charcoal fragments in soil pits at Plot 2 (EP3) Mount Haig, Plot 8 (EP30) Agapetes Logging Area, Plot16 (EP40) Agapetes Scientific Area, and Plot 11 (EP33) Curtain Fig (Ian Webb, personal observation). In the original surveys, no soil charcoal samples were collected. Without dated charcoal samples, no historical or ecological interpretations are possible due to the occurrence of relict Quaternary charcoal in the vicinity of at least some of these sites (Hopkins *et al.* 1993). The risks of uncalibrated interpretations are shown by the range in charcoal ages in the data from Plot 11 (EP33) Curtain Fig (Table 8).

Today, fire has no role in the on-going ecological processes and settings of any of the 20 CSIRO rainforest plots. Only for Plot 11 (EP33) Curtain Fig is there a possible historical record of fire that was probably associated with burning by European settlers in agricultural development context (West *et al.* 1988). However, as set out in the results below, radiocarbon dating has revealed that prehistoric fires occurred on, or immediately adjacent to, five of the plots during the last two thousand years (Table 8). Four of these sites include, or lie adjacent to, a ridgecrest (Table 4). Potential origins of the charcoal include aboriginal campfires, aboriginal ridgetop track maintenance activities (Ernie Grant of Tully, personal communication), more general aboriginal burning (or less likely natural fires) in cyclone or storm debris, and natural fire associated with lightning strikes in flammable ridgetop rainforest community debris (e.g. *Acacia* litter), or in now defunct *Eucalyptus* ridgetop vegetation. European origins for the charcoal fragments, such as campfires for forestry workers, are unlikely given the age of the wood burnt to produce the charcoal (mostly older than 1000 years BP), the broad distribution of the fragments within the sites, and the deliberate focus of the plot project on undisturbed forest settings.

The older charcoal date of 7790 BP from Plot 11 (EP33) Curtain Fig is most probably associated with the final phases of long-term Late Quaternary vegetation changes as described by Hopkins *et al.* (1993).

RAINFOREST STRUCTURAL TYPES AND REPRESENTATION

Table 9 sets out the rainforest structural type of each of the 20 plots, together with the generalised climatic and altitudinal zones in which the type occurs. Because of the bias towards nutrient-poor upland and highland settings, types 6, 8 and 9 are relatively well represented by 9 plots in total (Table 10). As noted previously, one of the type 6 representatives, Plot 1 (EP2) Downfall Creek, has an anomalous successional or regrowth stand structure.

Although Complex Mesophyll Vine Forest, type 1a, is represented nominally by three plots, two of these are floristic variants of the type. While these variants are locally extensive (e.g. the *Backhousia bancroftii* F.M.Bailey and F.Muell. ex F.M.Bailey dominated CMVF at Plot 9 (EP31) at Woopen Creek) or of outstanding conservation significance (e.g. *Idiospermum australiense* (Diels) S.T.Blake in Plot 17 (EP41) Oliver Creek), they are not representative of the physiognomy, stand structure or dynamics of the type at the regional scale. Complex Notophyll Vine Forest (CNVF), type 5a, is represented in Plot 15 (EP38) The Crater where the edaphic setting of the site (deep, carbon-rich soil developed from oligotrophic rhyolitic soil parent materials enriched with basaltic pyroclastics) is unusual for the type. The vast majority of this type is normally found on deep basaltic soils. Although Plot 11 (EP33) Curtain Fig satisfactorily represents Complex Notophyll Vine Forest (CNVF), type 5b, on a physiognomic basis, the site has a disturbance history that should be considered in any detailed interpretation of floristic composition and community dynamics.

STEM DENSITY AND BASAL AREA

The main aim of this report was to provide comprehensive biophysical site descriptions to allow subsequent detailed analysis of the stand, growth and floristic data. Accordingly, no detailed examination of these stem density and basal area data will be undertaken in this report. The summary of stem density and basal area data (Table 11) details mean, minima and maxima values to 2002 except for Plot 20 (EP44) Fantail Logging Area with data current to 2004, while data for Plot 6 (EP19) Garrawalt, Plot 9 (EP31) Woopen Creek and Plot 14 (EP37) Eungella are current to 2005.

No meaningful interpretations of these data are possible without considering the disturbance histories and topographic settings of the sites, as well as any pertinent forest characteristics such as local floristic variants. For conciseness, the data of Table 11 *do not* present the temporal relationships between stem density or basal area and various perturbations, or, just as importantly, the absence of perturbations. Such assessments must be done on a site-by-site basis.

For example, no reasonable explanation of the high stem density and low basal area of Plot 1 (EP2) Downfall Creek would be possible unless the high level of past disturbance on this site was known. Similarly, any attempt to generalise the characteristics of CNVF type 6 forest by considering both Plot 1 (EP2) Downfall Creek and Plot 16 (EP40) Agapetes Scientific Area would be unrewarding without that knowledge.

SOIL DESCRIPTIONS AND ANALYTICAL DATA

An incomplete version of the soil analysis data from the preliminary survey (unstratified sampling to 0.3 m depth) of the initial 19 plots has been published previously (Beadle 1981). These data, together with additional data from file records and Stocker (1983) are given in Table 12.

Despite the sampling limitations of this dataset (i.e. only 19 sites, and samples bulked over the depth 0 to 0.3 m), it allows some general interpretations of the relationships between soil conditions and forest physiognomic structure (in the sense of Webb 1959, 1968). Calcium and phosphorus are widely recognised as key macro-element indicators of soil fertility. The simplistic plot of total P against Ca (Figure 4) shows that the 19 sampled sites may be considered in two broad categories:

a) Five eutrophic sites (with either total P > 0.1% or Ca > 0.1 cmol(+) kg^{-1}); and
b) Fourteen oligotrophic to mesotrophic sites with low values for either P or Ca, or for both.

Most of this set of 14 oligotrophic to mesotrophic sites is located typically at higher altitudes on metasediments and acid igneous rocks (originating from burial of the metasediments at great depths, and hence of similar chemical composition). In general, these sites are structurally simple, predominantly being types 8 and 9 (Table 9).

Of the eutrophic sites, the most fertile is Plot 11 (EP33) Curtain Fig with high levels of both P and Ca. Both Plot 15 (EP38) The Crater and Plot 18 (EP42) Iron Range have moderately high values of P but low Ca, while Plot 14 (EP37) Eungella and Plot 12 (EP34) Russell River have moderately high Ca but low P levels. Of these five eutrophic sites, two are on basaltic soils, two on soils with basaltic influence, while the remaining site is on alluvial soil (Table 4). Most of these sites are structurally complex (types 1a or 5, CMVF or CNVF respectively). This general correlation of increasing structural complexity with more abundant soil nutrients is a keystone in the classification scheme of Webb (1968). The eutrophic Iron Range site (Plot 18 (EP42), is distinctive in its semi-deciduous nature, a feature facilitated by high nutrient availability (Webb 1968).

All available soil physical and chemical data from the subsequent more detailed stratified sampling programs are given in Appendix 1.

FLORISTIC COMPOSITION, SPECIES RICHNESS AND LIFE FORM ABUNDANCES

Detailed lists of the floristic composition of each of the plots at the time of establishment are given in Appendix 2. For plants >0.25 m high, the species richness varied from 84 to 189 variously representing between 6 and 11 of the 15 generalised life forms of higher plants that were represented in the plots (Table 13).

A number of key factors must be considered when attempting to identify relationships between the species richness or life form richness and the forest type or inferred nutrient status of the sites, including:

a) The limited replication in a restricted sampling of forest types;
b) The wide altitudinal, latitudinal and biogeographic ranges covered;
c) The great variation in climatic parameters;
d) The contrasting site disturbance histories; and
e) The differing landform elements encompassed.

In this dataset, no relationships appear to exist between either the total species richness or the tree species richness and either the altitude or rainfall (all four correlation coefficient values < 0.14). However, if the data are partitioned by forest structural type into “Simple” (Plots 2, 4, 5, 6, 7, 8, 19 and 20) and “non-Simple” types, significant differences between the groups are evident (2 tailed heteroscadistic t tests). The simple forests (types 8, 9 or 8/9) have significantly higher values for mean species richness (152 vs 124, $p = 0.025$), for mean tree-species richness (112 vs 84, $p = 0.004$), and for the mean percentage of tree species, i.e. tree species richness as a percentage of the total species richness (74 vs 68, $p = 0.002$). The lower values for tree species richness and for percentage of tree species in the more complex forests are still consistent with the principles of Webb’s classification scheme (Webb 1968) as more life forms will occur in the more complex forests that typically have a relatively low tree stem density. (However, note that these data do not address the relationships for a total census including seedlings.) Even when the three plots that may be considered biogeographic outliers are not considered in the comparisons (i.e. Plot 10 (EP32) McIlwraith Ra., Plot 14 (EP37) Eungella, Plot 18 (EP42) Iron Range), the simple forests still have significantly higher values for mean tree-species richness (112 vs 89, $p = 0.016$) and for the mean percentage of tree species (74 vs 68, $p = 0.0025$).

Within the “non-simple” forests sampled, Plot 3 (EP4) Little Pine Creek has the highest species richness and tree species richness values, these values being respectively 5% and 15% greater than the next highest values in the group. The possible role of cyclonic disturbance in maintaining the species richness of this plot will, no doubt, be examined in subsequent publications.

Earlier interpretations of analyses of the life form, species richness, species diversity and floristic characteristics of the CSIRO plots may have been hindered by some incorrect descriptions of site and forest characteristics. Statistical methodologies for analysing multivariate data have also advanced in recent years. The quantitative and qualitative floristic analyses of Graham and Kanowski carried out for this review show very clear floristic groupings of the sites (Appendix 2 Figure 1, Appendix 2 Figure 2), and that these groups strongly reflect the forest physiognomic structural types (sensu Webb 1959, 1968, 1978). These classification results and interpretations contrast strongly with those of West *et al.* (1988).

PLOT DESCRIPTIONS

A. W. Graham, K. D. Sanderson and M. G. Bradford

Plot 1 (EP2) Downfall Creek

Location, Landform and Climate

The Downfall Creek plot is located on the eastern side of the Tinaroo Range, a little to the south of Downfall Creek that flows into Tinaroo Dam (Table 1, Figure 5) some 18 km north-northeast of Atherton. It lies on the margin of Danbulla Forest Drive and Danbulla National Park Recovery, and is close to both Danbulla National Park and Danbulla State Forest, (all previously Downfall Logging Area of State Forest 185 Danbulla) within the Wet Tropics World Heritage Area. Early maps show this site was originally in surveyed Portion 115 Parish of Danbulla, suggesting an intention to develop the land for agriculture. The site now is accessible only on foot along an abandoned logging track that commences from Danbulla Forest Drive at approximately 7.2 km past the northern carpark at the wall of Tinaroo Dam. The plot was established in July 1971, and the establishment report (J. L. O'Farrell, 21 March 1973) states that the object of this plot was to examine the structure and species composition of a typical *Flindersia schottiana* site (but see structural description below).

The plot straddles a low, gently to moderately sloping (2° to 9°) ridgecrest rising in a southwesterly direction on the lower footslopes of the Tinaroo Range at 720 m altitude. The 100 m axis of the plot lies at 300°, almost parallel to the ridge and the plot extends onto the upper slopes (5° to 8°) on either side of the crest. The commencement corner (Subplot A) is located in the eastern corner of the plot and the subplot layout is as represented in Figure 3. On the northeastern side of the plot, the pre-existing access track was included within the 20 m buffer zone. The southeastern corner of the plot was tied to QDF theodolite traverse peg TP73 on the Tinaroo to Danbulla road survey (Danbulla Forest Drive), and the boundaries of the plot are shown on the 1972 QFS Danbulla 1:25,000 map.

Along some sections of the ridge crest, soils are skeletal with abundant outcrops of coarse-grained biotite granite (Willmott *et al*. 1988a,b). On the upper slopes, the soil profile is at least 1.3 m deep. The rainfall pattern, as assessed by the rainfall Coefficient of Variation, is strongly seasonal (Table 5) and, in terms of the climatic zones of Tracey and Webb (1975), the site is dry (Table 9). From 1974 to 1978, rainfall data were collected by recording pluviograph from a nearby clearing immediately adjacent to Danbulla Forest Drive (c. Tinaroo 1:50,000 AGD 1966 349500 8103900, GDA 1994 349615 8104076) and these data are held in the Permanent Plot Files. The mean annual rainfall recorded at the site during this period was 1660 mm.

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a tall, closed to mid-dense (but with local sparse patches) canopied forest with occasional emergents. The upper canopy ranges between 15 and 18 m with the more usually emergent *Agathis robusta* attaining only 22 m (Figure 6). Stocker (1983) described the upper canopy as relatively low and open, observing, "much light penetrated to within a few metres of the forest floor". In terms of both frequency and basal area contribution, *Cleistanthus semiopacus* clearly dominated the plot for stems ≥10 cm dbh (duplicated plot description, Table 2/3). Although not previously mentioned in any plot descriptions, numerous low branching trees were observed during the field inspection in 1999. These indicated that the canopy of the site was relatively open to clear in the recent past (see disturbance history below). The understorey is sparse and consists of overstorey tree species and shrubs while abundant ferns and sedges dominate the groundstorey, particularly in areas of more open canopy. The forest at this site is a successional stage of

Complex Notophyll Vine Forest (CNVF) with emergent *A. robusta*, i.e. type 6 of Tracey and Webb (1975) and Tracey (1982). A more typical example of the general appearance and forest structure of CNVF with *A. robusta* emergents to 30 m or more in height may be seen nearby, immediately adjacent to Danbulla Forest Drive from about 4.0 to 5.0 km north from the dam wall.

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 1. Key species that confirm the structural/environmental classification through corresponding floristic relationships are *A. robusta*, *Argyrodendron polyandrum* and *Pseudoweinmannia lachnocarpa*. All the recorded species are typical of the type in this area.

The total species richness and tree species richness, 90 and 58 respectively, are the lowest values recorded from the 19 northern sites in the series of 20 plots. Life forms are moderately abundant (8) but the tree species constitute only 64% of the total species list, a low value in comparative terms (Table 13). These low values (cf. the other type 6 site, Plot 16 (EP40) Agapetes Scientific Area) may best be explained by considering the successional nature of the site where the open canopy has allowed the persistence of grass and sedge species with a relative abundance of shrubs, vines and herbs in a species poor community.

Disturbance History and Stand Structure

At plot establishment, records indicate there was no evidence of recent disturbance of the forest by natural events. Selective logging was conducted in the vicinity before 1971 and an old road passes within 10 m of Subplot A. On this road, a substantial retaining wall, constructed by the dry-stone pitching method, indicates a construction date well before establishment of this plot. Although snig tracks were evident throughout the area surrounding the plot at establishment, there was no direct evidence of recent logging operations within the 0.5 ha plot area (but see below). No significant disturbances have been recorded on the plot during the 14 measurements that span 31 years of observations (Table 6) though the site map records an area of pig rooting in Subplot C in 1989.

There are several possible reasons for the unusual characteristics of the Downfall Creek plot. During World War II, this ridgeline was used as a machine gun firing range (John Rudder, Queensland Forestry Department retired, personal communication July 2000). Alternatively, the site may have been in a natural state of long-term succession reflecting relatively recent rainforest colonisation of a Late Quaternary sclerophyll forest inlier, delayed perhaps by the shallow soils on much of the ridgetop. However, this is unlikely as no residual stumps or surface charcoal fragments are evident. Finally, as the plot lies only 1 km northeast of an old sawmill site drowned by Tinaroo Dam (see 1942 Gordonvale 1 Mile series map sheet; location at Tinaroo 1:50,000 AGD 1966 349000 8102800, GDA 1994 349115 8102976), early logging might have occurred on this land that originally was intended for farming use at the time of the portion survey.

As noted above, the structure of this plot is not typical of type 6, CNVF with emergent *Agathis robusta*. The low basal area (34.1 m^2 ha^{-1}) and high stem density (1062 stems ≥10 cm ha^{-1}) are respectively the second lowest and second highest recorded from the 20 CSIRO plots (Table 11, maximum values). In combination, these values are atypical of most undisturbed rainforests in north Queensland and reflect the unusual disturbance history of the site.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the granitic soil at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 1) is based on field records (Profile Number TL54, compiled by R. Isbell, CSIRO Division of Soils, Townsville) from a soil pit located near the plot, possibly adjacent to the access track. The profile was described as having a Principal Profile Form Um6.3 and affinities with the earthy sand Great Soil Group. Soil chemical analysis data (second series of analyses) are presented in Appendix 1 Table 2. Soil bulk density and moisture retention data are given in Appendix 1 Table 3 while soil hydraulic parameters are presented in Appendix 1 Table 4. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 5. Soil particle density data are given in Appendix 1 Table 6.

Plot 2 (EP3) Mount Haig

Location, Landform and Climate

The Mount Haig plot is located close to the crest of the highest and northernmost section of the Tinaroo Range (Table 1, Figure 7) in Dinden National Park (previously Emerald Logging Area of State Forest 607) within the Wet Tropics World Heritage Area. The site is about 24 km north-northeast of Atherton. Vehicular access to the plot currently terminates at the most northerly point on the Mount Haig road (at Tinaroo 1:50,000 AGD 1966 349500 8109500, GDA 1994 349615 8109676) with foot access over the next 1 km (approximately) of abandoned logging tracks. The plot was set out in October 1971 and the establishment report (J.L. O'Farrell, undated) states that the object of this plot was to examine the structure and species composition of a typical rainforest containing *Flindersia bourjotiana* and *F. pimenteliana* towards the upper altitudinal limit of their occurrence.

The plot lies on the eastern flank of a major north-south ridgeline of the Tinaroo Range at an altitude of 1120 m. The 100 m axis of the plot lies parallel to, and just below, the crest of a side-ridge on a bearing of 50°. The 50 m axis runs down slope at 140° (at right angles to the side ridge) and encompasses upper, mid and lower slope landform elements. Subplot A is located in the southwestern corner of the plot (Figure 8), and the subplot layout is a mirror image of that represented on Figure 3. Logging activities have not disturbed the buffer zone. The northwestern corner of the plot was tied to QDF theodolite traverse peg TE2 that was located near the junction with another abandoned logging track leading to the summit of Mount Haig.

The soils at this site have developed from deeply weathered coarse-grained biotite granite (Willmott *et al.* 1988a,b). Some granite boulders occur along the main ridgeline and on the plot. The site consists of two contrasting geomorphic settings (Figure 8). The southern half of the plot (Subplots A to H) lies on a typical ridge to footslope catena with moderately inclined to steep slopes. In this section, soil depths and characteristics vary along the catena from the ridgetop to gully. The northern section (Subplots I to P) lies across a substantial landslide, with the very steeply sloping headwall located in the buffer zone adjacent to Subplots I and M. The near-level to upthrust toe section occupies much of Subplots O and P. As many of the trees growing on the margins and toe of the slide are of moderate size, the landslide may be hundreds of years old. On this feature, on-going local small slope-failures and mass soil movements, as well as accelerated erosion, are causing tree mortality by root wrenching, root breakages and infections, and by toppling from precarious positions on the head and sidewalls. Soil characteristics in this section of the site will reflect the complexity of the landslide setting.

In terms of the climatic zones of Tracey and Webb (1975) the site is cloudy wet (Table 9). The rainfall pattern is amongst the least seasonal of the CSIRO plots (Table 5). The relatively low seasonality of precipitation, as represented by the rainfall Coefficient of Variation parameter (Table 5), is comparable with that of Plot 8 (EP30) Agapetes Logging Area. Only Plot 7 (EP29) Mount Fisher has a more equable rainfall seasonality. From 1974 to 1978, rainfall data were collected by recording pluviograph and temperature and humidity data from a screened thermohygrograph (calibrated against wet and dry bulb thermometers) from a nearby clearing located approximately 500 m southwest of the plot and 550 m northeast of the "B" Road turnoff, near Tinaroo 1:50,000 AGD 1966 349870 8109750, GDA 1994 349985 8109926, elevation 1150 m). During this period, the mean annual rainfall at the instrumentation clearing was 2226 mm while the maximum and minimum temperatures recorded at screen-height were 32°C and 5.5°C respectively. The original data and calibration values are held in the Permanent Plot Files.

Forest Structure, Type and Floristics

This rainforest is a very tall closed forest with occasional emergents. The upper canopy height ranges between 25 and 32 m with emergent *Agathis atropurpurea* to 40 m (Figure 9). For stems ≥10 cm dbh, *Brackenridgea australiana*, typically a small tree to about 12 m high has the highest stem frequency, while the emergent *A. atropurpurea* contributes over 12% of the basal area (plot description). The treefern *Cyathea rebeccae* is a conspicuous component of the understorey. Interpretations of species importance of the plot should take account of the differences in crown form amongst the canopy trees (plot notes). This forest is Simple Microphyll Vine-Fern Forest (SMiVFF), i.e. type 9 of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 2. *A. atropurpurea* is the key species that confirms the structural/environmental classification. The recorded species are typical of the type in this area and the floristic composition shows similarities to a section of a long-term plot monitored by Prof. Joseph Connell at Davies Creek (Connell *et al.* 1984).

The total species richness (144), tree species richness (110) and life form abundance (8) fall in the moderate range amongst the values recorded from the 20 plots (Table 13). The percentage of tree species (76%) falls in the highest range (75% to 76%) that appears characteristic of structurally simple forests from cloudy sites in upland and highland settings.

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

At the time of plot establishment, the site was described as "relatively free from recent disturbance", although "tree falls across Subplots A, B and P have opened the canopy and increased the amount of seedling regeneration in these areas" (J. L. O'Farrell, undated plot establishment report). Selective logging of areas adjacent to the site commenced in 1971 after plot establishment but these activities caused no structural damage to the buffer zone or the plot.

From the limited quantitative data available (CSIRO plots 2, 5, 8 and 19) and the transect drawing of Tracey (1982), the combination of high stem density values (1014 stems ≥10 cm ha^{-1}) and a high basal area (67 m^2 ha^{-1}) appears typical of type 9 rainforest (Table 11, maximum values). This basal area is the second highest recorded from the 20 CSIRO plots, while the stem density value is the fourth highest in the series.

Although no significant disturbances have been recorded on the plot during the 14 measurements that span 31 years of observations (Table 6), patterns of large tree mortality appear concentrated around the ancient landslide, particularly on the steeply sloping sidewalls.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the granitic soil at this site was assessed as oligotrophic (Figure 4). The soil pit for the detailed soil profile description (Appendix 1 Table 7) was located near the northeastern corner of the plot in colluvial gully infill. This pit location is not typical of the *in situ* soils of the mid- and upper slope sections of the soil catena and extrapolation of the soil data across the plot should be undertaken with caution. The pit profile was described as having a Principal Profile Form Gn3.14 and affinities with the red podzolic Great Soil Group. Relict Quaternary charcoal fragments are abundant in the profile of the pit (Hopkins *et al.* 1993) but, because of their substantial age, they reflect past regional vegetation changes that have no immediate bearing on interpretation of the structure and dynamics of the plot. Soil chemical analyses data (second series of analyses) are presented in Appendix 1 Table 8. Soil bulk density and moisture retention data are given in Appendix 1 Table 9 while soil hydraulic parameters are presented in Appendix 1 Table 10. Soil particle size data are shown in Appendix 1 Table 11.

Plot 3 (EP4) Little Pine Creek

Location, Landform and Climate

The Little Pine Creek plot is located about 12 km north northeast of Gordonvale on the western lower slopes of the Malbon Thompson Range (Table 1, Figure 10) in Malbon Thompson Forest Reserve, designated by the Queensland Government as a future National Park (previously Little Pine Logging Area of State Forest 933 Malbon-Thompson) within the Wet Tropics World Heritage Area. An early forestry map shows this site originally lay in surveyed Portion 248 Parish of Trinity, suggesting an intention to develop the land for agriculture. The current access road to the site crosses privately owned land and prior permission for access by this route must be obtained from the landowner. The old forestry map clearly indicates that the surveyed access road extended across to the eastern flank of the range, suggesting that originally it may have been an old aboriginal foot track. Within the State Forest, present access to the plot is by foot for about 1.0 km along an abandoned logging track. This plot was established in July and August 1972. The plot establishment proposal (G. C. Stocker, 3 September 1971) and report (J. L. O’Farrell, undated) state that the object of this plot was to examine the structure and species composition of a lowland rainforest site containing *Flindersia pimenteliana* and *F. bourjotiana*.

The plot lies on a gently sloping area at 110 m on the western side of a north-westerly spur of the Malbon Thompson Range and includes hill crest, upper and midslope landform elements, close to the site of a now-demolished CSIRO canopy research tower. From the commencement corner (Subplot A), the 100 m axis of the plot runs southwest bearing 211° 45’ and the 50 m axis bears 301° 45’. Subplot A is located in the northeastern corner of the plot and the subplot layout is a mirror image of that represented on Figure 3. The buffer zone is undisturbed by logging. The northwestern corner of the plot was tied into a 75 mm square survey peg for R247 on Little Pine Creek.

Extensive outcrops of coarse-grained biotite granite (Willmott *et al.* 1988a,b) occur along the access track to the plot. While the relatively gentle slopes at the site suggest that soil depths and characteristics are probably relatively uniform across the plot, the patchy distribution of the fan palms suggests that some variability may occur in internal drainage characteristics. In terms of the climatic zones of Tracey and Webb (1975) the site is wet (Table 9) while the rainfall Coefficient of Variation value (Table 5) indicates the rainfall distribution is moderately seasonal. From May 1985 to December 1987, rainfall data were collected by an electronic weather station from a nearby clearing (probably at Gordonvale 1:50,000 AGD 1966 375000 8120000 or 374650 8120300, GDA 1994 375115 8120176 or 374765 8120476). Less extensive records of air and soil temperatures are also available. A printout of data is held in the Permanent Plot Files.

Forest Structure, Type and Floristics

At the time of plot establishment, the structure of the rainforest on the plot was a tall to very tall closed forest with an irregular canopy (Stocker 1983), occasional emergents and a conspicuous subcanopy of fan palms, *Licuala ramsayi*, at a density of 268 stems ha^{-1}. The upper canopy height varied between 15 and 23 m with emergent *Acacia celsa* and *Xanthostemon whitei* to 29 m (Figure 11), these emergents being disturbance artefacts rather than characteristic of the undisturbed physiognomic type. Stocker (1983) reported the vegetation of the site at establishment to be "characterised by a more or less continual mid canopy layer of the palm, *Licuala ramsayi".* The plot description shows that, on a species basis, this palm dominates both the stem frequency and basal area contributions (28% and 10% respectively). The next most frequent species were *Macaranga subdentata* (8%) and *Acacia celsa* (6%), while the next most important species by basal area were *Acacia celsa* (9%) and *Elaeocarpus bancroftii* (8%). In addition, *Pandanus monticola* and *Calamus* spp. were abundant in the understorey.

The plot establishment report (O'Farrell, undated) records "The most striking feature of the vegetation in this plot is the small tree/understorey growth in which *Licuala muelleri* (sic, *L. ramsayi)*, *Calamus* spp. and *Pandanus* sp. form an almost impenetrable mass in places where the upper canopy is slightly open." This description suggests that both the structure and floristics of the plot were already influenced by cyclonic disturbance prior to the time of plot establishment.

At establishment, and prior to extensive removal of the upper canopy by Tropical Cyclone *Joy* (described below), it is probable that much of this plot had the structure typical of the variant of Mesophyll Vine Forest (MVF) in which fan palms may be an important feature of the subcanopy, i.e. type 2a of Tracey and Webb (1975) and Tracey (1982). In terms of the palm forest classification developed subsequently by Hopkins *et al.* (1998), this structure probably resembled a "Class 3" fan palm forest, i.e. "a fan palm forest with a *Licuala* canopy or subcanopy stratum (palm crown cover of 50-100%) overtopped by a tree canopy stratum (60-100% crown cover)".

All species recorded from the plot at establishment are listed in life form groups in Appendix 2 Table 3. The recorded species are typical of the type in this coastal area that is intermittently disturbed by cyclones. The total species richness (160) is the third highest recorded in the plot series (Table 13), but lies well below the 189 recorded at Plot 4 (EP9) Robson or 183 at Plot 5 (EP18) Mount Lewis. Tree species richness (115) is moderate to high being comparable with values recorded from Plot 19 (EP43) Mount Baldy (118), Plot 6 (EP19) Garrawalt (112), Plot 2 (EP3) Mount Haig and Plot 8 (EP30) Agapetes Logging Area (110). The percentage of tree species is 72%, and the plot ranks as moderate, being in the fourth recognised class (72% to 73%), comparable to Plot 16 (EP14) Agapetes Scientific Area (73%), Plot 7 (EP29) or Mount Fisher (72%). These characteristics may reflect the relative abundance at this site of trees favoured by gross disturbance such as *Acacia* spp., *Alstonia* spp., *Commersonia bartramia* or *Grevillea baileyana*. The high life form abundance (11) reflects the importance of the palm, cycad and pandan forms at this site, and this value is shared with another cyclone disturbed MVF site, Plot 13 (EP35) Whyanbeel**.**

Flindersia sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

Cyclones, Logging and Plot Establishment

This plot has a history of periodic disturbance, as noted in the 12 measurements that span 30 years of observations (Table 6). According to the plot notes (at establishment), "This plot shows evidence of having been disturbed periodically by cyclones and some logging damage approximately 20 years ago, due to the presence of what are considered to be light responsive species such as *Acacia aulacocarpa, Commersonia bartramia, Alstonia muellerana, Alphitonia whitei* and, to a certain extent, *Flindersia bourjotiana* and *F. pimenteliana,* generally growing on old logging tracks." The plot notes also state "One representative of *Endiandra palmerstonii* at a dbh of 0.7 m (largest in the plot) and only attaining the height of 17 m further reinforces the opinion that the canopy is subject to a general compression due to cyclones." At plot establishment, however, O'Farrell (undated establishment report) recorded that "The site appears to be relatively free from recent disturbance". Stocker (1983) noted, "Although there was no evidence of recent logging, the site was close to an old logging road and it may have been selectively logged in the past. Damage from recent cyclones (perhaps from the one in 1958) was, however, strongly suspected for the canopy was rather irregular and "large gap" tree species, especially *Acacia aulacocarpa*, were relatively abundant."

O'Farrell's description of the dense understorey (noted above) is supported by his further comment "The plot has large areas of *Calamus* sp. and *Pandanus* sp., some of which had to be lightly brushed to give access to the trees. More trampling and clearing of understorey occurred than is desirable but in this instance could not be avoided."

Selective logging operations commenced nearby soon after plot establishment in 1972 but caused no structural damage to the area within the bounds of the buffer zone.

On 28 December 1990, Tropical Cyclone *Joy* caused considerable damage to the plot and surrounding areas. More than 30 large trees on the plot were uprooted, creating large canopy gaps and transforming the understorey considerably. The positions and extents of the fallen trunks and canopies were mapped on 31 July 1991.

By the 1998 remeasurement, the understorey was nearly impossible to walk through, being dominated by dense *P. monticola* and *Calamus* spp. Patches of recent seedling regeneration of shade tolerant species of Lauraceae had established below the dense understorey.

At this plot, the low basal area of 43.4 m^2 ha^{-1} (Table 11, maximum value) probably reflects a history of repeated disturbance by cyclones. This basal area value is at the lower end of the range recorded from the 20 CSIRO plots. Plot 13 (EP35) Whyanbeel, with only 2 stems ha^{-1} of *Licuala ramsayi*, is a somewhat more typical but disturbed MVF site in the series of CSIRO plots. Both the Little Pine Creek and Whyanbeel basal area values are much lower than the 63.6 m^2 ha^{-1} value determined for a typical MVF site at El Arish by Webb and Tracey, as reported by Hopkins *et al.* (1998). The basal area of Plot 3 (EP4) Little Pine Creek lies towards the lower end of the range of values recorded from Class 1 and Class 2 fan palm forests values by Hopkins *et al.* (1998) and the establishment basal area contribution of 3.6 m^2 ha^{-1} by the 268 stems ha^{-1} of *Licuala ramsayi* is very much lower (10% vs 37 to 56%). The history of repeated disturbances probably accounts for the high all-species stem density (1022 stems $\geq$10 cm ha^{-1}) recorded on the Little Pine Creek plot.

Pre-European Fire History

Charcoal fragments were found at a depth of 0.1 to 0.2 m in three of six soil cores taken from this site during 2000 (Table 7). A single charcoal fragment from hole 2 provided a radiocarbon date of 1740 ± 40 years BP (CSIRO sample L49 H2.3, ANSTO code OZF174), (Table 8). The corresponding calendar year ages, together with the interval probabilities, are 260 AD - 297 AD (40.2%) and 322AD - 384 AD (59.8%). Due to the small fragment sizes, no taxonomic determination was possible.

From the distribution of the charcoal across the site (Table 7), it is evident that the occurrence of fire was widespread across the site. It is not possible to distinguish between the more probable sources of the charcoal, i.e. burning of a possibly pre-existing *Eucalyptus* open forest now replaced by rainforest, burning of rainforest debris following a major storm or cyclone, or aboriginal activities along the probably important ridgetop track leading to the east coast.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the granitic soil at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 12) is based on field records from a soil pit located adjacent to the plot but the exact location is not known. The profile was described as having a Principal Profile Form Uf4.2 and affinities with the red earth Great Soil Group. Soil chemical analysis data (second series) are presented in Appendix 1 Table 13. Soil bulk density and moisture retention data are given in Appendix 1 Table 14 while soil hydraulic parameters are presented in Appendix 1 Table 15. Soil particle size data from four unrecorded positions are given in Appendix 1 Table 16 and some corresponding soil particle density data in Appendix 1 Table 17.

Plot 4 (EP9) Robson Logging Area

Location, Landform and Climate

The Robson Logging Area plot is located about 24 km northeast of Atherton on the western slopes of the Lamb Range (Table 1, Figure 12) in Danbulla National Park (previously Robson Logging Area of State Forest 185 Danbulla) within the Wet Tropics World Heritage Area. Current access to the plot is by foot along an abandoned logging track that leaves the Mount Edith Presentation Road at the southern end of an old sand quarry (Tinaroo 1:50,000 AGD 1966 354100 8106700, GDA 1994 354215 8106876). The plot was set out in March 1972 (Stocker 1983). The plot establishment proposal (G. C. Stocker, 17 April 1972) and report (J. L. O'Farrell, undated) state that the object of this plot was to examine the structure and species composition of a typical rainforest containing *Flindersia laevicarpa* var. *laevicarpa*.

The plot is located on the side of a major winding spur of the Lamb Range at 800 m. From the commencement corner (Subplot A), the 100 m axis of the plot runs at a bearing of 5°, parallel to, and just below, the crest of the ridge, which runs north to south in this vicinity. This axis rises at a 5° slope from the commencement corner. The 50 m axis lies on a bearing of 95° giving the plot an eastern aspect. This axis runs down-slope at an angle of 27°, from ridge crest to lower slope landform elements just above a creek flat. Subplot A is located in the southwestern corner of the plot, and the subplot layout is the mirror image of that represented on Figure 3. The western side of the plot is immediately adjacent to the ridgetop logging track, and as a result, there is virtually no marked buffer zone to the plot along that upper margin. (See disturbance history below.) The southwestern corner of the plot was tied in to QDF theodolite traverse peg TP24 on the main access road.

Mid-Palaeozoic metasediments of the Hodgkinson Formation outcrop along the ridgetop and metamorphic rock fragments are common across the plot. However, this exposure is not marked on the most recent detailed geological map for this area (Willmott *et al.* 1988a,b). Soil depths and characteristics will vary along the ridge-crest to lower slope catena. In terms of the rainfall Coefficient of Variation (Table 5) the rainfall seasonality pattern lies near the seasonal end of the range represented in the CSIRO plots. In terms of the climatic zones of Tracey and Webb (1975) the site is wet (Table 9).

Forest Structure, Type and Floristics

In structure, the rainforest on the plot is a very tall to extremely tall closed forest. The upper canopy ranges between 26 and around 40 m (Figure 13). The tallest trees on the plot are *Beilschmiedia bancroftii* (42 m), *Flindersia pimenteliana* (40 m), *Ceratopetalum succirubrum* (40 m), with *F. laevicarpa* var. *laevicarpa* and *F. bourjotiana* at 39 m. The plot description indicates that the small tree *Medicosma fareana* dominates the stem frequencies list (21%), while *Flindersia laevicarpa* and *Ceratopetalum succirubrum* lead the species contributions to basal area (11% and 9% respectively). This forest is Simple Notophyll Vine Forest (SNVF), i.e. type 8 of Tracey and Webb (1975) and Tracey (1982).

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 4. *Agathis microstachya* and *Elaeocarpus sericopetalus* are key species that confirm the structural/ environmental classification. The recorded species are typical of the type in this area and the floristic composition shows similarities to a section of a long-term plot monitored by Prof. Joseph Connell at Davies Creek (Connell *et al.* 1984).

Both the total species richness (189) and the tree species richness (142) are very high, being the maximum values recorded in the series of 20 plots, with only Plot 5 (EP18) Mount Lewis having near comparable values (183 and 127 respectively). The ecological reasons for this are not clear. One possible explanation may be a floristic composition reflecting an "overlap" zone between highland and upland communities. Life forms are of moderate abundance (9). At 75%, the proportion of tree species falls in the highest range (75 to 76), typical of structurally simple forests from cloudy sites in upland and highland settings.

Flindersia sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

Gaps, Logging and Plot Establishment

The plot establishment report (O'Farrell, undated) describes the site as "relatively free from recent disturbance" but also noted, "An old snig track is located below the eastern boundary of the plot adjacent to a creek." This report concludes "Subplots A, E, I and M have a high number of small trees which could be due to disturbance when the logging road on this side of the plot was first constructed. A tree fall on the southern ends of Subplots G and H has opened the canopy in this area. A considerable amount of trampling of the shrub layer has occurred during identification and measuring."

The plot notes record "The stand has been subjected to natural disturbance and the presence of a few stumps suggest(s) that stems have been selectively harvested at some stage approximately 30 years ago. Where the canopy has been opened by this activity the niche has been utilised by *Polyscias murrayi* and *Alphitonia whitei* in considerable numbers filling the lower to mid-canopy category in these disturbed sections of the plot." Areas of abundant seedlings and movement-restricting *Calamus* tangles were mentioned in the plot notes and Stocker (1983) suggested these were located in "Several small recent gaps due to natural tree deaths (perhaps lightning strike)".

On this plot, values for both basal area (59.9 m^2 ha^{-1}) and stem density (926 stems ≥10 cm ha^{-1}) fall towards the higher end of the ranges recorded from the 20 CSIRO plots (Table 11, maximum value) and appear typical of well developed undisturbed rainforests in north Queensland.

No major disturbances have been recorded at this site during the 13 measurements spanning 30 years of observations (Table 6).

Pre-European Fire History

Charcoal fragments were found at a depth of 0.1-0.2 m in one of six soil cores taken from this site during 2000 (Table 7). A single charcoal fragment from hole 1 provided a conventional radiocarbon date of 780 ± 50 years BP (CSIRO sample L50 H1.3, ANSTO code OZF175), (Table 8). The corresponding calendar year ages, together with the interval probabilities, are 1228 AD - 1229 AD (14%); 1240 AD - 1288 AD (86.0%). Due to the small fragment sizes, no taxonomic determination was possible.

Because of the restricted knowledge of the distribution of the charcoal across the site (Table 7), it is not possible to distinguish between the more probable sources of the charcoal, i.e. burning of a pre-existing ridgetop *Eucalyptus* open forest now replaced by rainforest, burning of rainforest debris following a major storm or cyclone, or aboriginal activities along a ridgetop track. A European origin for this charcoal is highly unlikely (though not impossible) given the age of the wood that was burnt and the relatively undisturbed nature of the site.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the metamorphic soil at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 18) is based on records from a soil pit, the location of which is not known. The profile was described as having a Principal Profile Form Gn3.71 and affinities with the xanthozem Great Soil Group. The slope along the 50 m axis of this plot suggests that variation within the soil catena may be an important environmental factor, and extrapolation of soil pit data sets across the whole plot may not be appropriate. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 19. Soil bulk density and moisture retention data are given in Appendix 1 Table 20 while soil hydraulic parameters are presented in Appendix 1 Table 21. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 22.

Plot 5 (EP18) Mount Lewis

Location, Landform and Climate

The Mount Lewis plot is located on the Carbine Tableland on the southwestern side of the Main Coast Range (Table 1, Figure 14) in the Mount Lewis Forest Reserve, designated by the Queensland Government as a future National Park, (previously North Mary Logging Area of State Forest Reserve 143 Mount Lewis) inside the Wet Tropics World Heritage Area. The site is 12.5 km northwest of Julatten Township. The plot is accessed by a short walk from the Mount Lewis Forestry Road at a northwest to northeast corner 26.0 km from the Julatten-Mossman Road, or 22.7 km from the eastern State Forest and World Heritage Area boundary, or 3 km back from the old shed that is at the end of the accessible road (in 2000). The plot was established in September 1973 to examine the structure and species composition of a typical rainforest containing *Flindersia brayleyana* along with *F. bourjotiana, F. pimenteliana* and *F. acuminata* (establishment report, J. L. O'Farrell, undated).

The plot lies on the western side of a north-south ridge at 1100 m. The 100 m axis of the plot is parallel to the broad and relatively flat ridge crest on a bearing of 190°. The 50 m axis runs at 280° and encompasses ridge crest and upper slope landform elements. The commencement corner (Subplot A) is located in the northeast corner of the plot, and the subplot layout (Figure 15) is a mirror image of the layout represented on Figure 3. Although the buffer zone was not affected by logging activities, there has been significant natural disturbance along the eastern margin (Figure 15) in a "patch death" caused by a lightning strike (described below).

Along the main ridgeline, minor outcrops of coarse-grained biotite granite occur, being of Late Carboniferous to Early Permian (Bain and Haipola 1997). Soil depths and characteristics possibly vary slightly along the catena from the ridgetop to upper-mid slope positions. The rainfall pattern is amongst the least seasonal of the CSIRO plots (Table 5) and, in terms of the climatic zones of Tracey and Webb (1975), the site is cloudy wet (Table 9).

Forest Structure, Type and Floristics

This rainforest is a very tall closed forest with an uneven upper canopy, ranging from between 23 and 28 m with the highest trees (e.g. *Ceratopetalum succirubrum*, *F. brayleyana* or *Syzygium wesa*) up to 34 m (Figure 16). This plot is of particular botanical interest because two of the charismatic tree species have very limited distributions. *Stenocarpus davallioides* is recorded only from the Mount Lewis, Thornton Peak and in the northern section of the Alexandra Creek valley (north of Thornton Peak) while *Prumnopitys ladei* occurs only in the Mount Lewis and Mount Spurgeon areas (Hyland *et al.* 1999). The limited distributions of *Elaeocarpus largiflorens* spp. *retinervis* and *Endiandra phaeocarpa* are of comparable botanical interest. This plot has the second highest values for species richness for all life forms as well as for tree life forms (Table 13) ranking as very high, although the percentage of tree species (69%) ranks only as moderate to low due to the importance of epiphytes (11%, second highest value in series) and vines (10%). The plot description indicates that *Niemeyera* (Mount Lewis AKI 1402) dominates the stem frequencies list (12%), while *Flindersia bourjotiana* leads the species contributions to basal area (9%). This forest is Simple Microphyll Vine-Fern Forest (SMiVFF), i.e. type 9 of Webb and Tracey (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 5. Key species that confirm the structural/environmental classification include *Sphalmium racemosum*, *Elaeocarpus elliffii*, *Balanops autraliana*, *Argyrodendron* sp. (Mount Haig LSS 14307), *Garcinia* sp. (Davies Creek JGT 14745), and a range of Lauraceae such as *Cryptocarya densiflora*. The recorded species are typical of the type in this area.

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

The plot establishment report (O'Farrell, undated) described the site as unlogged and free of recent wind damage. It noted that the western side of the plot has a rather dense shrub and small tree layer and the presence of several old logs on the ground, suggesting past wind damage. The plot notes suggest, "cyclonic disturbance … … could explain the relatively large amount of very old fallen stems. These specimens are in a similar stage of decay and probably 'came down' about 50 years ago." These notes specified "Subplots C, D, G, H, K, L, O and P have high numbers of small trees and shrubs which could be due to disturbance at some time. A considerable amount of trampling of the shrub layer in these subplots has occurred during identification and measuring. A dense shrub layer in Subplots C and G is composed mainly of *Ardisia brevipedata*" (now referred to *Ardisia* sp. (Mountain Ardisia BH 8778).

Selective logging of areas adjacent to the site commenced in 1973 during plot establishment but these activities caused no structural damage to the buffer zone or the plot.

Two distinct styles of disturbance have been recorded on the plot during the 13 measurements that span 29 years of observations (Table 6). Firstly, major tree fall gaps were recorded in 1985 (Subplots G and K) and in 1991 (Subplots D and H). Secondly, an extensive "patch death" phenomenon was first noted within the buffer zone adjacent to Subplots E and I in 1987 (Figure 15). This was due to a lightning strike (Bruce Gray, personal communication September 2000). The initial observation recorded the extent of the "patch death" as being roughly circular and 30 m in diameter. Subsequently, the patch had extended northwards into Subplots E and I and westwards in the buffer zone at the 1988 measure. By 1991, more than half of Subplot I was affected. The area had not extended by 1996 and the understorey was recovering. In 1998, there was no evidence of any further recent mortality and the understorey in Subplots E and I had completely recovered, being noticeably denser than in the unaffected plot area. The understorey species within this recovery area consist of tree and shrub species typically found within the plot.

Detailed notes dated 3 August 1989, from the plot records reveal some uncertainty about the timing and nature of this disturbance, possibly due to different staff making sequential observations. These notes read:

> "Dieback (death) affects most if not all canopy species. Patch death first recorded July 1989 – approx. 30 m diam. roughly circular patch adjoining upper shallow ridge (EI side of plot) – recent dieback in most canopy trees and some (approx. ½) understorey crowns. Dead leaves and branchlets still in place, (no sign of lightning damage). Upper crowns of canopy trees dead first (as in drought stress – exposure), lower crowns of some species still green. Understorey regeneration already commencing with shade intolerant species , e.g. *Omalanthus*. Plot trees still dying in EI as dieback creeps into the plot area. Dead patch now simply a passing canopy gap. Estimated age of patch death 3 – 6 months."

From the limited comparable quantitative data available (CSIRO plots 2, 5, 7, 8 and 19) and the transect drawing of Tracey (1982), the combination of moderate to high stem density values (908 stems ≥10 cm ha^{-1}) and a high basal area (62.1 m^2 ha^{-1}) appears typical of type 9 rainforest (Table 11, maximum values).

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the granitic soil at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 23) is based on records from a soil pit, the location of which is not known. The profile was described as having affinities with the xanthozem Great Soil Group. The flat nature of this plot suggests that variation in soil parameters may be relatively small although the soils of the western section of the plot may be somewhat deeper. No soil charcoal was found in near-surface soil samples from the plot (Table 7). Fragments of relict soil charcoal of Late Quaternary age are relatively abundant nearby (Hopkins *et al.* 1993) but, because of their age, reflect past regional vegetation changes that have no immediate bearing on interpretation of the structure and dynamics of the plot. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 24. Soil bulk density and moisture retention data are given in Appendix 1 Table 25 while soil hydraulic parameters are presented in Appendix 1 Table 26.

Plot 6 (EP19) Garrawalt

Location, Landform and Climate

The Garrawalt plot is located on the eastern side of the Seaview Range (Table 1, Figure 17) in Girringun National Park (previously Burgoo Logging Area, State Forest 750) inside the Wet Tropics World Heritage Area. The site is 46 km west northwest of Ingham. Originally, the plot was accessed from the old road to Princess Hills Station from Wallaman Falls (about 16 km to the south). As the plot now lies adjacent to one of the Great Walks of Queensland, vehicle access to the plot must now be negotiated with the Queensland Parks and Wildlife Service. The plot was set out in June 1975 “to examine the structure and species composition of a typical rainforest containing *Flindersia bourjotiana*” (plot establishment report, K. D. Sanderson, undated).

The plot lies at 620 m on the southeastern side of a ridge running northeast to southwest above White Adder Creek (previously named as Burgoo Creek), a tributary of Garrawalt Creek. The 100 m axis of the plot is parallel to the ridge crest on a bearing of 47°. The 50 m axis runs at 137° and encompasses upper and mid-slope landform elements. The commencement corner (Subplot A) is located in the northwest corner of the plot, the subplot layout (Figure 18) is a mirror image of the layout represented on Figure 3, and the buffer zone is complete and intact. The northwest corner of the plot was tied to QDF theodolite traverse peg TF79 on the main access road.

Although the archived plot descriptions consistently refer to the soil parent material as granite, geological maps (de Keyser *et al.* 1972; Bain and Haipola 1997) indicate that most of the locality in the vicinity of the plot is acidic volcanics, typically rhyolitic lavas and pyroclastics. Although there are no rock outcrops within the plot, nearby outcrops in creek gullies appear to be acid volcanics (2005 plot enumeration). Never the less, it is highly likely that local occurrences of granite could occur within the general area, as occurs along the Herberton Range.

In his discussion of the general area, Brown (1999) notes that “most of Garrawalt …. is on the Glen Gordon Volcanics, massive rhyolites to dacites” and that the “dominant soils in the area are red podzolics and xanthozems (GM3.14 and GM3.75 of Northcote 1965) (G. G. Murtha personal communication [to B. Brown])”.

The Garrawalt soil particle size data (Appendix 1 Table 30) show some similarities to those of the granitic soil of Plot 2 (EP3) Mount Haig (Appendix 1 Table 11) with the coarse sand fraction being greater than that of the fine sand. The Garrawalt soil particle size data differ strongly from rhyolitic profiles described by Laffan (1988) in which the fine sand fraction usually exceeds the coarse sand, and from those of the rhyolitic Plot 19 (EP43) Mount Baldy (Appendix 1 Table 82) that are characterised by lower percentages of coarse sand compared with either the Mount Haig or Garrawalt data with the fine and coarse sand fractions being of roughly equal proportions.

The plot is divided fairly evenly between the upper slope (inclination 5°) and midslope landform elements. A small gully forms just above the western side of the plot and runs from Subplot I to Subplot L. The rainfall pattern is highly seasonal with this plot having the second highest rainfall Coefficient of Variation of the CSIRO plot series (Table 5). In terms of the climatic zonation scheme of Tracey and Webb (1975), the site is dry (Table 9) although cloud combing may augment the direct precipitation.

Forest Structure, Type and Floristics

This rainforest is a tall to very tall closed forest with emergents (but see disturbance description below). The height of the continuous upper canopy is quite variable and ranges between 15 and 30 m (Figure 19). At establishment, the tallest trees were *Cryptocarya corrugata* (38 m), *F. bourjotiana* (38 m) and *Canarium muelleri* (36 m). The treefern *Cyathea robertsiana* and the ground fern *Blechnum cartilagineum* are conspicuous and fairly abundant. The plot description indicates that the small tree *Brombya platynema* dominates the stem frequencies list (13%), while *F. bourjotiana* clearly dominates the contributions to basal area (22%).

This plot has moderate values for total species richness (150) and for life forms (8), and these values are comparable to those of other high altitude cloudy sites on infertile soils such as Plot 19 (EP43) Mount Baldy and Plot 8 (EP30) Agapetes Logging Area (Table 13). The plot ranks fifth in tree species richness with a moderate to high value of 112, while the proportion of tree species (75%) falls in the highest range (75% to 76%), both characteristics being typical of structurally simple forests from cloudy sites in upland and highland settings.

This forest was mapped as Simple Notophyll Vine Forest, i.e. type 8 of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 6. Key species that confirm the structural/environmental classification include *Cryptocarya angulata*, *C. putida*, *F. bourjotiana* and *Halfordia kendack*. The recorded species are typical of the type in this area. It should be noted that this location lies outside the range of *Agathis microstachya* that characterises this physiognomic type in areas to the north.

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

Rainforest Development, Stand Form and Human Disturbance

Stocker (1983) suggested that, as large areas of eucalypt forest that had been recently invaded by rainforest were seen in the general area, “the rainforest species on this plot may not have been there for much longer than the age of the oldest tree.” This idea is also found in the plot report, “One of the more interesting features of the species reaching the upper canopy is their comparatively small crown development, which together with their fairly early successional nature tends to suggest that this stand of rainforest is quite young and of a transient nature.”

However, the possible aggregation of early successional species, together with the very variable canopy height (which in turn may have led to the technical definition of some emergent trees) alternatively may be viewed as responses to one or more of a series of relatively intense and/or localised disturbances ranging from droughts to cyclones and possibly including earlier patch death phenomena similar to that described below.

The plot lies about 40 m from the old Princess Hill Station access road and there is no structural damage from road construction within the buffer zone. Logging activities do not appear to have affected the plot or buffer zone.

Patch Death Phenomenon

This plot is of particular ecological interest because the 11 enumeration records over 30 years span most of a period of development of, and subsequent recovery from, a “patch death” mortality phenomenon that was associated with a positive record of *Phytophthora cinnamomi* (Table 6). Although patch deaths were present in the general Garrawalt area since at least 1968 (Brown 1976, 1999), the plot establishment report described the site as “relatively free from recent disturbance”. On 6 October 1976, Dr Bruce Brown, the forest pathologist of the Queensland Forest Service, collected soil samples from the site for pathogen assessment. The most common species of *Phytophthora* recorded was *P. cinnamomi* accounting for 85.8% of all isolates, while *P. heveae* A. W. Thomps. was the second most common species detected (9% of all isolates). There was no indication that P. heveae was specifically associated with diseased forest. The distribution of these species was as follows:

- Northwest corner – *P. cinnamomi*;
- Northeast corner – *P. cinnamomi and P. heveae;*
- Southeast corner – *P. cinnamomi and P. heveae*;
- Southwest corner – *P. heveae*; and
- Centre – *P. cinnamomi and P. heveae.*

In a discussion of the occurrence and role of *P. cinnamomi*, Stocker (1983, p. 229) noted “At the time of (plot) establishment there was a small dead patch containing a large dead tree on a ridge a few metres to the south of the plot and it was assumed then that the death of those trees had been caused by lightning.” File notes dated 22 July 1977 record widespread deterioration in the condition of the plot. Further more detailed files notes, dated 22 February 1978, report a “complete open gap” in the area of the three Subplots H5, G14 and K2 and “evidence of past patch death in gully”. In Subplot K, dead stems were observed, the mortality of which was considered by the observer(s) to precede plot establishment. Further the canopy was described as “open, disturbed” with the “understorey in gully recovering – vigorous – extra light”. The first patch death mortality to occur during the enumeration period was also recorded in this vicinity at the joint corner of Subplots G, H, K and L. The general development of this patch death phenomenon until 1989 is presented in Figure 18.

K. D. Sanderson (file note 25 June 1991) recorded that (by 1991) no additional mortality was attributed to the patch death phenomenon, the understorey was in the process of recovery, the ‘Pc’ phase was past, and “one would never know ‘Pc’ had occurred in (the) plot”. In 1998 there still was no further patch death mortality and the understorey had recovered, being noticeably denser than the original understorey cover and restricting passage through the plot.

Cyclone Disturbance

During Tropical Cyclone *Winifred* (1 February 1986), about ten tree falls occurred in the strong northeast to easterly winds, and the positions of the stems and crowns were mapped during the 1987 remeasurement (Table 6).

The (post-recovery) stem density value (1014 stems ≥10 cm ha^{-1}) ranks with higher values for the plot series, (Table 11, maximum values). The basal area of 44.9 m^2 ha^{-1} lies towards the lower end of values for the plot series, and, within the Wet Tropics biogeographic region, is comparable only to forests with known histories of heavy human or natural disturbance (i.e. Plot 1 (EP2) Downfall Creek, Plot 3 (EP4) Little Pine Creek, Plot 13 (EP35) Whyanbeel, and the floristically unusual Plot 9 (EP31) Woopen Creek).

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 27) is based on records from a soil pit, the location of which is not known. The profile was described as having a Principal Profile Form Um6.34 and affinities with the xanthozem Great Soil Group. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 28. Soil bulk density and moisture retention data are given in Appendix 1 Table 29, soil hydraulic parameters in Appendix 1 Table 30 and particle size data in Appendix 1 Table 31.

Plot 7 (EP29) Mount Fisher

Location, Landform and Climate

The Mount Fisher plot is located near the northern end of the Cardwell Range about 8 km west-southwest of Millaa Millaa (Table 1, Figure 20) in Malaan National Park (previously State Forest 650) within the Wet Tropics World Heritage Area. Current access to the plot is by foot along about 4.5 km of abandoned logging road from the gate at the end of Kjellberg Rd (Millaa Millaa 1:50,000 AGD 1966 349000 8060600, GDA 1994 349115 8060776). The plot was set out on 3 November 1975, and the establishment report (K. D. Sanderson, 11 May 1976) states the purpose was "to examine the structure and species composition of typical high altitude rainforest on Mount Fisher" (but see geological and landform descriptions below).

This plot lies at 1200 m on a major ridgeline leading to the summit of Mount Fisher (1385 m) and is the highest elevation sampled in the 20 plots of the CSIRO series (Table 2). The 100 m axis runs on a bearing of 20° across a broad ridge, this axis being more-or-less level except in the most northeastern subplots that rise at about 15°. The 50 m plot axis runs parallel to the ridgeline at 290° down a 15° slope. The major landform elements of the site are ridge crest and upper slopes, although a minor shallow drainage line runs through the centre of the plot (in Subplots K, J, I and exiting between trees E19 and E21) dropping along a 17° slope. The commencement corner (Subplot A) is located in the southeast corner of the plot, and the subplot layout is as represented on Figure 3. The buffer zone is intact.

The dominant soil parent material of this plot is rhyolite. Although Mount Fisher is a basaltic volcano of early Quaternary age, the plot itself lies on an inlier of older Permian acidic Glen Gordon Volcanics (Bultitude *et al.* 1997) exposed by erosion. In the vicinity of the plot, outcrops of rhyolite occur in roadside cuttings, and much of the surface of the plot is covered with rhyolitic gravel. This localised rhyolitic section of the ridgeline contrasts strongly with the adjacent and extensive basaltic mid- and upper slopes of Mount Fisher, which is probably the most elevated volcanic vent in northeastern Australia. Some early descriptions of the plot incorrectly report the soil parent material of the plot as basalt.

In terms of the climatic zones of Tracey and Webb (1975) the site is cloudy wet (Table 9). With a rainfall Coefficient of Variation value of 67, the rainfall pattern at Mount Fisher is the least seasonal of all the 20 CSIRO plots (Table 5).

Forest Structure, Type and Floristics

The rainforest on this plot is a very tall closed forest. The canopy height ranges between 20 and 27 with a conspicuous subcanopy between 14 to 19 m (Figure 21). The tallest trees are *Syzygium endophloium* (30 m) and *Aceratium doggrellii* (28 m). The Atherton Palm *Laccospadix australasica* and the Gristle Fern *Blechnum cartilagineum* are very conspicuous components of the midstorey and understorey respectively. The forest type on this rhyolitic site is Simple Microphyll Vine-Fern Forest (SMiVFF), i.e. type 9 of Tracey and Webb (1975) and Tracey (1982). Physiognomically, this type contrasts strongly with the adjacent Complex Notophyll Vine Forest (type 5a) on the surrounding basaltic soils. All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 7. *Balanops australiana*, *Elaeocarpus ferruginiflorus* and *Steganthera macooraia* are key species that confirm the structural/ environmental classification.

The plot description indicates that the trees *Cryptocarya densiflora* and *Sphenostemon lobosporus* dominate the stem frequencies list (11% and 8.5% respectively), while *Sphenostemon lobosporus* and *Elaeocarpus foveolatus* dominate the contributions to basal area (12% and 11% respectively).

This plot has moderate to low values for total species richness (150) and for life forms (7) but these values are comparable to those of other high altitude cloudy sites on infertile soils such as Plot 2 (EP3) Mount Haig, Plot 19 (EP43) Mount Baldy and Plot 8 (EP30) Agapetes Logging Area (Table 13). The plot ranks thirteenth in tree species richness with a moderate to low value of 88, while the proportion of tree species (72%) falls in the moderate class (72% to 73%).

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

At the time of plot establishment the site was described as "relatively free of recent disturbance" (plot establishment report, K. D. Sanderson, 11 May 1976). Logging operations commenced in adjacent areas during plot establishment but caused no structural damage within the buffer zone.

This site features a combination of high stem density values (990 stems $\geq$10 cm ha^{-1}) with only a low to moderate basal area (45.5 m^2 ha^{-1}). The limited comparative data available from CSIRO plots 2, 5, 8 and 19 (Table 11) and the transect drawing of Tracey (1982) suggest the stem density value is typical of this structural type. This plot has a high abundance of stem suckers and naturally occurring low branching or multi-stem form trees. These distinctive structural characteristics and the low basal area may be explained by the adverse site conditions including high elevation, poor water holding capacity, low soil nutrients, possible soil toxicity, and the ridgetop position exposed to the dominant southeasterly winds.

Excluding a 1995 record of a large tree fall, no significant disturbances have been recorded on the plot during the 12 measurements that span 27 years of observations (Table 6).

Soil Profile and Characteristics

Soil depth and characteristics appear fairly uniform across the plot. Using selected chemical analysis data from the preliminary survey (Table 12) the soil at this site was assessed as oligotrophic (Figure 4) typical of rhyolitic soils. The brief soil profile description (Appendix 1 Table 32) is based on records from a soil pit, the location of which is not known. This profile was not formally referred to a Great Soil Group in the file records. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 33. Soil bulk density and moisture retention data are given in Appendix 1 Table 34. In some early documentation of this plot, the soil parent material was described as basalt. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 35.

Plot 8 (EP30) Agapetes Logging Area

Location, Landform and Climate

The Agapetes Logging Area plot is located near the southern margin of the Windsor Tableland adjoining a section of the Great Dividing Range (Table 1, Figure 22) in Mount Windsor National Park, possibly with some of the plot on the adjacent Mount Windsor National Park Recovery, (both previously Agapetes Logging Area of State Forest 144) inside the Wet Tropics World Heritage Area. The site lies 27 km west of Daintree Village on the Daintree River. Access is along the Mount Windsor Forestry Road system. The plot was set out in June 1976 to examine the structure and species composition of a typical high altitude rainforest on Windsor Tableland (plot establishment report, K. D. Sanderson, 14 April 1977).

The plot locality lies on the western headwaters of Spencer Creek that flows into the McLeod River. The site is at 1060 m elevation along the northeastern side of a major ridge (an ancient erosion-residual) rising to 1186 m on an otherwise undulating to rolling low hills landscape that is a dissected plateau remnant. The plot includes upper, middle and lower slope landform elements as well as a small section of hillcrest. The 100 m axis of the plot lies along a bearing of 15°, roughly following the contour just below the local ridgeline. The short axis bears 105° and runs down slope (across the contour lines) on a fairly uniform grade of around 11%. About 15 m west of the lower margin of the plot (at the base of the slope), a fairly substantial gully, around 5m deep and with some steep sides around large granite boulders, drains an extensive area including part of the hill to the west of the road. A smaller dry gully passes through Subplots B, C, D and H. The commencement corner (Subplot A) is located in the southeast corner of the plot, and the subplot layout is as represented on Figure 3. The nearest road lies about 250 m south along the ridgeline, and the buffer zone is intact. At the time of plot establishment, a location survey was undertaken from the plot to a pegged position on the then unsurveyed access road.

Outcrops of coarse-grained granite of Late Carboniferous to Early Permian age (Bain and Haipola 1997) occur along the main ridgeline and in gullies in the vicinity of the plot. Soil depths and characteristics probably vary along the catena from the ridgetop to lower slope positions. The rainfall distribution pattern is amongst the least seasonal of the CSIRO plots (Table 5) and, in terms of the climatic zones of Tracey and Webb (1975), the site is cloudy wet (Table 9).

Forest Structure, Type and Floristics

This rainforest is a very tall to extremely tall closed forest. The upper canopy ranges between 22 and 37 m (Figure 23), being “quite variable in height and density” (Stocker 1983). At establishment, the tallest trees were *Pouteria papyracea* and *Elaeocarpus bancroftii* (both 37 m) with *Musgravea heterophylla*, *Cardwellia sublimis* and *Darlingia darlingina* at 36 m. In terms of both stem frequency and basal area contribution, *Ceratopetalum succirubrum* is the most important species (plot description). Five species of *Flindersia* occur within the plot, *F. acuminata, F. bourjotiana, F. brayleyana, F. ifflaiana* and *F. pimenteliana.* The subcanopy was dominated by *Ceratopetalum succirubrum* and *Brombya platynema*, while *Cyathea rebeccae* was conspicuous in the understorey (Stocker, 1983). The plot has moderately high values for all-species richness, tree species richness and life forms (Table 13). The proportion of tree species (75%) falls in the high range (75% to 76%), being typical of structurally simple forests from cloudy sites in upland and highland settings.

This forest appears to be a transitional type of Simple Notophyll to Microphyll Vine-Fern Forest (SN/MiVFF), i.e. type 8/9 of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2

Table 8. The floristic composition of this plot is somewhat unusual, as noted for *Flindersia* species above. While species such as *Balanops australiana*, *Ceratopetalum succirubrum* and *Syzygium wesa* are typical of forests of this environmental setting, many species at the site are "generalists" occurring over a wide range of altitudinal settings and soil types. Further, there is a "dry" component in the plot flora that is consistent with the occurrence of many large kauri trees (*Agathis robusta*) nearby on the ridge to the south of the plot.

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

At the time of plot establishment, logging activities had not reached the vicinity of the plot (plot establishment report, K.D. Sanderson, 14 April 1977). Logging activities that commenced during plot establishment did not affect the buffer zone or plot areas. At establishment, there was no evidence of recent disturbance from natural events, and no significant disturbances have been recorded in the 10 enumerations spanning 26 years (Table 6).

The available file descriptions of the plot differ in detail, and, in some regards, do not correspond with the subplot stem density or height data. In his brief site description, Stocker (1983) suggested that the variation in the canopy height and density was suggestive of past cyclonic disturbance, and further proposed that this canopy variability determined the understorey density that ranged "from dense to almost absent across the plot". Referring to the vicinity of Subplot C, the file description reported "On one side (of the plot) near a small gully, the canopy is more open and on average appears lower in stature, and tree stems do not reach anywhere near the sizes of those situated in the more luxuriant areas. The understorey is abundant and retards movement of people to some degree". A file note adds to the description, noting "On the better formed portion of the plot, the flora is characteristic of good quality rainforest with (a) very entire upper canopy at 25-30 metres and understorey almost absent". This record continues, "Upper canopy height in the poorer section is approximately the same as the remainder of the plot but large trees are less numerous causing a great deal more light to penetrate to lower levels of the canopy and in some places to the ground". Most probably, it is the increased understorey and density of trees less than 10 cm dbh that give the impression that some sections of the site are "poorer" (M. Bradford, personal observation 2002).

This plot features the highest stem density (1170 stems ≥10 cm ha^{-1}) and the fourth highest basal area (64.6 m^2 ha^{-1}) recorded from the CSIRO plots (Table 11, maximum values). From the limited comparable quantitative data available (CSIRO plots 2, 4, 5, 7, 8, 19 and 20) and the transect drawing of Tracey (1982), it appears that this combination of values is typical of type 8/9 rainforest.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil at this granitic site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 36) is based on records from a soil pit, the location of which is not known (an important issue given the variability in landform elements across the plot). The profile was described as having a Principal Profile Form Gn3.14 and affinities with the red podzolic Great Soil Group. Stocker (1983) recorded "The yellowish clay loam soil contained an increasing quantity of partially decomposed granitic gravel with depth." Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 37. Soil bulk density and moisture retention data are given in Appendix 1 Table 38 while soil hydraulic data are presented in Appendix 1 Table 39 respectively.

Plot 9 (EP31) Woopen Creek

Location, Landform and Climate

The Woopen Creek plot is located about 22 km west of Innisfail (Table 1, Figure 24) in Wooroonooran National Park within the Wet Tropics World Heritage Area. At the time of plot establishment in August 1976, this locality was in Barong Logging Area, State Forest 755. The original access to the plot lay along the now-abandoned logging road from the end of Woopen Creek Road (at Bartle Frere 1:50,000 AGD 1966 GR 378600 8065000, GDA 1994 378715 8065176). The original 12 km access route to this plot has become impossible as most bridges have been removed (25 October 1988) and the logging road is now covered with dense Giant Bramble (*Rubus alceifolius*) and Lantana (*Lantana camara*). In 2005, an alternative access route was found via the old "Nerada" tea plantation and across the North Johnstone River.

The plot establishment report (J. D. Fitzsimon, undated) states that the object of this plot was "to examine the structure and species composition of rainforest on the coastal fringe of the Barron River Metamorphic soils. Rainforest on the site is of particular interest because of the dominance of one particular species, *Backhousia bancroftii*, in relatively large (size) classes." A set of summary notes records that the plot was established in "a distinctive and locally isolated type of coastal rainforest, dominated very definitely by the one major tree species, viz. *Backhousia bancroftii* or Johnstone River Hardwood."

This plot lies at about 80 m elevation and, according to the plot notes, "is located on relatively uniform terrain sloping only slightly to the south, towards Badgery Creek, a tributary of the North Johnstone R" (Figure 24). The establishment report specifies "The long axis of the plot slopes gently towards a dry gully along a bearing of 178° 30', while the short axis follows the contour on a bearing of 88° 30'." The dominant landform element of the plot is recorded in the old soils database records as "lower slope". A shallow and usually dry gully, about 10 m wide, cuts across the southeast corner of the plot, draining through Subplot P to Subplot N. The commencement corner (Subplot A) is located in the northwest corner of the plot and the subplot layout is as on Figure 3. There are no comments recorded on the condition of the buffer zone.

In the past, there was some doubt about the nature of the soil parent material for this plot and the available original data are referred to below. It appears that the plot is located on a mixed alluvial soil derived mainly from metasedimentary parent materials on a remnant of an extensive alluvial terrace. Such relict terrace landforms with alluvial soils partially derived from basalt are widespread in the lower North Johnstone catchment and are, or were, often characterised by rainforests dominated by *B. bancroftii*.

In terms of the climatic zones of Tracey and Webb (1975) the site is very wet (Table 9). With a Rainfall Coefficient of Variation value of 78, the rainfall pattern at Woopen Creek is moderately seasonal (Table 5).

Forest Structure, Type and Floristics

The rainforest on this plot is a very tall to extremely tall closed forest. The canopy height ranges generally between 20 to 35 m, with some sections over 40 m (Figure 25) though there are "very few trees of middle-level canopy heights" (summary notes). In 13 of the 16 subplots, the tallest tree is *B. bancroftii* with the highest reaching 44 m in Subplot A (summary notes). This forest is a floristic variant of Complex Mesophyll Vine Forest (CMVF), type 1a (Tracey and Webb 1975, Tracey, 1982) determined by the often-localised cyclonic-disturbance settings of the district, i.e. a lociation (sensu Webb and Tracey 1981). All species recorded from the plot at the time of establishment are listed in life form groups in

Appendix 2 Table 9. As a numerically dominant canopy tree, *B. bancroftii* is the key species that distinguishes this forest as a lociation within the CMVF type. The only other trees that occur in the upper canopy are *Castanospermum australe* and *Cardwellia sublimis*, as well as the epiphytic *Schefflera actinophylla*. Table 13 indicates the total species richness is high, and life forms and tree species richness are moderate. However, fewer than half the tree species are represented in the enumerated stems, the majority occurring in the understorey. Trees species constitute only 66% of the total species list, this low to moderate contribution being balanced by the highest species count for both shrubs (19, 12% of all species) and herbs (11, 7% of all species) in the plot series.

Disturbance History and Stand Structure

The summary notes record that "The plot has been established in a previously unlogged area, although operations have commenced in adjacent rainforest since that date. Aerial photos and ground observation of exposed areas upstream of the plot site reveal marked vegetation effects of past cyclone damage." The effects of the selective logging operations were outside the bounds of the buffer zone, although the site "lies beside a newly formed road" (plot establishment report). Stocker (1983) gives further details: "While there was no evidence of logging or cyclone damage within the plot, the results of past severe cyclone damage were obvious in nearby areas where dense thickets, locally known as "cyclone scrubs", were a feature of the landscape. The upper canopy of the trees in the plot was dense and well developed. It was however open enough to allow moderately dense clumps of *Calamus* spp. to survive in a suppressed state on the forest floor. Few other tree species reached the upper canopy although aerial photographs revealed that large crowns of the woody hemiepiphyte, *Schefflera actinophylla*, were much more prominent than would be expected from a ground view. The most conspicuous species at mid canopy level was *Myristica insipida*." Other files notes indicate the disturbed context of the location: "Because of this disturbance the site for the plot was by necessity a relatively undisturbed area to enable persons to move about reasonably freely."

In February 1986, Tropical Cyclone *Winifred* caused considerable structural damage creating large gaps from fallen trees and debris. A scaled diagram of this damage and gaps was drawn January 1987. By 1988 these gaps were invaded by Stinging Tree (*Dendrocnide moroides*). However in 1990 the understorey appeared to be recovering and the Stinging Trees were becoming less dense. No other forms of disturbance were recorded during the 9 measurements spanning 29 years of records (Table 6).

This site has the lowest stem density values (484 stems $\geq$10 cm ha^{-1}) in the series of 20 plots and a low basal area of 43.4 m^2 ha^{-1} (Table 11, maximum values). At the time of plot establishment, *B. bancroftii* constituted 34% of the ≥10 cm dbh stems on the plot, i.e. 81 of 238 enumerated stems and 65.7% of the total basal area (undated summary notes). According to the plot establishment report, *B. bancroftii* "would constitute about eighty percent of the millable timber for that area." The summary notes also comment that "Basal area for the rainforest stand at the plot site … … is largely taken up by *Backhousia bancroftii*", continuing "In view of the relatively fewer number of trees on which such B.A. is accumulated logging volumes <u>could</u> be particularly high in exploitation of this rainforest stand during logging."

Soil Profile and Characteristics

The detailed soil profile description (Appendix 1 Table 40) is based on records from a soil pit, the location of which is not known. This profile was described as having a Principal Profile Form Gn3.21 but was not formally referred to a Great Soil Group in the file records. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 41. In this review, the soil parent material has been described as alluvium, probably derived from metamorphic rocks but possibly with some basaltic alluvium input. Previous descriptions (e.g. Beadle 1981, Stocker and Unwin 1989) described the soil parent material as metamorphic although Stocker (1983) correctly suggested, “The deep red sandy loam soil on this plot did not appear to have the massive clay subsoil characteristic of many soils derived from metamorphic parent materials. Surrounding soils of basaltic origin may have also influenced its properties”. Doubts about the soil parent material were also obvious in the undated summary notes in which the sentence relating to metamorphic soil parent materials was ruled through. The old soils database records the substrate material as “unidentified unconsolidated material” and the surface horizons are dominated by sand (Appendix 1 Table 42). Despite the possible basaltic content of the soil parent material, this site is relatively nutrient poor (Table 12, Figure 4).

Plot 10 (EP32) McIlwraith Range

Location, Landform and Climate

The McIlwraith Range plot is located about 32 km northeast of Coen near the headwaters of Leo Creek in the McIlwraith Range (Table 1, Figure 26) on Cape York Peninsula. At the time of plot establishment in September 1975, the tenure was Timber Reserve 14 McIlwraith Range, but is now Unallocated State Land (USL) although Environmental Protection Agency staff have indicated an intention to declare a National Park in this area in the future. Current access to the plot is by four-wheel drive vehicle only along a rough track that leads to the abandoned Leo Creek mining area at 13° 42’ 50” S, 143° 22’ 55” E. The plot establishment report (K. D. Sanderson, c. September 1975) states that the object of this plot was “to examine the structure and species composition of rainforest on McIlwraith Range, Cape York Peninsula”.

According to the plot establishment report “The plot site is on a fairly indistinct ridge that appears to run in a southwesterly direction” with the “topography flat to undulating and slope uniform”. After some consideration, the altitude was determined as 450 m. From the commencement corner (Subplot A), the 100 m axis of the plot follows the contour of the ridge in a southeast direction, bearing 135°. The 50 m axis runs across the contours on a slight downhill slope in a southwesterly direction, bearing 225°. The plot thus encompasses upper and midslope landform elements. There are no drainage gullies in the vicinity of the plot, and the nearest permanent creek crosses the access track to the Leo Creek mine about 300 m before the plot. Subplot A is located in the northern corner of the plot, the subplot layout being a mirror image of that represented on Figure 3. The buffer zone was intact and unaffected by roads or tracks. The location of the plot was determined initially by chain and compass survey to a sclerophyll open forest pocket that was visible on aerial photographs, with the position of this pocket being confirmed more recently by a handheld global positioning system (GPS) in 1998.

The field notes for this plot record no rock outcrop on the site, and show uncertainty as to whether the soil parent material was sandstone or shale (Permanent Plot Soil Database Records). Stocker (1983) observed that the underlying rocks were “metamorphic shales although most of this poorly known region is underlain by granite.” This description suggests that the plot locality falls on a small inlier of 1800 to 1600 Ma (millions of years) old Palaeoproterozoic Coen Metamorphics (predominantly metasediments, as extensively exposed both 5 km to the northwest and 5 km southeast of the site) within the more widespread Early Devonian granites (Whitaker and Gibson 1977, Bain and Halpola 1997). The situation may be further complicated by the sequence of deeply weathered, old land surfaces observed in this area (Whitaker and Gibson 1977). Because of the fairly uniform topography of the plot, soil depths and characteristics are expected to be relatively similar within the plot, although the patchy distribution of palms suggests that some local differences in internal soil drainage may occur. No local rainfall data are available, but, based consideration of records from Coen, the rainfall pattern at the site is probably moderately to strongly seasonal, though possibly augmented by some mist or cloud occurrences. Extrapolation of the climatic zones of Tracey and Webb (1975) suggests the site may be cloudy moist (Table 9) although the lower latitude may require adjustment of this classification.

Forest Structure, Type and Floristics

In structure, the rainforest on the plot is a tall to very tall closed forest. The upper canopy ranges from 18 to 25 m up to 30 m (Figure 27). While the tallest tree on the plot is *Acmena hemilampra* (30 m), the most common tall tree is *Xanthostemon chrysanthus* (24 to 28 m). The fan palm *Licuala ramsayi* is a common and conspicuous midcanopy component. Stocker (1983) described the understorey as moderately dense (to the point of retarding movement to some degree), being "composed of tree species regeneration, vines and pandans", as well as young fan palms. At the time of plot establishment, *X. chrysanthus* constituted 23.4% of the basal area from only 13 stems (Stocker 1983) although *L. ramsayi* and *Cryptocarpya vulgaris* dominated the stem frequencies at 16% and 10% respectively (plot description). In physiognomic terms, this forest is a hybrid type with features of Mesophyll Vine Forest, fan palm variant (MVF) and Simple Notophyll Vine Forest (SNVF), approximating types 2a/8 of Tracey and Webb (1975) and Tracey (1982).

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 10. Stocker (1983) stated that the floristic affinities of this northern rainforest were with rainforests to the south rather than with nearby northern lowland rainforests represented by Plot 18 (EP42) Iron Range. Results from the floristic analysis undertaken by Kanowski and Graham strongly support this view.

The total species richness (112) and tree species richness (71) are low in comparison with other CSIRO plots, being ranked seventeenth and eighteenth respectively (Table 13). The species richness is similar to the other northern site in the series, Plot 18 (EP42) Iron Range. At 63%, the tree species percentage was low with only the biogeographically distant Plot 14 (EP37) Eungella having smaller values. However, lifeforms were moderately abundant (9) perhaps due to the somewhat unusual combination of fan palms, palms shrubs, treeferns and pandans. Vines constituted an important proportion of the flora (13%) while the epiphyte species richness ranked as moderate, being similar to some of the high altitude sites such as Plot 4 (EP9) Robson LA, Plot 2 (EP3) Mount Haig or Plot 8 (EP30) Agapetes Logging Area.

Disturbance History and Stand Structure

Stand Structure, Floristics and Possible Past Disturbance

The only evidence of human activities in this virgin rainforest area was the access track into the Leo Creek gold mine. Although there was no evidence of recent cyclone damage at the time of plot establishment, Stocker (1983) noted that the *Xanthostemon chrysanthus* and *Blepharocarya involucridgera* appear to show only intermittent recruitment. Periodic disturbance from cyclones or storms, possibly in combination with regional climatic events such as drought, may well be a factor in explaining the unusual dominance of the former species, while the latter is a widely acknowledged "disturbance response" species that regenerates in storm damaged rainforests and also colonises open *Eucalyptus* forests. No significant physical disturbances have been recorded on the plot during the 9 measurements spanning 23 years of observations.

Decline in Podocarpus grayae

Seven individuals of *Podocarpus grayae* (previously referred to as *P. neriifolius*) were enumerated in 1975. By 1998, only 3 of these remained alive. The impact of a putative pest or disease, which has resulted in the deaths across a wide range of size classes of many *P. grayae* in and adjacent to the plot, is detailed by Stocker (1983, pp. 152, 231-237), based on plot enumerations and additional data from adjacent transects.

This site has the lowest basal area value (30.6 m^2 ha^{-1}) in the series of 20 plots but a mid-range stem density of 894 stems ≥10 cm ha^{-1} (Table 11, maximum values). Five of the next six plots in ascending rank order of maximum basal area show either disturbance by disease, past clearing, cyclonic damage at plot or site level, or unusual species dominance thought related to cyclonic disturbance, while the other is a seasonally deciduous rainforest from the northern biogeographic area. However, no other quantitative data are available from Cape York upland rainforests to allow further local comparisons.

Soil Profile and Characteristics

The soil at this site was described by Stocker (1983) as a deep reddish sandy loam. Using selected chemical analysis data from the preliminary survey (Table 12) the nutrient status was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 43) is based on records from a soil pit, the location of which is not known. This profile was not formally referred to a Great Soil Group in the file records. The abundance of fan palms suggests poor internal soil drainage and possible soil chemical toxicity associated with the highly acidic profile that is evident in the soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, as presented in Appendix 1 Table 44. Soil bulk density and moisture retention data are given in Appendix 1 Table 45, soil hydraulic parameters are presented in Appendix 1 Table 46 and particle size datasets are given in Appendix 1 Table 47 and Appendix 1 Table 48.

Plot 11 (EP33) Curtain Fig

Location, Landform and Climate

The Curtain Fig plot is located on the Atherton Tableland (Table 1, Figure 28) in Curtain Fig National Park (previously State Forest 452) inside the Wet Tropics World Heritage Area. The site is 2 km southwest of Yungaburra on the western side of the Yungaburra to Malanda road, immediately adjacent to the site of a now-demolished CSIRO canopy research tower and not far from the well-known tourist feature, the Curtain Figtree. The plot was established in March 1976. The establishment report (K. D. Sanderson, 10 March 1978) states that the object of this plot was “To examine the structure and species composition of rainforest established on stony and relatively unweathered basalt soils on the Atherton Tableland”.

The plot locality lies at 720 m elevation on a plateau landform, typically of undulating plain to rolling rise patterns, that developed by infilling of an older landscape by a series of basaltic lava flows (Stephenson *et al.* 1980). The majority of the plot lies falls on a flat landform element although the external edges of Subplots L and P, and all of Subplot M together with adjacent sections of Subplots I and N, occupy lower to mid-slope landform elements on eroded basaltic rises (mostly from 3 to 5 m high) of characteristic vesicular basalt boulders (Figure 29). The 100 m axis of the plot lies along a bearing of 305°, and the short axis bears 215°. The commencement corner (Subplot A) is located in the southeast corner of the plot, and the subplot layout is as represented on Figure 3. The buffer zone is intact and, together with the immediately adjacent forest area, has been the site for numerous research activities (see publications list in Appendix 3).

The flat areas at this site are accumulations of soil and gravel between the residual low rises, and soil depths and characteristics vary with the distance from the basaltic outcrops and the proportions of gravel and cobbles. There is no soil cover on the boulder heaps or stony rises. No surface water flows or drainage channels are evident in this vicinity, or in this section of forest. The comparatively low annual and driest quarter rainfall values produce a seasonal moisture environment (Table 5) and many canopy and understorey species in this forest wilt during drier parts of the year. In terms of the climatic zones of Tracey and Webb (1975), the site is dry (Table 9). Some meteorological and soil temperature data were collected by an electronic weather station from a clearing to the south of the site on Coleman's farm. Weekly rainfall data are held from late April 1985 to July 1986. Air temperature records run from late April 1985 to July 1987 while soil temperature data (two litter values and from 25, 75, 125 and 175 mm depths, two replicate sites) are available from December 1986 to June 1987. A printout of these data is held in the Permanent Plot Files. At some time, a small Stevenson Screen was located 6 m northwest of tree B2.

Forest Structure, Type and Floristics

This rainforest is a very tall to extremely tall closed forest. The upper canopy generally ranges between 28 and 35 m (Figure 30) and the tallest trees on the subplots range from 32 to 43 m in height with *Argyrodendron* sp. (Boonjee BH 2139RFK) at 43 m, *Aleurites rockinghamensis* at 43 m and *Toona ciliata* at 42m. There is no layering of the vegetation into strata above the 15 m level. A distinctive, dense, and locally impenetrable, understorey is present in many areas, consisting of a dense *Hodgkinsonia frutescens* shrub layer to 1.5m high together with abundant basal rosettes of *Calamus caryotoides*. However, this *H. frutescens* understorey is conspicuously absent in two large patches on the plot, running from Subplot A to C, the other from J to L (Figure 29).

At establishment, the Shining Leaved Stingingtree, *Dendrocnide photinophylla*, was the most important species in terms of both stem frequency (16%) and basal area contribution (12%) (plot description). While *Argyrodendron peralatum* is the next most abundant tree species (10.5%) in the ≥10 cm dbh size classes and is a common species in the upper canopy, only a few hundred metres distant, *Argyrodendron* sp. (Boonjee BH 2139RFK) dominates the canopy (Proctor-Gray 1985). Other characteristic and immediately recognisable species of the upper canopy include *Flindersia brayleyana*, *Aleurites rockinghamensis* and *Toona ciliata*. This Complex Notophyll Vine Forest, i.e. type 5b of Tracey and Webb (1975) and Tracey (1982), is characterised by a seasonally sparse canopy (Tracey 1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 11. Key tree species that confirm the structural/environmental classification include *Alloxylon flammeum, Firmiana papuana, Flindersia schottiana* and *Viticipremna queenslandica*. The recorded species are typical of the type in this area. Of the taxa that occur on the plot, *Alloxylon flammeum* is considered "vulnerable" while *Firmiana papuana* and *Sauropus macranthus* are recognised as "rare" (Queensland Herbarium 2002).

The plot values for all species richness, tree-species richness, life form numbers as well as the percentage of tree species for this plot are low when assessed against data from the other CSIRO plots (Table 13) but the values are typical of the type (see Hopkins *et al.* 1996). Vines and shrubs are important components of the flora at this plot, representing 14% and 10% respectively of all species.

Disturbance History and Stand Structure

Pre-European Fire History

Charcoal was found at depths of 0.25 m to 0.75 m in five soil pits on this site during 1995 and two of the recovered fragments were submitted for radiocarbon dating during 2003. One charcoal fragment provided a radiocarbon date of 7790 ± 70 years BP (CSIRO sample L34 S1.5, ANSTO code OZG734, Table 8). The corresponding calendar year ages, together with the interval probabilities, are 6642 BC - 6562 BC (63.3%) and 6558 BC - 6509 BC (36.7%). The other charcoal fragment provided a radiocarbon date of 1080 ± 40 years BP (CSIRO sample L34 S2.6, ANSTO code OZG736, Table 8). The corresponding calendar year ages, together with the interval probabilities, are 911 AD - 914 AD (11.8%) and 970 AD - 1017 AD (88.2%). Due to the small fragment sizes, no taxonomic determinations were possible.

The 7000-year difference between the ages of these charcoal fragments shows the great dangers in making ecological or historical interpretations from undated charcoal fragments. The older date is consistent with the regional and local charcoal records associated with the Late Quaternary vegetation change from eucalypt dominated pyrophytic vegetation to rainforest (Hopkins *et al.* 1993, Chen 1986, 1988). In the case of the younger charcoal, the 1000-year age of the wood makes it unlikely that the burning and charcoal formation was of European origin. It is not possible to distinguish between the more probable sources of the charcoal, i.e. burning of rainforest debris following a major storm or cyclone, or some local aboriginal cultural or domestic activities.

Tenure History, Forest Preservation and Logging Disturbance

By the early 1900s, the land subsequently occupied by the Curtain Fig State Forest was surveyed for agricultural subdivision (1911 cadastral map, Parish of East Barron). However, the site was spared from agricultural clearing because it contained only rocky ridges and gravely and excessively drained soil that was totally unsuited to cultivation or grazing. Broad scale logging activities were not possible as the timber smashed on falling and the rocky ridges precluded extended hauling of logs to the adjacent pasture or roads (G. Putt, personal communication). In 1976 there was “some sign of selective felling, probably in the early 1920s” (plot establishment report). According to the plot description “This plot has perhaps been subjected to periodic disturbance, ie, removal of *Gmelina fasciculiflora* and *Castanospermum australe* for fence posts and occasional *Toona australis* for timber, being in close proximity to Yungaburra, one of the oldest established farming and saw-milling communities on the Atherton Tableland”.

Pre-European Historical Catastrophic Disturbances and Fire

The life history attributes of many of the canopy species, as well as the demographic characteristics of their populations on and adjacent to the plot, suggest that past catastrophic disturbances have been important at this site. The impacts of drought and, possibly, fire during 1915 probably were compounded by the effects of the 1918 cyclone (Stocker 1983, West *et al.* 1988). Forest damage from that cyclone in the Boar Pocket Rd area, 14 km northeast of the plot, was graphically described by Bryde (1977). The dominance of large *D. photinophylla*, as well as the irregular recruitment and recent near-synchronous mortality of *A. rockinghamensis* in areas adjacent to the plot support interpretations based of such styles of perturbation.

Post-establishment Natural Disturbances

No structural damage from recent natural events was evident when the plot was established in March 1976. No disturbances such as extensive gaps were noted in the 22 year record with a total of 11 measurements, but mortality and structural damage associated with drought were observed in the 1990s (Table 6). At establishment, the plot featured the highest basal area (69.8 m^2 ha^{-1}) recorded from the CSIRO plots (Table 11, maximum values). However, the post-1990 mensuration data reveal a dramatic decline in basal area associated with mortality that is dispersed across the plot for a wide range of size classes and life-history types including typical secondary, late secondary and primary species. Plot records show that 33 enumerated trees died in the period 1990 to 1995, and a further 16 by 1998. Most of this mortality appears directly related to the impacts of severe water stress during a drought that occurred from late 1991 until December 1993. Soil water modelling (Hopkins *et al.*, unpublished) using meteorological data from Yungaburra town indicated that, when water stress intensity and duration were considered jointly, the conditions predicted by the model for October 1992 were unique in the preceding 89 years, with an Average Water Stress Intensity of 181.7 mm, a Water Stress Duration Index of 73.3% and, for the third consecutive year, a Monthly Average Water Stress Intensity of >180 mm.

Detailed observations during this period revealed that many of the surviving trees suffered major structural damage caused by water stress. Ends of branches died back by several metres (e.g. *C. australe*) and substantial declines in leaf area index occurred in both the canopy and understorey. The understorey shrub *H. frutescens* was virtually leafless during the later stages of the drought. Many canopy stems and understorey rosettes of *Calamus* spp. also died. It seems likely that the impending deaths of some of the oldest large canopy trees were hastened by this event, while the mortalities in the smaller size classes probably represent competitive failure under severe water stress.

With the return of typical annual rainfall patterns, the understorey redeveloped rapidly. In the high light intensities below the new inter-canopy gaps, the Stinging Tree *D. moroides* germinated and established forming dense impenetrable thickets that persisted until the damaged upper canopies expanded and more typical canopy foliar cover re-established. Some exotic species also established in the inter-canopy gaps at this time (Hopkins *et al.*, unpublished).

The maximum plot stem density value, 630 stems ≥10 cm ha^{-1}, is the fourth lowest of the plot series and this characteristic probably accounts for the visually imposing appearance of the forest under typical rainfall conditions. From the limited remaining and relatively intact examples of this or closely related types (e.g. 5a, 1b, or 5b/1b as at Malanda Falls) it appears that this combination of high basal area and low stem density was typical of the type.

Soil Profile and Characteristics

Of the 20 CSIRO plots, this one has the highest soil nutrient status, being ranked as eutrophic (Table 12, Figure 4). The detailed soil profile description (Appendix 1 Table 49) is based on records from a soil pit adjacent to the plot near the access track. According to the general description of Laffan (1988), this profile has a Principal Profile Form Uf6.31 and falls within the Prairie Great Soil Group. After no doubt observing the excavations associated with the supports for the research tower, Stocker (1983) noted, “the soil volume was very restricted by numerous basalt boulders throughout the profile.” Soil chemical analyses (second series), based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 50. Soil bulk density and moisture retention data are given in Appendix 1 Table 51 while soil hydraulic parameters are presented in

Appendix 1 Table 52. Soil particle size data from four unrecorded positions are given in Appendix 1 Table 53. Soil particle density data are presented in Appendix 1 Table 54.

Plot 12 (EP43) Russell River

Location, Landform and Climate

The Russell River plot is located east of Boonjie, at the base of the southwestern flank of Mount Bartle Frere (Table 1, Figure 31) about 10 km southeast of Butchers Creek, or 15 km west of Miriwinni. The site lies within Wooroonooran National Park in the Wet Tropics World Heritage Area. The previous land tenure was Gosschalk Logging Area, State Forest 755, and the area was intended for logging. It now is accessible only on foot, initially along the abandoned logging road that leads to the Russell River from the registration point for the Bartle Frere walking track (about 1 hour, 15 minutes walk), then by an indistinct route along the proposed logging road down the valley, and finally up a major erosion gully that runs past the plot a few metres west of the commencement corner of Subplot A (about 12 minutes walk from the Russell River crossing). The route of the historic Russell River valley pack track passes through the site entering the plot in the vicinity of the external boundary of Subplots I and E, and exiting roughly between Subplots A and B. The plot establishment report (K.D. Sanderson 29 September 1977) states that the object of this plot was “to examine the structure and species composition of rainforest on the lower southwest slopes of the Mount Bartle Frere/Bellenden Ker Range”. The plot was established in November 1976 (Stocker 1983).

The site is located on the northern side of the Russell River valley in a foothill setting at 380 m. Much of the valley floor adjacent to the river is constituted by alluvial terraces or large depositional fans dissected by gullies of ephemeral streams. The geomorphology of the plot is complex (Figure 32) and this was not recognised in previous descriptions of this site. The eastern margin of the plot (Subplots H, L and P) lies on the foot- and midslopes of a ridge that is a remnant of a basaltic lava flow that originated from the Lamins Hill shield volcano on the eastern margin of the Atherton Tableland. Basalt rocks from near the summit of this vent and from the lower Russell River valley were dated at 0.9 Ma and 1.4 Ma respectively (Whitehead and McDougall 1991). Subplot P is bisected by a steep-sided gully that discharges its basaltic sediment load onto a small alluvial fan covering parts of Subplots J, K, N and O. The margin of another small fan lies across Subplots D and C. The remainder of the plot is located on an old, inactive alluvial terrace primarily granitic in origin. The southern 100 m axis of the plot runs across flat ground at 200°, roughly parallel to the basaltic ridge. The short axis bears 110° and, at the eastern end, runs onto the ridge up a slope of about 15°. The commencement corner (Subplot A) is located in the southwest corner of the plot and the subplot layout is a mirror image of the layout represented on Figure 3.

Boulders of coarse-grained granite (see Willmott *et al.* 1988a, b) occur across the whole plot including on the surface of the basalt ridge. A deep krasnozem soil is developed on the basalt, and basaltic alluvium has greatly enriched much of the plot, either in the fan deposits or mixed with the deep soils of the relict terrace that is predominantly granitic in origin. Fragments of metamorphic rock are also reported from the site. Such geomorphological settings, or related variants, are relatively common along the northern side of the upper valley of the Russell River. The rainfall pattern, as interpreted from the Rainfall Coefficient of Variation (72), is amongst the least seasonal of the 20 CSIRO plots (Table 5) with the moisture index value being the third highest. In terms of the climatic zones of Tracey and Webb (1975) the site is wet to very wet (Table 9).

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a very tall to extremely tall closed forest with an extremely uneven canopy. In the earlier forestry-based terminology used by Stocker (1983) and in the plot notes, the highest trees were referred to as emergents. The upper canopy ranges from 30 to 35 m with the highest trees, specifically *Argyrodendron peralatum*, *Alstonia scholaris* and *Beilschmiedia bancroftii*, attaining 45 m (Figure 33). Below, a somewhat separate subcanopy layer extends from 15 to 25 m below which the midstorey and groundstorey has an open appearance.

The plot notes reported a contrast in vegetation structure across the plot and attributed this to the "topographic difference", but this observation is not supported by the stem data. Floristic differentiation in species composition across the soil types is limited to three species which are abundant (>4 individuals) on the flat but absent from the slope, *Doryphora aromatica* (7), *Macaranga inamoena* (4) and *Niemeyera prunifera* (4), and two species abundant on the slope but absent from the flat, *Litsea leefeana* (7) and *Garcinia gibbsiae* (4). In the plot notes, the use of *Geissois biagiana* as an example of such floristic differentiation was incorrect as it is represented by only one individual on the plot (Subplot O).

At establishment, the plot description indicates that *Rockinghamia angustifolia* and *Opisthiolepis heterophylla* dominated the stand in terms of stem abundance (8.3% and 8.0% respectively) while the main basal area contributions were spread across four species, *Tetrasynandra laxiflora* (11%), *Argyrodendron peralatum* (9.9%), *Alstonia scholaris* 9.6%) and *Opisthiolepis heterophylla* (8.5%). In this type, Complex Mesophyll Vine Forest, i.e. type 1a of Tracey and Webb (1975) and Tracey (1982), as is characteristic, hemi-epiphytes are abundant, with "*Pothos longipes, Freycinetia* and *Piper* spp., making d.b.h. measurements difficult at times" (plot notes). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 12. Many of the species on the plot occur widely throughout the coastal lowlands and in the forests of the wet escarpment, and the recorded species are typical of the type in this area. The tree *Haplostichanthus* sp. (Johnstone River LWJ471) and the shrubs *Ixora baileyana* and *Lasianthus strigosus* are characteristic of lowland complex rainforests.

The total species richness value for this plot is moderately high, ranking fifth highest of the CSIRO series of 20 plots, but has 45 fewer species than the maximum recorded at Plot 4 EP9 Robson Creek (Table 13). The moderate tree-species richness lies in the mid-range at 99, constituting only 64% of the total species, due to the combined high contributions of shrubs and vines along with the epiphytic species. Seven life forms were recorded at establishment, ranked as moderate to low in this plot series, and this value is comparable to some of the more unusual complex forests of the series, i.e. Plot 7 (EP29) Mount Fisher, Plot 14 (EP37) Eungella, Plot 15 (EP38) The Crater and Plot 18 (EP42) Iron Range.

Disturbance History and Stand Structure

No structural damage from recent natural events was evident when the plot was established in November 1976 and there was no evidence of logging activity (plot establishment report and Stocker 1983). Across the plot, the historic pack track was evident from an indistinct linear depression possibly having a lower understorey density, but no pattern of disturbance amongst the subcanopy or canopy trees was immediately evident. The 26 year plot record, based on 10 measurements, indicates no localised large disturbances were recorded until the passage of Tropical Cyclone *Winifred* in 1986 though some localised gaps have been recorded subsequently (Table 6). The basal area of 51.6 m^2 ha^{-1} recorded from the CSIRO plots (Table 11, maximum values) lies towards the lower end of the range for plots in the Wet Tropics region that had not been affected in the recent past by cyclones (i.e. 45 to 69.8 m^2 ha^{-1}).

The maximum plot stem density value, 604 stems ≥10 cm ha^{-1}, is the third lowest of the plot series. It accounts for the visually appealing and open appearance of the mid- and subcanopy, being typical of undisturbed examples of the type.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the mixed basaltic and granitic alluvial soils at this site were assessed as mesotrophic to eutrophic (Figure 4). However, as described above, there are strong contrasts in nutrient levels in the soil parent materials across the site. The detailed soil profile description (Appendix 1 Table 55) is based on a soil pit on a flat section of the site although the exact location is not known. Presumably referring to the pit profile, Stocker (1983) reported, “The deep brown sandy soil appeared to be derived mainly from granites.” The profile was not attributed to a Great Soil Group in the file records. Soil chemical analyses (second series), based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 56. It is not known if this sampling took account of the geological differences across the site. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 57.

Plot 13 (EP35) Whyanbeel

Location, Landform and Climate

The Whyanbeel plot is located to the west of the coastal Dagmar Range in the intensely dissected headwaters of Barratt Creek (Table 1, Figure 34) about 13 km north northeast of Mossman. Currently, the site is Unallocated State Land (USL) within the Wet Tropics World Heritage Area. Previously, the site fell in either Barratt Logging Area, State Forest 206 or Chinaman Logging Area, Timber Reserve 55. It now is accessible only on foot along an abandoned, ridgetop vehicle track around 600 m long (commencing at electricity pole JA2, previously numbered 227, approximate location Mossman 1:50,000 AGD 1966 GR 321250 8191450, GDA 1994 321365 8191626), about 10 km from the southern end of the electricity line vehicle access track off Whyanbeel Road (at Mossman 1:50,000 AGD 1966 GR 320800 8188100, GDA 1994 320915 8188276). Detailed access instructions are held in the plot file. The plot was established in May 1977 (Stocker, 1983) and the establishment report (K.D. Sanderson, 6 March 1978) states the object was “to examine the structure and species composition of rainforest on the lower coastal ranges north of Mossman”.

The site lies along the southeastern side of a ridge at 230 m elevation on a rolling low hills landscape that is a dissected plateau remnant. Landform elements represented on the plot include upper, middle, and lower slope as well as gully (Subplots D and H only) and a small section of hillcrest (Subplot A). The 100 m axis of the plot lies on a bearing of 65°, almost parallel to, and just below the ridgeline, falling gently to the northeast end (on a slope of 5°) and moderately at the southwest end (10° slope). The short axis bears 155° and runs down a fairly uniform slope of 15°. The commencement corner (Subplot A) is located in the northwest corner of the plot and the subplot layout is a mirror image of the layout represented on Figure 3. The buffer zone is intact.

Across this rolling landscape, metasediments (typically micaceous greywacke) of the Middle Devonian-Lower Carboniferous Hodgkinson Formation (Amos and de Keyser 1964) form relatively shallow and infertile soils. At the plot site, along the ridge and upper slopes, soils are locally skeletal, often with outcrops of white quartz (see mining disturbance below). The rainfall pattern, as interpreted from the Rainfall Coefficient of Variation, is seasonal (Table 5). In terms of the climatic zones of Tracey and Webb (1975) the site is wet (Table 9).

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a very tall closed forest. The surface of the upper canopy ranges generally between 26 m and 30 m (Figure 35) with the tallest trees being *Alstonia muelleriana* at 35m and three individuals of *Acacia celsa* at 30 m. Stocker (1983) noted that the canopy was fairly low and relatively compact. The plot description specifies "The more densely foliated section of the canopy is at the 15-20 metre mark … … there being no clear demarcation of categories (of strata)". Even in 2001, occasional large low branching trees were still present, indicating that sections of the canopy of the site were relatively open or broken in the recent past. At establishment, *Endiandra wolfei* was most important in terms of stem density at 10% while *Acacia celsa* contributed 12.9% of the basal area with *Flindersia bourjotiana* the next important at 7.7% (plot description). The understorey is relatively sparse and consists mainly of overstorey tree species and shrubs. The tree fern *Cyathea rebeccae* is abundant in some parts of the plot (Stocker 1983). This site is a typical example of regularly disturbed Mesophyll Vine Forest, i.e. type 2a of Tracey and Webb (1975) and Tracey (1982). Stocker (1983) noted the resemblance between the vegetation of this site and that at Plot 3 (EP4) Little Pine Creek. However, the Whyanbeel site lacks the fan palm understorey characteristic of the Little Pine Creek locality.

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 13. Although many of the species on the plot occur widely throughout the coastal lowlands, both *Argyrodendron* sp. (Whyanbeel BH 1106RFK) and *Backhousia hughesii* are distinctive trees with somewhat restricted geographic distributions (Hyland and Whiffin 1993).

For this plot, the total species richness of 121 lies in the lower mid-range of the series. The tree-species richness also lies in the lower mid-range at 89 but represents 74% of the total species richness, ranking moderate to high in this regard. This may be due to the unusually low number of vine species (5) that represent only 4% of the total species recorded. At 11, the number of life forms is the joint highest in the plot series (Table 13).

Limited *Flindersia* sapling and seedling data are held in the plot files and electronic archive.

Disturbance History and Stand Structure

Pre-establishment Cyclones and Forest Structure

They are four descriptions of this site available, the plot establishment report, the plot description, Stocker (1983) and West *et al.* (1988). Despite some differences in interpretation, all note that this site has been disturbed by cyclones in the past. Key features used in these interpretations were "a high frequency of smaller sized stems and the occasional large sized tree of an early successional species" (plot establishment report), "the flora … has a vigorous appearance which could be mostly due to the very early age of the stand and predominance of early successional and therefore relatively fast growing light responsive species" (plot description), while Stocker (1983) recorded the presence of "many signs of repeated cyclone damage" with some "cyclone scrub patches and recent windfalls within a few hundred metres of the plot". Stocker (1983) also noted that there were only two large trees in the 80-90 cm dbh class at plot establishment. One, an *Acacia celsa* subsequently died while the other "a slow growing *Backhousia hughesii* was probably a relic from forest which existed prior to the last catastrophic disturbance". In the most recent description (West *et al.*, 1988), the structure is referred to as being "in the late stages of recovery from a catastrophe which, at this site, would have almost certainly been severe cyclone damage".

This view is supported by the plot floristics, as noted by West *et al.* (1988), particularly in the presence of *Acacia celsa*, *Alstonia muellerana, Flindersia bourjotiana* and *F. pimenteliana* in the upper canopy. In the regional forest mapping by Tracey and Webb (1975), this district was represented as a mosaic of type 2a Mesophyll Vine Forest and type 12c Vine Forests with Acacia, a pattern usually indicative of regular disturbance.

Post-establishment Disturbances and Cyclones

A number of disturbances have been recorded during the 11 censuses over 25 years at this plot (Table 2). After establishment in May 1977, large gap disturbance was evident at the next enumeration in 1979 (Table 6). The site was then disturbed by strong winds associated with Tropical Cyclone *Winifred* in 1986 and further gap disturbance was noted in 1991.

A site inspection during 2001 revealed that severe Tropical Cyclone *Rona* (12 February 1999) caused some damage on and adjacent to the plot, and tree falls resulting from this disturbance were mapped on that visit. (Plot file notes, however, predicted no damage to the plot from this cyclone, emphasising the importance of regular site appraisals.)

On this plot, the low basal area of 44.0 $m^2 ha^{-1}$ (Table 11, maximum value) probably reflects a history of repeated disturbance by cyclones. This basal area value lies towards the lower end of the range recorded from the 20 CSIRO plots, and as noted previously, is much lower than the 63.6 m^2 ha^{-1} value determined for a typical MVF site at El Arish by Webb and Tracey, as reported by Hopkins *et al.* (1998). The history of repeated cyclonic disturbances is also likely to account for the high stem density of 1002 stems ≥10 cm ha^{-1} (Table 11, maximum value) recorded on the Whyanbeel plot.

Pre-European Fire History

Charcoal fragments were found at a depth of 0.1 m to 0.2 m in only one of six soil cores taken from this site during 2000 (Table 7). A single charcoal fragment from hole 1 provided a conventional radiocarbon date of 1950 ± 40 years BP (CSIRO sample L51 H1.3, ANSTO code OZF176). The corresponding calendar year age or intervals, together with the interval probabilities, are 35 AD - 36 AD (12.4%); 55 AD - 89 AD (58.7%); 101 AD - 121 AD (28.9%). Due to the small fragment sizes, no taxonomic determination was possible.

Because of the limited extent of the charcoal (Table 7), it is not possible to recognise or distinguish between the most probable sources of the charcoal, i.e. burning of a pre-existing *Eucalyptus* open forest now replaced by rainforest, burning of debris from a rainforest (possibly dominated by *Acacia*) following a major storm or cyclone, or aboriginal activities along the ridgetop.

Mining Disturbance and Pre-establishment Cyclones

According to the plot description “The rough track into the area provided access for mining activity in the vicinity of the plot and some disturbance of the earth in the plot is evident, caused by prospecting and the sampling of quartz outcrops. This mining activity occurred probably 20 years ago and has caused no obvious damage”. The plot establishment report refers to this activity as “small diggings” throughout the plot. A recent inspection confirms that these disturbances were at an insignificant scale.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil derived from the metasediments at this site was assessed as oligotrophic (Figure 4) confirming the view expressed earlier in the plot description. The detailed soil profile description (Appendix 1 Table 58) is based on field records from a soil pit located adjacent to the plot although the exact position is not known. This profile was not formally referred to a Great Soil Group in the file records. Stocker (1983) noted, "The gravely reddish loam surface soil was underlain by a massive clay subsoil." Soil chemical data (second series) are presented in Appendix 1 Table 59. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 60.

Plot 14 (EP37) Eungella

Location, Landform and Climate

The Eungella plot is located on the southern section of the Clark Range (Table 1, Figure 36) in Crediton State Forest (previously referred to as Range Logging Area of State Forest 679) on the headwaters of Endeavour Creek. The site is about 16 km southwest of Finch Hatton township in the Pioneer River valley west of Mackay. Vehicular access to the plot requires negotiation with the adjacent landowner. By road, the plot is about 15 km from the Broken River Bridge, and the 2001 access details are recorded on the plot files. In 2005 it was discovered that the alignment of the Mackay Highlands Great Walk (constructed by the Queensland Parks and Wildlife Service in 2002) passed through the buffer zone of the plot, providing easier local access. The plot establishment report (K.D. Sanderson 14 November 1978) states that the object of this plot was to examine the structure and species composition of highland rainforest in a geographically isolated belt of rainforest on Clarke Range, south of Eungella National Park. The plot was established in June 1977.

The plot lies at an altitude of 920 m on the eastern margin of a major broad ridge that is a plateau remnant. The 100 m axis of the plot parallels this major ridgeline on a bearing of 184°. The 50 m axis runs down slope bearing 94°. The eastern margin of the plot lies about 60 m from the edge of the escarpment. The bulk of the plot lies on midslope landform elements sloping eastwards at between 6° and 3.5°, although a minor ridge runs from Subplot I to Subplot L with associated small upper slope elements. On the northern margin of the plot, a dry gully about 3 m deep and wide runs eastwards through the buffer zone before turning southeast and passing through Subplot D. Subplot A is located in the northwestern corner of the plot and the subplot layout is as represented on Figure 3. While no recent logging activities have disturbed the buffer zone, cattle occasionally stray into this area from the cleared paddock about 150 m to the north.

In contrast to the northern section of the Clark Range where extensive granitic landscapes are represented in Eungella National Park, much of the southern Clark Range, of which the plot locality is typical, is capped by basalt of the Nebo Province (Early Miocene to Palaeocene, between 34.2 and 21.5 million years in age, see Stephenson *et al.* 1980) on which deep and relatively fertile soils have developed. Extrapolation of the climatic zones of Tracey and Webb (1975) suggests the site is cloudy wet (Table 9). Although no model climatic data are available, the estimated rainfall lies in the mid-range of the CSIRO plots (Table 5) and the relative seasonality of precipitation is probably moderate to low.

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a very tall to extremely tall closed forest with an uneven canopy. In the earlier forestry-based terminology, some of the conspicuous and relatively abundant highest trees were referred to as emergents (plot notes). The upper canopy ranges from 25 m to 40 m with *Acmena resa* being a conspicuous component (Figure 35). At establishment, the tallest tree heights in all subplots ranged from 31.8 m to 42 m with *Alphitonia petrei* at 42 m, *Acmena resa* at 41m and *Argyrodendron actinophyllum* ssp. *diversifolium* at 41 m. This rainforest is "most impressive with a well developed upper canopy over most of the plot and a mid canopy dominated by the palm *Archontophoenix cunninghamiana*" (Stocker 1983) up to 15 m high (plot notes). The understorey is described as "virtually non-existant" under the more densely closed sections of the canopy, though sections of the plot have a dense ground cover of *Pollia macrophylla* to 0.5 m high. Hemi-epiphytes are conspicuous on the lower section of tree trunks (Stocker 1983).

This forest is a feather palm variant of Complex Notophyll Vine Forest (CNVF) and represents a lociation (Webb and Tracey 1981) determined by the environmental setting of the site where in addition to a relatively high orographic rainfall, abundant moisture is intercepted from clouds that roll across the margin of the escarpment and some local restriction of drainage may also occur. The parent CNVF type is comparable to type 5a of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 14. *Argyrodendron actinophyllum* spp. *diversifolium* is a species that confirms the structural/ environmental classification. The recorded species are typical of the type in this Central Queensland area.

Total species richness and tree species richness are the lowest of the plot series, at 84 and 48 respectively, reflecting the biogeographic location. The comparative ranking by life forms is moderate to low (7). The contributions of the tree species to the total species set is also the lowest in the series (57%) due to the high proportion of epiphytic and hemi-epiphytic species on the plot (15% and 4% respectively, both highest ranking in the series), the moderate numbers of vine species (11%) and the and the importance of herbs (7%).

Tabulations in the plot description show that *A. resa* clearly dominates the basal area of the stand (38%) followed by *Cryptocarya angulata* (13%), *Argyrodendron actinophyllum* ssp. *diversifolium* (10%), *Syzygium wesa* (9%) and *A. cunninghamiana* (7%). In contrast, this palm dominates the stem frequencies (29%) followed by *C. angulata* (19%) and *Dendrocnide photinophylla* (8.5%) while the structurally important *A. resa* ranks fifth, and contributes only 3.9% of stems.

Disturbance History and Stand Structure

Historical Catastrophic Natural Disturbances

In 1977, there was no evidence of recent natural disturbance (plot establishment report). In his preliminary analysis of the stand structure, Stocker (1983) noted that the three tree species with the largest individuals, *A. resa*, *S. wesa* and *A. actinophyllum* ssp. *diversifolium* "regenerate only periodically although recent conditions on the plot may not have allowed *A. resa* to regenerate at all", suggesting this latter species "may be something of a relic out of tune with the recent environment". The presence of such long-lived disturbance-responsive canopy species suggests periodic disturbances either on a broad scale, such as catastrophic regional drought or cyclonic destruction, or with a more localised impact such as thunderstorm wind tracks, are responsible for some aspects of the canopy species composition as well as the size class distribution. As at Plot 11 (EP33) Curtain Fig, the presence of numerous mid-canopy individuals but very few saplings or groundstorey representatives of *D. photinophylla* also suggests that periodic disturbances may be important at the Eungella site.

Past Logging

At plot establishment, there was no sign of any logging activity on the actual plot site (plot establishment report). Evidence of the logging that occurred probably 30 to 40 years previously, was obvious in the surrounding area (Stocker 1983), but was highly selective. Stumps and debris of *Gmelina leichhardtii*, a very durable species often used for fencing, were evident at the northern end of the site in 1977 (plot notes). It may be that the adjacent logging activity had " some effect on understorey growth in certain areas of the plot" (plot notes).

Post-establishment Disturbances and Cyclones

The 28-year data record (spanning 10 measurements) shows large gap disturbance was evident in the 1983 enumeration, with subsequent disturbance by cyclonic winds in February 1989, and further gap disturbance in 2001 (Table 6).

Assessed against data for the 20 plots, this plot has a high basal area (63.2 m^2 ha^{-1}) and moderate stem density values (880 stems ≥10 cm ha^{-1}), these values being typical of undisturbed CMVF or CNVF (Table 11, maximum values).

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the basaltic soil at this site was assessed as mesotrophic to eutrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 61) is based on field records from a soil pit located adjacent to the plot although the exact position is not known. This profile was referred to the krasnozem Great Soil Group and Principal Profile Form Gn3.14 in the file records, being also described as a red well structured sandy loam with the clay content gradually increasing with depth (Stocker, 1983). Soil chemical data (second series) are presented in Appendix 1 Table 62. Soil bulk density and moisture retention data are given in Appendix 1 Table 63 while soil hydraulic parameters are presented in Appendix 1 Table 64. Soil particle size data are shown in Appendix 1 Table 65.

Plot 15 (EP38) The Crater

Location, Landform and Climate

This plot is about 17 km due south of Atherton on the Hugh Nelson Range (Table 1, Figure 37) in the Herberton Range Forest Reserve (previously referred to as State Forest 194 Barron). It lies just outside the boundary of the Wet Tropics World Heritage Area close to the northern margin of the Mount Hypipamee National Park. Access to the plot is along the Plath Rd to Rolley Rd connecting road, followed by a walk of about 0.5 km along an overgrown abandoned vehicle track through open forest (see plot files for full details). This plot was established in September 1977 as part of a study of the dynamics of rainforest-eucalypt forest boundaries in the Herberton Highland (see Unwin 1983, Unwin *et al.* 1985, Unwin 1989) and was incorporated the "EP" series of CSIRO study plots. This plot was established in September 1977.

The plot is located on a moderately inclined slope of southeasterly aspect at 1000 m (see geomorphology description below). From the northeastern commencement corner (Subplot A), the 100 m axis of the plot runs more or less parallel to the adjacent ridgetop in a westerly direction (bearing 265°) and the 50 m axis runs downhill bearing 175° with slope values around 12 ° to 14 °.

The plot includes upper, mid- and lower slope landform elements as well as a section of relict valley flat. The subplot layout is as represented on Figure 3 with a complete buffer zone. At plot establishment, there was no evidence of recent disturbance within the buffer zone (but see disturbance history below).

Field inspections carried out for this review revealed that the locality has relatively complex geological and geomorphological settings that have not been adequately described in earlier reports on this plot. The Hugh Nelson Range is composed mainly of rhyolitic and granitic rocks with overlying basaltic lava flows and pyroclastic deposits. The ridge on which the plot occurs is part of a broad range crest that is an elevated plateau with relatively low relief characterised as undulating low hills. For example, immediately south of this plot on this plateau, a 1 km long section of the Barron River has a gradient of only 2%. The bounding escarpments of the plateau are clearly evident to the west in the headwaters of North Nigger Creek (now referred to as North Wondecla Creek), particularly at Halls Falls (Atherton 1:50,000, AGD 1966 335000, 8074300, GDA 1994 335115, 8074476), and, to the east, on the Barron River below Dinner Falls (Atherton 1:50,000, AGD 1966 339300, 8072500, GDA 1994 339415, 8072676) or in the headwaters of Poona and Kauri Creeks. The actual plot site lies only 1 km northwest of the Hypipamee Diatreme and 4 km west-northwest of the remnant crest of the Malanda shield volcano (Stephenson *et al.* 1980). Basaltic rock fragments excavated from the plot indicate that basaltic pyroclastics blanketed the plot locality at the time of one or both of these events. While now weathered and substantially eroded, some of this relatively fertile soil parent material is retained on lower slopes and in valley infills, strongly influencing forest composition and physiognomy. On and adjacent to the plot, loose rocks and scattered outcrops of rhyolite and coarse-grained granite commonly occur. Weathered rhyolitic outcrop is exposed in the creek bed immediately downslope of the plot. This creek is incised at least 8 m into the valley infill of friable, dark grey sandy loam. On the plot, similarly textured but lighter coloured soil profiles are at least 0.6 m deep on the most elevated sections, and more than 1 m deep on the lower slopes. Some soil charcoal was recovered from one small pit on the site at a depth of 0.5 m (Appendix 1 Table 67). In terms of the climatic zones of Tracey and Webb (1975) the site is cloudy moist (Table 9) and the rainfall pattern is of moderate to low seasonality (Table 5).

Forest Structure, Type and Floristics

At establishment, the structure of the rainforest on the plot was a very tall to extremely tall closed forest. The uneven upper canopy varied in height between 30 and 38 m with the tallest trees being *Geissois biagiana*, *Ficus* spp. and *Flindersia brayleyana* (Figure 38). The understorey of most of the plot has always been relatively sparse. The plot description indicates that stem frequencies were dominated by *Cryptocarya onoprienkoana* (13%) and *Franciscodendron laurifolium* (11%) while the highest basal area contributions were from *Geissois biagiana* (16%), *Cryptocarya onoprienkoana* (12%) and *Franciscodendron laurifolium* (11%).

This forest is Complex Notophyll Vine Forest (CNVF), i.e. type 5a of Tracey and Webb (1975) and Tracey (1982). Characteristic physiognomic features of this forest type such as well-developed buttresses and strangling figs are abundant at this site. Previous descriptions of the forest type on this plot (e.g. Stocker 1983) appear to have been based on the regional mapping class rather than field observation, interpretation or analysis of the forest features and soils at the site. All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 15 and are typical of the complex type at this altitude. In combination, the key species that support the structural /

environmental assessment are *Doryphora aromatica*, *Franciscodendron laurifolium*, *Geissois biagiana*, *Sloanea australis* ssp. *parviflora* and *Haplostichanthus* sp. (Topaz LWJ 520).

The life forms recorded rank as moderate to low (7), the total species richness as moderate (141), the tree species richness as moderate (95), and the tree species percentage as low to mod (67%). Vine species are particularly important at this site, having the second highest number of species in the plot series (21) contributing 15% of the species on the site.

Disturbance History and Stand Structure

Natural Disturbances and Past Logging

Details of the disturbance history of this plot are based on observations during 11 measurements over 25 years (Table 2). At establishment, there was no evidence of disturbance from natural events within the plot and buffer area. However, file records indicate that, at establishment, the plot contained two or three large stumps of *Flindersia brayleyana* (one of which was still visible in 2000) and an old snig track in the northwestern section of the plot. These features indicate that selective logging occurred in the past, probably prior to 1960. The plot notes record "The disturbed section of the plot is approximately one-third of the total plot area and has recovered to a certain extent."

Patch Death Phenomenon

In 1989, a "patch death" phenomenon (commonly associated with *Phytophthora cinnamomi*, but also linked with lightning strikes as at Plot 5 (EP18) Mount Lewis) was observed in Subplots O and P. File notes record the upper canopy to be dead or dying, and the understorey as thin and scattered. By 1998, the canopy had re-established in this area and no further localised deaths were evident in 2000. No formal assessment of a *P. cinnamomi* infestation was undertaken (B.N. Brown, personal observation 2000).

Context and Rainforest Development

Although Unwin (1983) referred to the presence of several moribund *Eucalyptus grandis* surrounded by relatively young rainforest, these trees were still alive in 2000. They are located only on the ridgetop above the plot where the nutrient poor and locally skeletal soils contrast strongly with the deeper soil profile typical of most of the plot, and their occurrence reflects the often fine-grained forest type pattern in such settings. There is no evidence to suggest that the rainforest of the plot is "young rainforest" (cf. Stocker 1983).

Structural Characteristics

Despite the well-developed nature of the rainforest on this plot and a low to moderate stem density of 764 stems ≥10 cm ha^{-1}, it has only a low to moderate basal area of 49.9 m^2 ha^{-1} (Table 11, maximum values). Disturbances associated with past logging and the effects of dieback are probable explanations (Table 6).

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil from the mixed parent materials at this site was assessed as mesotrophic (Figure 4). No detailed soil profile description was available in the plot file. In August 2000, new soil samples were taken at upper slope and lower slope positions to account for the variation in the catena across the plot. At each position, the profile was sampled by three auger holes and the stratified samples were bulked. The corresponding soil chemical analyses for the upper and lower slope locations are given in Appendix 1 Table 66 and the fertility differences between the upper and lower slope sampling positions are clearly evident. Recently sampled, near surface soil bulk density data for contrasting upper, mid- and lower slope positions across the plot are presented in Appendix 1 Table 67.

Plot 16 (EP40) Agapetes Scientific Area

Location, Landform and Climate

The Agapetes Scientific Area plot is located near the drier southern margin of the Windsor Tableland adjoining a section of the Great Dividing Range (Table 1, Figure 39) in Mount Windsor National Park (previously Agapetes Scientific Area of State Forest Reserve 144) inside the Wet Tropics World Heritage Area. The site lies 23 km west southwest of Daintree Village on the Daintree River, or 36 km northwest of Mossman. Access is from the Mount Windsor Forestry Road system. The plot was set out in October 1978. Although no plot establishment report has been found, the intent no doubt was to examine the structure and species composition of “the tall dry upland rainforest on granitic soil” (Stocker 1983).

The plot locality lies in the central southern section of the Spencer Creek catchment above the McLeod River. The site is at 800 m elevation along the northwestern side of a minor ridge that rises to 824 m on a rolling low hills landscape that is a dissected remnant of an ancient plateau. The plot includes extensive ridge, upper and midslope landform elements as well as lower slope and gully settings. The 100 m axis of the plot lies along a bearing of 55°, roughly along the ridgeline. The short axis bears 145° and generally runs down slope. While much of the southern section of the plot is a fairly uniform midslope setting, the northern portion features a side ridge and associated gullies (see file records sketch map). The commencement corner (Subplot A) is located in the southeastern corner of the plot, and the subplot layout is as represented on Figure 3. The nearest logging track lies across the creek to the west of the plot and the buffer zone is intact. On the 1986 Queensland Department of Forestry 1:50,000 Mount Spurgeon map, the plot appears to be about 200 to 300 m away from the wet sclerophyll forest margin to the southwest, or about 400 m away to the southeast.

Stocker (1983) described outcrops or residual corestones of coarse-grained granite in the vicinity of the plot and suggested weathering probably exceeded 5 m in depth. However, soil characteristics are likely to vary along the various catenas from the ridgetop to lower slope positions. The soil parent material is Late Carboniferous to Early Permian granite (Bain and Haipola 1997). The rainfall distribution pattern is moderately seasonal (Table 5) and, in terms of the climatic zones of Tracey and Webb (1975), this upland to highland site is moist to marginally wet (Table 9).

Forest Structure, Type and Floristics

This rainforest is a very tall to extremely tall closed forest with the upper canopy ranging between 30 m and 41 m (Figure 23). The tallest trees are *Agathis robusta* (41 m, three at 36 m) and *Argyrodenron polyandrum* (36 m and 35 m). In terms of overall stem frequency *Backhousia hughesii* clearly dominates (24% of stems) although *Mallotus polyadenos* was the most frequent species amongst subcanopy stems (plot description). This record also shows that basal area contributions are dominated by *A. robusta* (32%) closely followed by *B. hughesii* (26%). The plot has low values for all-species richness (118) and moderate to low for tree species richness (86), while the number of life forms is the joint lowest (6) with Plot 11 (EP33) Curtain Fig and Plot 20 (EP44) Fantail Logging Area in the series (Table 13). The proportion of tree species (73%) falls in the moderate range (69% to 74%) that appears to represent somewhat “disturbed” or “stressed” sites.

This forest is a representative example of Complex Notophyll Vine Forest with emergent *A. robusta*, i.e. type 6 of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 16. Key species that confirm the structural/ environmental classification are *A. robusta* and *Argyrodendron polyandrum*, and the recorded species are typical of the type in this area.

Disturbance History and Stand Structure

At the time of plot establishment, logging activities had not reached the vicinity of the plot (Stocker 1983) and subsequently did not affect the buffer zone or plot areas. At establishment, there was no evidence of recent disturbance from natural events. No significant disturbances have been recorded during the 9 measurements over a 24 year period (Table 6).

On this plot, values for both basal area (61.2 m^2 ha^{-1}) and stem density (996 stems ≥10 cm ha^{-1}) fall towards the higher end of the ranges recorded from the 20 CSIRO plots (Table 11, maximum value) and appear typical of well developed undisturbed rainforests in north Queensland. Comparable quantitative data from similar undisturbed forests of the Tinaroo Range area show basal areas of 62 and 71 m^2 ha^{-1} and stem densities of 960 and 1090 stems ≥10 cm ha^{-1} respectively (CSIRO 20 m by 20 m plots, unpublished data) and the transect drawing of Tracey (1982), suggest that this combination of values appears typical of type 6 rainforest.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil at this granitic site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 68) is based on records from a soil pit, the location of which is not known (an important issue given the variability in landform elements across the plot). In the soil data base records the profile was described as having affinities with the earthy sand Great Soil Group and a Principal Profile Form Uc. Stocker (1983) recorded “The yellowish loamy soil contained quantities of gravel derived from partially decomposed granite.” Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 69. Soil bulk density and moisture retention data are given in Appendix 1 Table 70 while soil hydraulic parameters are presented in Appendix 1 Table 71.

Plot 17 (EP41) Oliver Creek

Location, Landform and Climate

This plot lies adjacent to Oliver Creek in the Daintree National Park within the Wet Tropics World Heritage Area, about 7 km south-southwest of Cape Tribulation (Table 1, Figure 41). At the time of plot establishment in November 1977, the area was Vacant Crown Land, and the file records from that time refer to this location as “Arsenic Creek”. Access is by foot along the western bank of Oliver Creek for approximately 200 m upstream from the road bridge on the Cape Tribulation road. No documentation for the plot establishment proposal is on file.

The plot lies on the landward margin of the coastal plain at about 15 m elevation immediately adjacent to the footslopes of Mount Hemmant (1065 m). Both the 100 m axis (bearing 336°) and the southern 50 m axis (bearing 246°) run across the western margin of the Oliver Creek valley. Subplot A is located in the southeastern corner of the plot approximately 120 m west of the main creek channel. The plot layout is as represented on Figure 3 and includes a complete buffer zone.

The plot is located on a gently inclined (3° to 5°), poorly sorted fan deposit at the base of a steeply rising gully (c. 18°) in the Mount Hemmant footslopes. Surface soil parent materials predominantly are Palaeozoic metasediments of the Hodgkinson Formation (see Arnold and Fawckner 1980) that outcrop on the adjacent ridge, while deeper valley infill may include a granitic component from the headwaters of Oliver Creek. (Some earlier file records refer to the substrate at this site only as granitic in origin.) Weathered metamorphic gravel and cobbles cover most of the surface of the plot. An ephemeral creek enters the plot through Subplot P (Figure 42) and gully-head erosion in this creek is actively reworking the upper sections of the fan. During peak flows, this creek overflows its channel and discharges over the plot, depositing new debris and disturbing and shifting the previous deposits. In terms of the climatic and altitudinal zones of Tracey and Webb (1975) this is a very wet lowland site (Table 9) but with a moderately seasonal rainfall pattern (Table 5).

Forest Structure, Type and Floristics

In structure, the rainforest on the plot is a tall to very tall closed forest with the uneven upper canopy ranging mostly between 25 and 30 m with the highest sections to 34 m. The tallest trees are *Lindsayomyrtus racemoides* at 42 m and *Storckellia australiensis* at 34 m (Figure 43). Floristically, the plot is unusual with four canopy tree species constituting more than half the ≥10 cm dbh stems on the plot, viz. *Lindsayomyrtus racemoides* (137 stems) *Ryparosa javanica* (32 stems)*, Idiospermum australiense* (27 stems) and *Storckiella australiensis* (19 stems). In terms of basal area, the plot is dominated by *Lindsayomyrtus racemoides* (38%) and *Idiospermum australiense* (16%) with *Storckiella australiensis* contributing 9%. This forest is a floristic variant of Complex Mesophyll Vine Forest (CMVF), type 1a (Tracey and Webb 1975; Tracey 1982) determined by the fluvial geomorphic processes and local edaphic setting of the cobble-strewn alluvial fan, i.e. a lociation (Webb and Tracey 1981).

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 17 and are typical of the type in this geomorphic setting. The four most abundant canopy tree species on the plot (listed above) are also common on the rocky alluvial deposits and regularly disturbed alluvial fans adjacent to Noah, Oliver and Cooper Creeks. The plot notes suggest that the floristic composition of the plot differs from that of the forest closer to, and along the banks of, Oliver Creek. The 1977 understorey was described by Stocker (1983) as “rather poorly developed” and “sparse consisting of tree seedlings (especially *L. racemoides* and *I. australiense*), a few shrubs and vines (especially *Calamus* spp.).” Depending on seeding and weather patterns (see below), dense carpets of *I. australiense* can be a notable characteristic of the plot.

On this plot, the number of recorded life forms is moderate (8) and species richness ranks as moderate to low (121), while tree species richness is also moderate to low (85). The percentage of tree species is moderate (70%) with shrubs contributing 11% and vines 12% of the plot flora (Table 13).

Disturbance History and Stand Structure

Plot records and observations are based on 11 measurements over 25 years. Prior to the passage of severe Tropical Cyclone *Rona* on 12 February 1999, no major disturbances had been recorded at this site (Table 6). At establishment, “the plot appeared to be free from past human interference and although there was plenty of evidence of cyclone damage in the vicinity, it did not seem to have been affected by cyclones for a long time” (Stocker, 1983). Minor disturbance of the groundstorey from walking tracks was recorded in 1985.

Cyclone Disturbance

Following Cyclone *Rona*, an inspection of the general Daintree area and Plot 17 (EP41) was carried out on 25 February 1999 (K.D. Sanderson, Plot 17 (EP41) file report). Throughout the Daintree River to Cape Tribulation region, damage was localised and associated with westerly winds. Areas of heavy damage were often associated with topographic wind-funnelling effects (e.g. along the lower Noah Creek valley) or exposure adjacent to cleared land (e.g. east of the clearing at Mason's Store adjacent to Myall Creek). Localised heavy damage was evident in both open and closed sclerophyll communities, and in rainforests including Notophyll Vine Forest adjacent to beaches, Complex Mesophyll Vine Forest on the coastal plain, and Mesophyll Vine Forest on the footslopes and ridges. Most shoreline vegetation was largely untouched. Where fan palm forests (Mesophyll Vine Forests dominated by *Licuala ramsayi)* were impacted, the damage appeared limited to the upper canopy or emergent trees and the palms were largely unaffected. Further accounts of the effects of this cyclone on the forests of the region have been given by Grove *et al.* (2000), Turton (1999) and and Turton and Siegenthaler (2004).

In the valley of Oliver Creek, the effects of Cyclone *Rona* were rated as *Damage Category 3, Moderate Canopy Disturbance* in terms of the cyclone damage criteria developed by Unwin *et al.* (1988), i.e. most stems remained erect, some treefalls occurred, and structural injury was mostly branch and foliage loss. In the vicinity of the plot, the most intense structural damage was largely limited to Subplots A and B (see summary data in the electronic archive) and the buffer area adjacent to Subplots A and B. Many of the seven trees that broke appeared to have weaknesses due to trunk rot either at the base or above.

Significant structural crown damage was recorded for 13 trees across the plot varying from loss of more than half the crown to only a few damaged branches (see summary data in the electronic archive). Many small branches with dead leaves hung in the understorey and their high visual impact gave a false over-estimate of both the extent and intensity of serious structural damage. However, leaf loss was extensive, and some trees with only light structural damage were virtually leafless. As a result, in late February 1999, the projective foliage cover appeared quite low with an estimated reduction of approximately 60% due to leaf loss from defoliation and minor crown damage.

On about one quarter of the plot, the groundstorey is extensively disturbed by water flow and gravel movement during occurrences of intense rainfall. During the intense rainfall associated with Cyclone *Rona*, the ephemeral creek again distributed coarse gravel and cobbles across much of Subplots A, B, E and F (Figure 42). In July 2000 the groundstorey of this area remained conspicuously sparse in contrast to the remainder of the plot, which featured a dense carpet of well-established *L. racemoides* seedlings.

Structural Characteristics

On the Oliver Creek plot, the basal area (45.6 m^2 ha^{-1}) is low to moderate while stem density (792 stems ≥10 cm ha^{-1}) is moderate to high in comparison with data recorded from the other 19 CSIRO plots (Table 11, maximum values). These values probably reflect past disturbances associated with cyclones, intense rainfalls and extreme stream discharges across the alluvial fan. Similar situations and disturbance regimes are quite common in much of the lowland rainforest in north Queensland.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil at this site was assessed as oligotrophic (Figure 4). The brief soil profile description (Appendix 1 Table 72) is based on field records from a soil pit located adjacent to the plot although the exact position is not known. This profile was not formally referred to a Great Soil Group in the file records, but was described as a colluvial soil by Stocker (1983). Soil chemical data (second series) are presented in Appendix 1 Table 73. Limited soil particle size data from the preliminary soil survey are given in Appendix 1 Table 74.

Plot 18 (EP42) Iron Range

Location, Landform and Climate

The Iron Range plot is the most northerly in the series of 20 plots, lying about 550 km north - northwest of Cairns on the east coast of Cape York (Figure 1). The plot is located on the south bank of the West Claudie River, 6 km east-northeast of Mount Tozer, and 10 km northwest of the Lockhart River settlement (Table 1, Figure 44). This site lies in Iron Range National Park and is accessible by walking 550 m upstream from the last causeway crossing the Claudie River, approximately 12 km before the Lochhart River settlement. The plot was established in November 1977 but no plot establishment proposal or report is on file.

The site lies on an active riverine plain landform (Figure 45) at about 60 m elevation. The landform elements represented on the plot include: an actively eroding streambank (now in Subplots I and M, about 9 m high above the streambed), a scroll (an alluvial sediment rise centred on Subplots F, G, J and K), a gully (seasonal overflow channel, possibly a partially infilled meander channel, along the eastern, northern and western plot margins) and small areas of footslope (Subplots D and P, leading up to the higher sections of the alluvial plain). The 100 m axis of the plot lies at 220°, tangential to the bend of the Claudie River. The commencement corner (Subplot A) is located in the northern corner of the plot and the subplot layout is as represented in Figure 3. The buffer zone has always been incomplete on the western corner of the plot, around Subplot M, where the 1977 position of the riverbank lay only a few metres from the plot corner peg. (For further details, see disturbance description below.) About one-third of the plot (along and adjacent to the overflow channel) is subject to inundation almost every wet season, January-April (Figure 45).

The site has a deep sandy alluvial loam soil (Stocker 1983) typical of the riverine plain. Extrapolation of the climatic zones of Tracey and Webb (1975) suggests the site is moist (Table 9) though with “severe drought conditions prevailing through October-December” (plot notes). Although no model climatic data are available, the estimated rainfall lies in the mid-range of the CSIRO plots (Table 5) but the relative seasonality of precipitation is probably higher than for any other site in the series. Assessment of the soil moisture availability at this site must consider the augmentation of the rainfall by groundwater and soil moisture recharge from flooding.

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a variably tall to extremely tall closed forest, the upper canopy being irregular and very uneven (Figure 46). The tallest trees have characteristically broad crowns with *Antiaris toxicaria* var. *macrophylla* and *Tetrameles nudiflora* both attaining heights of 41 m. Between the large trees, the canopy height drops to as low as 10 to 15 m. There are no large gaps in the canopy but in the channel from Subplot M to Subplot P, the trees are relatively widely spaced. Across the plot, the understorey density varies inversely with the duration of flooding. The bed of the overflow channel is almost devoid of small tree and understorey growth whereas the higher ground towards the centre of the plot (on the scroll deposit) has a dense understorey of seedlings and shrubs (plot notes). This forest contains a number of facultative and obligate deciduous species and is a typical Semi-Deciduous Mesophyll Vine Forest, i.e. type 4 of Tracey and Webb (1975) and Tracey (1982).

All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 18. Representative species that support the structural/ environmental classification are *Ailanthus integrifolia* ssp. *intregrifolia*, *Neolamarckia cadamba*, *Barringtonia calyptrata*, *Beilschmiedia obtusifolia*, *Myristica insipida*, *Nauclea orientalis*, *Palaquium galactoxylum, Sterculia shillinglawii*, *Tetrameles nudiflora* and *Rhyticaryum longifolium.* All the recorded species are typical of the type in this area. Stocker (1983) observed that the floristic composition of this plot "suggested … greater affinity with the rainforests of parts of southern New Guinea than with those ... in the Cooktown to Townsville region".

In terms of stem densities, the plot is dominated by *Pisonia umbelliflora* (11.5% of stems) followed by *Beilschmiedia obtusifolia* (7%) and *Cleistanthus apodus* (6%). The greatest basal area contributions are from *Castanospermum australe*(19%), *Nauclea orientalis* (14%) and *Beilschmiedia obtusifolia* (9%).

At 111, the total species richness value for this plot is the third lowest of the series, exceeding only the successional Plot 1 (EP2) Downfall Creek, and biogeographically remote Plot 14 (EP37) Eungella (Table 13). This low species richness is, at least in part, due to the relatively small numbers of herbaceous, epiphytic and hemi-epiphytic species recorded. (The paucity of herbaceous species may reflect both the disturbance of the site by pigs and, possibly, the timing of the sampling in the late dry season.) The tree-species richness lies in the lower mid-range at 89 (comparable to Plot 17 (EP41) Oliver Creek or Plot 11 (EP33) Curtain Fig), but the surprisingly, the percentage of tree species (76%) is the joint highest of the series equalled only by biogeographically and climatically dissimilar Plot 2 (EP3) Mount Haig. The life forms count (7) is moderate to low, but is comparable to that of the other northern Plot 10 (EP32) McIlwraith Range.

Disturbance History and Stand Structure

Timber Removal and Feral Animals

Being remote from population centres, this site showed little human disturbance at establishment (plot notes). Based on the evidence from a cut stump, the location of which was not specified, Stocker (1983) suggested that one *C. australe* was "probably removed to provide a bridge girder when the access road was constructed in the early 1940s". In common with many rainforest areas, this plot was subject to extensive pig disturbance at least between 1977 and 1983 (Stocker 1983).

Cyclone Disturbance and River Bank Erosion

Stocker (1983) reported that, during 1979, a cyclone passed across this locality but did little direct damage to the vegetation. His observations that "most if not all of the … canopy level species regenerated either periodically or under different conditions to those recently occurring" may reflect the influence of earlier cyclones on the floristic composition of the plot. He also noted that the high river levels associated with the 1979 event caused erosion of the stream bank and consequential tree falls in Subplot M. This erosion has continued unabated (file records, Figure 45) with the riverbank cutting back up to 25 m in a northeast direction by 1998. There has been no evidence of structural damage from other types of natural events during the 9 measurements spanning a 25-year record to 2002 (Table 6).

The structure of this plot appears typical of type 4, SDMVF with a low basal area (43 m^2 ha^{-1}) and the maximum recorded stem density is low at 554 stems ≥10 cm ha^{-1} (Table 11, maximum values). The only comparable dataset available is the basal area of 41.3 m^2 ha^{-1} and c. 560 stems ≥10 cm ha^{-1} recorded from Long Scrub, Bamaga (Webb and Tracey, unpublished "18 sites" data). The Iron Range plot basal area value is similar to the cyclone disturbed forests of Plot 9 (EP31) Woopen Creek or Plot 4 (EP4) Little Pine Creek. Stocker (1983) suggested that more stems occurred in the larger size classes than might be expected and the Webb and Tracey Long Scrub data show a similar trend, suggesting this may be a characteristic of the type.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the alluvial soil at this site was assessed as mesotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 75) is based on field records from a soil pit at an unknown location adjacent to the plot. The Principal Profile Form Uc6.14 has affinities with the earthy sand Great Soil Group, being developed on unspecified unconsolidated material (soil database records). Soil chemical data (second series) are presented in Appendix 1 Table 76. Soil particle size data are shown in Appendix 1 Table 77.

Plot 19 (EP43) Mount Baldy

Location, Landform and Climate

The Mount Baldy plot is located 7 km southwest of Atherton near the crest of the Great Dividing Range (Table 1, Figure 47). This site lies in the Herberton Range State Forest (previously referred to as Scrubby Logging Area, State Forest 194) and is not in the World Heritage Area. It is most easily accessed by a c. 1.5 km near level walk along an abandoned logging track leading off the Mount Baldy Forestry Road from the major intersection at Atherton 1:50,0000 AGD 1966 332600 8086450, GDA 1994 332715 8086626. The plot was established in June 1978 but no plot establishment proposal or report is on file.

The plot lies at 1120 m centered on the midslope of a major spur running southeast from the range crest. The 100 m axis (bearing 305° 30') runs across the upper slope landform element parallel to the ridgeline, and the 50 m axis (bearing 215° 30') runs down a steep slope (12°, soil database) to the lowerslope landform element. Subplot A is located in the eastern corner of the plot and the layout is as represented on Figure 3 with a complete buffer zone.

The soil parent material is Late Carboniferous to Early Permian rhyolite (Bain and Haipola 1997) and surface boulders are common, particularly in the lower sections of the plot. In terms of the climatic and altitudinal zones of Tracey and Webb (1975) this is a cloudy moist highland site (Table 9). From the modelled data, the rainfall pattern appears moderately seasonal (Table 5) but at this elevation, the 1655 mm of direct rainfall is undoubtedly augmented by cloud interception.

Forest Structure, Type and Floristics

Structurally, the rainforest on the plot is a very tall to extremely tall closed forest with an uneven canopy ranging mostly from 25 to 42 m, across the plot (Figure 48). The tallest trees have high, broad crowns that structurally dominate the uppermost canopy, e.g. *Galbulimima baccata* 42 m, *Cinnamomum laubatii* 40 m and 38 m, *Flindersia brayleyana* 40 m, *Xanthostemon whitei* 37 m, *Flindersia pimenteliana* 37 m and *Carwellia sublimis* 36 m. In terms of both frequency and basal area contribution, *Franciscodendron laurifolium* dominated the plot for stems ≥10 cm dbh (29% of stems, 24% of basal area). Except in recent gaps and older treefall areas, the understorey was sparse, being mostly composed of small trees. All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 19. This forest appears typical of Simple Microphyll Vine-Fern Forest (SMiVFF), type 9 of Tracey and Webb (1975) and Tracey (1982). The group of species that confirms the structural/ environmental classification includes *Acronychia crassipetala*, *Balanops australiana*, *Bobea myrtoides*, *Canarium australasicum*, *Halfordia kendack, Steganthera macooraia, Syzygium endophloium* and *Sarcotoechia* sp. (Mount Carbine GJM 995). All the recorded species are typical of the type in this area.

At 157, the total species richness value ranks as moderate to high, being fourth highest of the plot series (Table 13), exceeded only in Plot 4 (EP9) Robson (189), at Plot 5 (EP18) Mount Lewis (183) and from the heavily disturbed Plot 3 (EP4) Little Pine Creek (160). The tree-species richness is also moderate to high, being exceeded only in the two relatively undisturbed plots listed above. The percentage of tree species also is high (75%) as appears characteristic of structurally simple forests from cloudy sites in highland settings. The life forms count (8) is only moderate with treeferns, pandans and palm forms being conspicuous absences.

Disturbance History and Stand Structure

Establishment Condition and Effects of Tropical Cyclone Winifred

At establishment, the plot "appeared not to have been logged and contained no evidence of cyclone damage" (Stocker 1983). File notes from the 1986 remeasurement record minimal damage to the plot canopy or understorey during the passage of Tropical Cyclone *Winifred* on 2 February 1986. In the vicinity, some large trees were blown over or uprooted, but only a few trees were lost within the plot. Numerous small branches were lost from canopy trees but these were recovering by the August census. No other significant disturbances were noted during the 24 years of observations spanning 10 measurements (Table 6).

Stand Characteristics

This plot has a high basal area of 66.2 m^2 ha^{-1} (Table 11, maximum value) ranking third highest in the series below Plot 11(EP33) Curtain Fig (69.8 m^2 ha^{-1}) and Plot 2 (EP3) Mount Haig (67 m^2 ha^{-1}). The stem density of 784 stems ≥10 cm ha^{-1} (Table 11, maximum value) ranks as moderate, and is the sixth lowest in the series. Together with the imposing height of the uppermost canopy trees and the relatively clear understorey, these structural characteristics combine to make a visually appealing forest.

Present Forest Context and Pre-European Fire History

While there is no sclerophyll vegetation along the ridge immediately uphill from the plot, *Eucalyptus grandis* occurs along the ridge crest about 200m to the east, marking the uphill boundary of the widespread tall open forests along the eastern flank of the range. At this location, the oldest eucalypts along the ecotone are moribund and now stand in developing rainforest. The ridge carries an old logging and mining road and was probably an important Aboriginal foot track prior to the full establishment of European development in the district. Fire has long been an important part of management along Aboriginal access routes, both in rainforest and sclerophyll forests (Ernie Grant, Tully, personal communication).

Charcoal fragments were found at a depth of 0.05 m to 0.2 m in two of six soil cores taken from this site during 2000 (Table 7). The radiocarbon age of a single charcoal fragment from hole 5 was 2020 ± 40 years BP (CSIRO sample L53 H5.3, ANSTO code OZF177). The corresponding calendar year intervals, together with the interval probabilities, are 39 BC - 27

AD (77.7%); 40 AD - 51 AD (22.3%). Due to the small fragment sizes, no taxonomic determination was possible.

Because of the limited extent and small size of the charcoal (Table 7), it is not possible to recognise or distinguish between the most probable sources of the charcoal, i.e. burning of a pre-existing *Eucalyptus* open forest now replaced by rainforest, burning of rainforest debris following a major storm or cyclone, or aboriginal activities along the ridgetop. The age of the burnt wood (Table 8) suggests that it is unlikely that the firing was of European origin.

Soil Profile and Characteristics

Using selected chemical analysis data from the preliminary survey (Table 12) the soil derived from the rhyolite at this site was assessed as oligotrophic (Figure 4). The detailed soil profile description (Appendix 1 Table 78) is based on field records from a soil pit located adjacent to the plot although the exact position is not known. This profile, more than 2 m deep, was documented as having a Principal Profile Form Gn3.71 and affinities with the xanthozem Great Soil Group, being described by Stocker (1983) as a “red loamy soil”. The soil chemical data (second series) are presented in Appendix 1 Table 79. Soil bulk density and moisture retention data are given in Appendix 1 Table 80 while soil hydraulic parameters are presented in Appendix 1 Table 81. Soil particle size data are given in Appendix 1 Table 82.

Plot 20 (EP44) Fantail Logging Area

Location, Landform and Climate

The Fantail Logging Area plot is located in the central section of the Windsor Tableland (Table 1, Figure 49) in the Mount Windsor National Park (previously Fantail Logging Area of State Forest Reserve 144) inside the Wet Tropics World Heritage Area. The site lies 31 km west-northwest of Daintree Village on the Daintree River, or 47 km southwest of Cape Tribulation. Access is from the Mount Windsor Forestry Road system. There is no record of the specific purpose for which this plot was established. It was first enumerated on 5 November 1980. Details of this plot were not included in Stocker (1983) or other published literature to date.

The plot locality lies on the Great Dividing Range in the mid-western section of the Bargoo Creek catchment above the Daintree River. The site is at 910 m elevation along the northwestern side of a major ridge that rises to 950 m on a rolling low hills landscape that is a dissected plateau remnant. The plot is located on an extensive midslope landform element that is not traversed by any gullies or drainage lines. Bargoo Creek is about 100 m to the north of the plot while a local ridgeline lies about 60 m to the south. The 100 m axis of the plot lies along a bearing of 248°, roughly parallel to the ridgeline. The short axis bears 158° and runs down slope. The commencement corner (Subplot A) is located in the northeastern corner of the plot, and the subplot layout is as represented on Figure 3. The now abandoned major logging road is about 100 m to the east of the plot and the buffer zone is intact. There is no longer any direct access by vehicle to this plot and a 3 hour walk now is required. Although there is no outcrop evident on the plot, the soil parent material is Late Carboniferous to Early Permian granite (Bain and Haipola 1997). The rainfall seasonality is moderate to low (Table 5) and, in terms of the climatic zones of Tracey and Webb (1975), this highland site is cloudy wet (Table 9).

Forest Structure, Type and Floristics

This rainforest is a very tall to extremely tall closed forest with the upper canopy ranging between 30 m and 39 m. In the transect diagram (Figure 50), the apparently open nature of the canopy is an artifact resulting from occurrences of small trees along the plot margin beneath adjacent larger stems. The tallest trees are *Elaeocarpus ruminatus* (39 m), *Ceratopetalum succirubrum* (38 m), *Galbulimina baccata* (38 m), *Cardwellia sublimis* (36 m) and *Syzygium wesa* (36 m). In terms of overall stem frequency *Medicosma fareana* was most common (22%) followed closely by *Fransiscodendron laurifolium* (19%). The basal area contributions are clearly dominated by *F. laurifolium* (20%) followed by *Syzygium wesa* (7.1%) and *Neorites kevediana* (6.8%). The plot has a relatively low value for all-species richness (119) being similar to Plot 13 (EP35) Whyanbeel with 121 species and Plot 16 (EP40) Agapetes Scientific Area with 118 species (Table 13). Tree species richness is moderate to low (89) and the number of life forms is the joint lowest in the series (6) along with Plot 11 (EP33) Curtain Fig and Plot 16 (EP40) Fantail Logging Area (Table 13). The proportion of tree species (73%) falls in the high range (75%) that appears typical of high altitude, wet and infertile sites.

This forest appears typical of Simple Notophyll Vine Forest (SNVF), type 8 of Tracey and Webb (1975) and Tracey (1982). All species recorded from the plot at the time of establishment are listed in life form groups in Appendix 2 Table 20. When considered in combination, species that confirm the structural/ environmental classification are *Archidendron vaillantii*, *Beilschmiedia collina*, *Cryptocarya saccharata*, *Eleaocarpus elliffii*, *Litsea connorsii* and *Steganthera macooraia*. The recorded species are typical of the type in this area.

Disturbance History and Stand Structure

At the time of plot establishment, logging activities had not reached the vicinity of the plot and subsequently did not affect the buffer zone or plot area. At establishment, there was no evidence of recent disturbance from natural events and no significant disturbances have been recorded during the seven remeasurements, a total record of 24 years (Table 6).

On this plot, the basal area value of 59.4 m^2 ha^{-1} (Table 11, maximum value) is typical of the well developed forests on wet, upland to highland sites such as Plot 15 (EP38) The Crater, Plot 5 (EP18) Mount Lewis, Plot 16 (EP40) Agapetes Scientific Area and Plot 4 (EP9) Robson Logging Area. The stem density (890 stems ≥10 cm ha^{-1}) falls in the mid-range recorded from the 20 CSIRO plots (Table 11, maximum value) and is most similar to 5 (EP18) Mount Lewis (908 stems ≥10 cm ha^{-1}), 10 (EP32) McIlwraith Ra. (894 stems ≥10 cm ha^{-1}) and 14 (EP37) Eungella (880 stems ≥10 cm ha^{-1}).

Soil Profile and Characteristics

Although no soil chemical analysis data for this plot are available from the preliminary survey (as presented for other plots in Table 12) the soil at this granitic site was assessed as oligotrophic by comparison with the nearby Plot 8 (EP30) Agapetes Logging Area and Plot 16 (EP40) Agapetes Scientific Area. The detailed soil profile description (Appendix 1 Table 83) is based on records from a soil pit, the location of which is not known. As the landform element of the plot is quite extensive, concerns about variability in soil characteristics across the plot may be minimal. In the soil data base records the profile was described as having a Principal Profile Form Gn3.14 and affinities with the red podzolic Great Soil Group. Soil chemical analyses, based on multiple bulked samples taken at various depths from random locations, are presented in Appendix 1 Table 84. Soil bulk density and moisture retention data are given in Appendix 1 Table 85 while soil hydraulic parameters are presented in

Appendix 1 Table 86. Soil particle size data from the preliminary soil survey are presented in Appendix 1 Table 87. Soil particle density data are given on Appendix 1 Table 88.

Fragments of relict soil charcoal of Late Quaternary age are relatively abundant in soil profiles in the section of the Windsor Tableland a little to the north of this plot (Hopkins *et al.* 1993). However, because of its age, this material reported by Hopkins' team reflects past regional vegetation changes that have no immediate bearing on interpretation of the structure and dynamics of the plot.

TABLES

Table 1: The reference names, current tenures and Geodetic Datum of Australia 1994 locations of the twenty CSIRO rainforest plots in the North to Far North Queensland region from Mackay to Cape York. Plots located within the boundary of the Wet Tropics World Heritage Area are marked with asterisks against tenure detail. Abbreviations: LA – logging area, ScA – Scientific Area, SF – State Forest. The tenures shown were current in May 2006. All Forest Reserves have been designated by the Queensland Government as future National Parks.

Plot, file number and name	Land tenure (May 2006)	Latitude (approx.)	Longitude (approx.)	Grid reference	
				Easting	Northing
1 (EP2) Downfall Creek	Danbulla Forest Drive* (see text)	17° 09' S	145° 35' E	349690	8103676
2 (EP3) Mount Haig	Dinden National Park*	17° 05' S	145° 35' E	350365	8110226
3 (EP4) Little Pine Creek	Malbon Thompson Forest Reserve*	17° 00' S	145° 50' E	375564	8120676
4 (EP9) Robson LA	Danbulla National Park*	17° 07' S	145° 39' E	354565	8107176
5 (EP18) Mount Lewis	Mount Lewis Forest Reserve*	16° 31' S	145° 16' E	314965	8172426
6 (EP19) Garrawalt	Girringun National Park*	18° 30' S	145° 45' E	368914	7954277
7 (EP29) Mount Fisher	Malaan National Park*	17° 31' S	145° 33' E	345965	8059577
8 (EP30) Agapetes LA	Mount Windsor National Park* (see text)	16° 16' S	145° 04' E	293915	8199325
9 (EP31) Woopen Creek	Wooroonooran National Park*	17° 32' S	145° 50' E	375714	8061736
10 (EP32) McIlwraith Range	Unallocated State Land (see text)	13° 45' S	143° 21' E	105153	8477918
11 (EP33) Curtain Fig	Curtain Fig National Park*	17° 17' S	145° 34' E	348115	8088376
12 (EP34) Russell River	Wooroonooran National Park *	17° 25' S	145° 46' E	369514	8075026
13 (EP35) Whyanbeel	Unallocated State Land*	16° 21' S	145° 20' E	322265	8191175
14 (EP37) Eungella	Crediton State Forest	21° 15' S	148° 33' E	660212	7649280
15 (EP38) The Crater	Herberton Range Forest Reserve	17° 25' S	145° 25' E	338615	8073676
16 (EP40) Agapetes ScA	Mount Windsor National Park*	16° 17' S	145° 06' E	297265	8199125
17 (EP41) Oliver Creek	Daintree National Park*	16° 08' S	145° 26' E	333315	8215375
18 (EP42) Iron Range	Iron Range National Park	12° 44' S	143° 15' E	92883	8588539
19 (EP43) Mount Baldy	Herberton Range State Forest	17° 19' S	145° 26' E	333715	8085676
20 (EP44) Fantail LA	Mount Windsor National Park*	16° 13' S	145° 04' E	295265	8205975

Table 1(a): The reference names, tenures and Australian Geodetic Datum 1966 locations of the twenty CSIRO rainforest plots in the North to Far North Queensland region from Mackay to Cape York. The tenures shown were current in December 2000. Plots located within the boundary of the Wet Tropics World Heritage Area are marked with asterisks against tenure detail. Abbreviations: LA – logging area, ScA – Scientific Area, SF – State Forest, NP – National Park, TR – Timber Reserve. The thirteen plots inspected during 2000 and 2001 specifically for this report are marked with the + symbol. Key to derivation of AMG values: D – Department of Forestry 1981 Danbulla State Forest 1: 25,000; T – 1:50,000 topographic series, Australian Geodetic Datum 1966; T1 – 1:100,000 topographic series, Australian Geodetic Datum 1966; Q – Queensland Department of Forestry series, Australian Geodetic Datum 1966. Plot positions were transferred from uncontoured Queensland forestry maps where appropriate.

Plot, file number and name	Land tenure (current at 2000)	1:100 000 map and source code	Grid reference	
			Easting	Northing
1 (EP2) Downfall Creek+	Ridings LA, SF 185*	Bartle Frere (8063) D	349575	8103500
2 (EP3) Mount Haig+	Emerald LA, SF 607*	Bartle Frere (8063) D	350250	8110050
3 (EP4) Little Pine Creek+	Little Pine LA, SF 933*	Cairns (8064) T	375450	8120500
4 (EP9) Robson LA+	Robson LA, SF 185*	Bartle Frere (8063) D	354450	8107000
5 (EP18) Mount Lewis+	North Mary LA, SF 143*	Rumula (7964) T	314850	8172250
6 (EP19) Garrawalt	Burgoo LA, SF 750*	Kangaroo Hills (8060) T	368800	7954100
7 (EP29) Mount Fisher+	Dirran LA, SF 650*	Tully (8062) Q	345850	8059400
8 (EP30) Agapetes LA	Agapetes LA, SF 144*	Mossman (7965) T	293800	8199150
9 (EP31) Woopen Creek	Wooroonooran NP* (*ex* Barong LA, SF 755)	Tully (8062) T	375600	8061560
10 (EP32) McIlwraith Range	State Land (*ex* TR 14)	Coen (7570) T1	754000$^{\phi}$	8479500$^{\phi}$
11 (EP33) Curtain Fig+	SF 452*	Bartle Frere (8063) T	348000	8088200
12 (EP34) Russell River+	Wooroonooran NP* (*ex* Gosschalk LA, SF 755)	Bartle Frere (8063) T	369400	8074850
13 (EP35) Whyanbeel+	Unallocated State Land* (*ex* Barratt LA, SF 206; or Chinaman LA, TR55)	Mossman (7965) T	322150	8191000
14 (EP37) Eungella+	Range LA, SF 679	Mirani (8655) T1	660100	7649100
15 (EP38) The Crater+	Barron LA, SF 194	Atherton (7963) T	338500	8073500
16 (EP40) Agapetes ScA	Agapetes ScA, SF 144*	Mossman (7965) T	297150	8198950
17 (EP41) Oliver Creek+	Daintree NP* (*ex* Oliver Ck NP 164)	Mossman (7965) T	333200	8215200
18 (EP42) Iron Range	Iron Range NP	Cape Weymouth (7572)	744400$^{\phi}$	8590250$^{\phi}$
19 (EP43) Mount Baldy+	Scrubby LA, SF 194	Atherton (7963) T	333600	8085500
20 (EP44) Fantail LA	Fantail LA, SF 144*	Mossman (7965) T	295150	8205800

$^{\phi}$ Maps in Zone 54

Table 2: A schedule of establishment and dbh remeasurement dates together with the length of available data records (at December 2005) for the twenty CSIRO rainforest plots. Tree heights were measured only at establishment and again for plots enumerated in 1998 or, for the Eungella plot (plot 14), at establishment and in 2001.

	Plot																			
Year of Record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	EP2	EP3	EP4	EP9	EP18	EP19	EP29	EP30	EP31	EP32	EP33	EP34	EP35	EP37	EP38	EP40	EP41	EP42	EP43	EP44
1971	M	M																		
1972			M	M																
1973	M	M			M															
1974			M	M																
1975	M	M			M	M	M			M										
1976			M	M				M	M		M	M								
1977	M	M			M	M	M			M			M	M	M		M	M		
1978			M	M				M	M		M	M				M			M	
1979	M	M			M	M	M			M			M	M	M		M	M		
1980			M	M				M	M		M	M				M			M	M
1981	M	M			M	M	M			M			M	M	M		M	M		
1982			M	M				M	M		M	M				M			M	M
1983	M	M			M	M	M			M			M	M	M		M	M		
1984			M	M				M	M		M	M				M			M	M
1985	M	M			M	M	M			M			M	M	M		M	M		
1986			M	M				M	M		M	M				M			M	M
1987	M	M			M	M	M			M			M	M	M		M	M		
1988			M	M				M	M		M	M				M			M	M
1989	M	M			M	M	M						M	M	M		M			
1990			M	M				M	M	M	M	M				M		M	M	M
1991	M	M			M	M	M						M	M	M		M			
1992																				
1993																				
1994																				
1995	M	M		M			M				M		M		M		M		M	
1996					M															
1997																				
1998	M	M	M	M	M	M	M	M		M	M	M	M		M	M	M	M	M	M
1999																				
2000																				
2001														M						
2002	M	M	M	M	M		M	M		M	M	M	M		M	M	M	M	M	
2003																				
2004																				M
2005						M			M					M						
Years of data	31	31	30	30	29	30	27	26	29	27	26	26	25	28	25	24	25	25	24	24

Table 3: A summary of the soil data sets held for the twenty CSIRO rainforest plots. Key to abbreviations: A = available; **I** = incomplete. Numeral entries indicate the number of depths for which data is available. Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	Profile description	Preliminary chemical analysis (bulked depths)	Preliminary particle size analysis (bulked depths)	Detail chemical analysis	Moisture retention data	Hydraulic conductivity data	Bulk density	Detailed particle size analysis	Particle density
1 (EP2) Downfall Creek	A5	A	A1	A5	A3	A4	A3	-	A2
2 (EP3) Mount Haig	A6	A	-	A11	A3	A1	A4	A6	-
3 (EP4) Little Pine Creek	A6	A	-	A11	A5	A4	A6	A13	A3
4 (EP9) Robson LA	A6	A	A1	A9	A5	A4	A5	-	-
5 (EP18) Mount Lewis	A7	A	-	A8	A2	A2	A2	-	-
6 (EP19) Garrawalt	A6	A	-	A10	A4	A3	A4	A10	-
7 (EP29) Mount Fisher	I5	A	A1	A5	A3	(failed)	A6	-	-
8 (EP30) Agapetes LA	A9	A	-	A9	A4	A4	A4	-	-
9 (EP31) Woopen Creek	I6	A	A1	A6	-	-	-	-	-
10 (EP32) McIlwraith Range	A7	A	A1	A12	A3	A4	A5	A11	-
11 (EP33) Curtain Fig	A9	A	-	A11	A5	A2	A5	A12	A3
12 (EP34) Russell River	I6	A	A1	A6	-	-	-	-	-
13 (EP35) Whyanbeel	A5	A	A1	A5	-	-	-	-	-
14 (EP37) Eungella	A8	A	-	A11	A5	A2	A6	A11	-
15 (EP38) The Crater	-	A	-	A6+6*	-	-	A4	-	-
16 (EP40) Agapetes ScA	A6	A	-	A6	A4	A3	A4	-	-
17 (EP41) Oliver Creek	A5	A	A1	A5	-	-	-	-	-
18 (EP42) Iron Range	A6	A	-	A9	-	-	A3	A9	-
19 (EP43) Mount Baldy	A8	A	-	A9	A4	A5	A4	A6**	-
20 (EP44) Fantail LA	A8	-	A1	A10	A4	A3	A7	-	A3

* Sampled during 2001/2002; ** Sampled in August 2003.

Table 4: A summary of the topographic, geological and landform characteristics of the twenty CSIRO rainforest plots. Asterisks indicate if the current soil parent material descriptions differ significantly from those previously listed in file or published records. Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	Altitude (m)	Plot aspect	Soil parent material	Landform pattern of site	Landform elements of 0.5 ha plot
1 (EP2) Downfall Creek	720	SE	Granite	Hills (in mountains)	Hillcrest, upper slope
2 (EP3) Mount Haig	1120	SE	Granite	Hills (in plateau remnant)	Upper, mid and lower slopes, landslide alcove and toe
3 (EP4) Little Pine Creek	110	SW	Granite	Low hills (mountain foothills)	Hillcrest, upper and mid slopes
4 (EP9) Robson LA	800	E	Meta-sediments*	Hills	Ridgecrest, upper, mid and lower slopes
5 (EP18) Mount Lewis	1100	W	Granite	Low hills (in plateau remnant)	Hillcrest, upper slope
6 (EP19) Garrawalt	620	SE	Rhyolite*	Plateau (low hills)	Upper and mid slopes with gully
7 (EP29) Mount Fisher	1200	SE	Rhyolite*	Hills (in mountains)	Midslope with gully
8 (EP30) Agapetes LA	1060	W	Granite	Plateau (low hills)	Hillcrest, upper, mid and lower slopes
9 (EP31) Woopen Creek	80	S	Alluvium, possibly basalt enriched*	Low hills on a remnant of a relict alluvial terrace	Flat
10 (EP32) McIlwraith Range	450	SW	Metamorphosed sandstone	Plateau	Upper and mid slopes
11 (EP33) Curtain Fig	720	W	Basalt	Plateau (infilled landscape)	Flat and lower slope
12 (EP34) Russell River	380	SW	Basalt enriched granitic alluvium, and basalt*	Alluvial terrace or fan with minor old valley infill by lava flow	Relict terrace (flat), minor gully and associated fan, lower and mid slope (lava flow)
13 (EP35) Whyanbeel	230	SE	Metasediments	Plateau (low hills)	Hillcrest, upper, mid and lower slopes
14 (EP37) Eungella	920	SE	Basalt	Plateau above escarpment margin	Midslope with minor crest, upper slope and gully
15 (EP38) The Crater	1000	SE	Rhyolite with basaltic influence*	Plateau (low hills)	Upper, mid and lower slopes with relict valley flat
16 (EP40) Agapetes ScA	800	N	Granite	Low hills (edge of plateau)	Ridge, upper and mid slopes with gully
17 (EP41) Oliver Creek	15	SE	Alluvium	Hills (in mountains)	Lower slope, gully, active fan and valley flat
18 (EP42) Iron Range	60	SE	Alluvium	Flood plain and low hills	Stream bank (eroding), ox-bow, scroll, gully, footslope
19 (EP43) Mount Baldy	1120	S	Rhyolite	Escarpment	Upper and mid slopes
20 (EP44) Fantail LA	910	NE	Granite	Plateau (low hills)	Mid slope (extensive)

Table 5: Estimates of the climatic settings of the twenty CSIRO rainforest plots. Values for those sites located within the Wet Tropics region (indicated by asterisks) are derived from the ANUCLIM model (McMahon *et al.* 1995) with annual rainfall and rainfall of the driest quarter calculated from the 80 m digital elevation model by Turton *et al.* (1999). For the remaining sites, annual rainfalls are estimates based on the available long-term records from the nearest recording stations. Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	Annual mean temperature (˚C)	Temp. seasonality (C of V)	Mean temp. of warmest quarter (˚C)	Mean temp. of coldest quarter (°C)	Annual rainfall (mm)	Precipitation Seasonality (C of V)	Rainfall of driest quarter (mm)	Annual mean moisture index
1 (EP2) Downfall Ck*	20.7	97	23.9	16.8	1403	95	66	0.66
2 (EP3) Mount Haig*	18.7	97	22.7	14.1	2884	69	237	0.97
3 (EP4) Little Pine Ck*	24.9	96	27.5	21.8	2453	87	140	0.75
4 (EP9) Robson LA*	20.4	97	23.7	16.5	1769	91	102	0.76
5 (EP18) Mount Lewis*	19.2	97	23.0	14.8	2676	70	227	0.87
6 (EP19) Garrawalt*	21.4	97	25.0	17.0	1236	93	72	0.74
7 (EP29) Mount Fisher*	18.3	97	22.5	13.4	2857	67	252	0.98
8 (EP30) Agapetes LA*	19.5	97	23.2	15.1	2597	69	228	0.82
9 (EP31) Woopen Ck*	24.2	97	27.1	20.8	3365	78	260	0.92
10 (EP32) McIlwraith Range	n.a.	n.a.	n.a.	n.a.	2000	n.a.	n.a.	n.a.
11 (EP33) Curtain Fig*	20.6	97	23.9	16.7	1424	88	84	0.73
12 (EP43) Russell River*	22.8	97	25.9	19.0	3101	72	252	0.95
13 (EP35) Whyanbeel*	24.4	97	27.0	21.3	2411	90	154	0.73
14 (EP37) Eungella	n.a.	n.a.	n.a.	n.a.	2400	n.a.	n.a.	n.a.
15 (EP38) The Crater*	19.2	97	23.1	14.7	1797	75	139	0.88
16 (EP40) Agapetes ScA*	20.7	97	23.9	16.8	2097	81	167	0.73
17 (EP41) Oliver Ck*	25.3	96	27.7	22.4	3470	80	225	0.86
18 (EP42) Iron Range	n.a.	n.a.	n.a.	n.a.	2200	n.a.	n.a.	n.a.
19 (EP43) Mount Baldy*	19.1	97	23.0	14.5	1655	87	121	0.81
20 (EP44) Fantail LA *	20.2	97	23.6	16.2	2365	76	201	0.78

n.a. = not available; plot lies outside regions for which model estimate data are available.

Table 6: A summary of observations of disturbances in the twenty CSIRO rainforest plots. Abbreviations: C – cyclone damage; D – drought damage; E – meander migration erosion; F – fire, G – large gaps or tree fall damage; I – invasion by Dendrocnide spp.; L – selective logging; M – mining (insignificant pit diggings only); NO – no observation recorded; P – patch death confirmed or attributed as due to Phytophthora cinnamomi; R - recovering or recovered; RA – recovery advanced; S - patch death due to lightning strike; T – cattle/walking tracks, grazing; U – undisturbed; W – WWII military training activities; ? – uncertainty. Perturbations and observations that occurred during years in which no enumeration was carried out are shown in parentheses. Further details on the nature and timing of these disturbances are included in the detailed plot descriptions.

Year of Record	Plot																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	EP2	EP3	EP4	EP9	EP18	EP19	EP29	EP30	EP31	EP32	EP33	EP34	EP35	EP37	EP38	EP40	EP41	EP42	EP43	EP44
Pre-establishment																				
	W		?C ?L	L							?C ?F			L	L					
Post-establishment																				
1971	U	U																		
1972			U	U																
1973	U	U			U															
1974			U	U																
1975	U	U			U	U	U			U										
1976			U	U				U	U		U	U								
1977	U	U			U	U	U			U			M	U	U		U	U		
1978			U	U		(P)		U	U		U	U				U			U	
1979	U	U			U	P	U			U			G	U	U		U	E		
1980			U	U				U	U		U	U				U			U	U
1981	U	U			U	P	U			U			R	U	U		U	E		
1982			U	U				U	U		U	U				U			U	U
1983	U	U			U	P	U			U			RA	G	U		U	E		
1984			U	U				U	U		U	U				U			U	U
1985	U	U			G	P	U			U			RA	R	U		T	E		
1986			U	U		(C)		U	C		U	C	(C)			U			C	U
1987	U	U			R, S	P	U			U			R	R	U		U	E		
1988			U	U	S			U	I		U	R				U			R	U
1989	U	U			S	P	U						RA	C	P		U			
1990			C	U				U	I	U	U	G				U		E	RA	U
1991	U	U			S	R	U						G	R	P		U			
1992											(D)									
1993																				
1994																				
1995	U	U		U			G				D		NO		NO		NO		NO	
1996					R															
1997																				
1998	U	U	R	U	R	RA	RA	U	*	U	R	RA	RA	**	R	U	U	E	U	G
1999													(C)				(C)			
2000	(U)	(U)	(R)	(U)	(RA)		(U)	(U)			(U)		(R)		(U)		(R)		(U)	

	Plot																			
Year of Record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	EP2	EP3	EP4	EP9	EP18	EP19	EP29	EP30	EP31	EP32	EP33	EP34	EP35	EP37	EP38	EP40	EP41	EP42	EP43	EP44
2001														G						
2002	U	U	R	U	U		U	U		U	U	G	U		U	U	U	E	U	
2003																				
2004																				U
2005						R			R	(C)				U				(C)		

* Plot 9 was inaccessible in 1998 following road closure.

** Plot 14 was not visited in the 1998 assessment.

Table 7: The occurrence of soil charcoal at the ten CSIRO rainforest plots included in a new sampling program during 2000. Data are the upper profile distribution, spatial occurrence and bulk mass of soil charcoal fragments extracted from corehole samples collected using a tube sampler of 47 mm internal diameter. The total volume of each soil core to 0.2 m was 0.000347 m^3. Asterisks indicate those samples from which a fragment was selected for radiocarbon dating. Abbreviation: LA – logging area.

Plot	Depth (m)	Mass of bulked charcoal fragments (g)					
		Hole 1	Hole 2	Hole 3	Hole 4	Hole 5	Hole 6
1 (EP2) Downfall Creek	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	0.0320	0.0073	-	-	-	-
	0.10-0.20	-	-	-	-	-	-
2 (EP3) Mount Haig	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	0.0989	-	0.1551	-	-	-
3 (EP4) Little Pine Creek	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	-	0.2277*	-	0.0298	0.0450	-
4 (EP9) Robson LA	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	0.0530*	-	-	-	-	-
5 (EP18) Mount Lewis	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	-	-	-	-	-	-
7 (EP29) Mount Fisher	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	-	-	-	-	-	-
13 (EP35) Whyanbeel	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	0.0742*	-	-	-	-	-
15 (EP38) The Crater#	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	-	-	-	-	-	-
17 (EP41) Oliver Creek	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	-	-
	0.10-0.20	-	-	-	-	0.0173	-
19 (EP43) Mount Baldy	0.0-0.05	-	-	-	-	-	-
	0.05-0.10	-	-	-	-	0.2459	-
	0.10-0.20	-	-	-	-	0.5169*	0.0118

At this site, charcoal was subsequently recovered from a pit excavated for soil bulk density samples.
See Appendix 1 Table 67.

Table 8: The conventional ^{14}C dates of single charcoal fragments either (i) extracted from soil cores at four of the seven CSIRO rainforest plots where charcoal was encountered in the new sampling program during 2000 (selection criteria detailed in the text); or (ii) collected during an earlier Quaternary vegetation history sampling program at Plot 11 (EP33) Curtain Fig.

Plot	CSIRO charcoal sample number	ANSTO sample number	Conventional ^{14}C age ± 1σ error (years BP)	δ(^{13}C) per mil
Plot 3 (EP4) Little Pine Creek	L49 H2.3	OZF174	1740 ± 40	-25.7
Plot 4 (EP9) Robson LA	L50 H1.3	OZF175	780 ± 50	-24.8
Plot 11 (EP33) Curtain Fig	L34 S1.5	OZG734	7790 ± 70	-27.8
Plot 11 (EP33) Curtain Fig	L34 S2.6	OZG736	1080 ± 40	-25.6
Plot 13 (EP35) Whyanbeel	L51 H1.3	OZF176	1950 ± 40	-24.3
Plot 19 (EP43) Mount Baldy	L53 H5.3	OZF177	2020 ± 40	-24.6

Table 9: The rainforest structural types represented in the twenty CSIRO rainforest plots together with the climatic and altitudinal zones in which each plot is located (based on both field observations and the ANUCLIM data of Table 5). The typing and zonal terminologies follow Webb (1959, 1968, 1978), Tracey and Webb (1975) and Tracey (1982). Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	Rainforest structural form and most comparable humid tropics type	Plot climatic and altitudinal zones
1 (EP2) Downfall Ck	Complex Notophyll Vine Forest with emergent *Agathis robusta* (CNVF), Type 6	Dry upland
2 (EP3) Mount Haig	Simple Microphyll Vine-Fern Forest (SMiVFF), Type 9	Cloudy wet highland
3 (EP4) Little Pine Ck	Mesophyll Vine Forest with patches of fan palm variant (MVF), Type 2a	Wet foothill
4 (EP9) Robson LA	Simple Notophyll Vine Forest (SNVF), Type 8	Cloudy moist upland
5 (EP18) Mount Lewis	Simple Microphyll Vine-Fern Forest (SMiVFF), Type 9	Cloudy wet highland
6 (EP19) Garrawalt	Simple Notophyll Vine Forest (SNVF), Type 8	Dry upland
7 (EP29) Mount Fisher	Simple Microphyll Vine-Fern Forest (SMiVFF), Type 9	Cloudy wet highland
8 (EP30) Agapetes LA	Simple Notophyll to Microphyll Vine Forest (SN/MiVF), Type 8/9	Cloudy (?) wet highland
9 (EP31) Woopen Ck	Complex Mesophyll Vine Forest (CMVF), Type 1a (floristic variant)	Very wet lowland
10 (EP32) McIlwraith Range	Hybrid type: Mesophyll Vine Forest, fan palm variant (MVF) and Simple Notophyll Vine Forest (SNVF) *cf.* Types 2a/8	Cloudy (?) moist upland
11 (EP33) Curtain Fig	Complex Notophyll Vine Forest (CNVF), Type 5b	Dry upland
12 (EP43) Russell River	Complex Mesophyll Vine Forest (CMVF), Type 1a	Very wet foothill
13 (EP35) Whyanbeel	Mesophyll Vine Forest (MVF), Type 2a	Wet foothill
14 (EP37) Eungella	Complex Notophyll Vine Forest, feather palm variant (CNVF), *cf.* Type 5	Cloudy wet highland
15 (EP38) The Crater	Complex Notophyll Vine Forest (CNVF), Type 5a	Cloudy moist highland
16 (EP40) Agapetes ScA	Complex Notophyll Vine Forest with emergent *Agathis robusta* (CNVF), Type 6	Moist / wet up/highland
17 (EP41) Oliver Ck	Complex Mesophyll Vine Forest (CMVF), Type 1a (floristic variant)	Very wet lowland
18 (EP42) Iron Range	Semi-Deciduous Mesophyll Vine Forest (SDMVF), Type 4	Moist lowland (riverine)
19 (EP43) Mount Baldy	Simple Microphyll Vine-Fern Forest (SMiVFF), Type 9	Cloudy moist highland
20 (EP44) Fantail LA	Simple Notophyll Vine Forest (SNVF), Type 8	Cloudy (?) wet highland

Table 10: The main rainforest structural types in North Queensland defined by Tracey and Webb (1975) and Tracey (1982) showing the frequencies of those types represented by the twenty CSIRO plots.

Rainforest structural type	Representation in CSIRO plots
Complex Mesophyll Vine Forest (CMVF), Type 1a	1 (+ 2 variants)
Complex Mesophyll Vine Forest (CMVF), Type 1b	0
Complex Mesophyll Vine Forest (CMVF), Type 1c	0
Mesophyll Vine Forest (MVF), Type 2a	1 (+ 1 variant)
Mesophyll Vine Forest (MVF), Type 2b	0
Mesophyll Vine Forest with dominant feather palms (MVF+P), Type 3a	0
Mesophyll Vine Forest with dominant fan palms (MVF+P), Type 3b	0
Semi-Deciduous Mesophyll Vine Forest (SDMVF), Type 4	1
Complex Notophyll Vine Forest (CNVF), Type 5a	1
Complex Notophyll Vine Forest (CNVF), Type 5b	1
Complex Notophyll Vine Forest, feather palm variant (CNVF), *cf.* Type 5	1
Complex Notophyll Vine Forest with emergent *Agathis robusta* (CNVF), Type 6	2
Notophyll Vine Forest, Type 7a	0
Notophyll Vine Forest, Type 7b	0
Simple Notophyll Vine Forest (SNVF), Type 8	2
Simple Notophyll to Microphyll Vine Forest (SN/MiVF), Type 8/9	1
Simple Microphyll Vine-Fern Forest (SMiVFF), Type 9	4
Simple Microphyll Vine-Fern Thicket (SMiVFT), Type 10	0
Deciduous Microphyll Vine Thicket (DMiVT), Type 11	0
Hybrid type: Mesophyll Vine Forest, fan palm variant (MVF) and Simple Notophyll Vine Forest (SNVF) *cf.* Types 2a/8	1

Table 11: The mean, minima and maxima data for tree stem density (stems ha^{-1}) and basal area (m^{2} ha^{-1}) over the period of available plot records to 2002, except for Plot 20 (EP44) Fantain LA which is current to 2004, while data for Plot 6 (EP19) Garrawalt, Plot 9 (EP31) Woopen Creek and Plot 14 (EP37) Eungella are current to 2005. Data are calculated from enumerations of all trees ≥10 cm dbh on the 0.5 ha plots. Note that the commencement dates as well as the number and duration of the enumeration periods varies between plots, and that maxima or minima have no temporal relationship in this table. Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	Date of initial record	No. of measures	Years of data	Stem density (trees ≥10 cm dbh, stems ha^{-1})			Basal area (trees ≥10 cm dbh, m^{2} ha^{-1})		
				Mean	Min.	Max.	Mean	Min.	Max.
1 (EP2) Downfall Ck	1971	14	31	1015	924	1062	31.5	28.6	34.1
2 (EP3) Mount Haig	1971	14	31	993	960	1014	65.7	63.4	67
3 (EP4) Little Pine Ck	1972	12	30	971	844	1022	39.2	36	43.4
4 (EP9) Robson LA	1972	13	30	892	878	926	55.3	51.8	59.9
5 (EP18) Mount Lewis	1973	13	29	885	854	908	61.2	59.4	62.1
6 (EP19) Garrawalt	1975	11	30	841	790	1014	38.8	35.8	44.9
7 (EP29) Mount Fisher	1975	12	27	957	902	990	42.5	40	45.5
8 (EP30) Agapetes LA,	1976	10	26	1136	1106	1170	61.7	58.8	64.6
9 (EP31) Woopen Ck	1976	9	29	449	408	484	40.0	36	43.4
10 (EP32) McIlwraith Range	1975	10	27	871	846	894	30.0	29.4	30.6
11 (EP33) Curtain Fig	1976	11	26	598	520	630	65.5	61.2	69.8
12 (EP43) Russell River	1976	10	26	575	534	604	49.8	48.2	51.6
13 (EP35) Whyanbeel	1977	11	25	949	856	1002	41.2	38	44.0
14 (EP37) Eungella	1977	10	28	834	754	880	61.8	60.2	63.2
15 (EP38) The Crater	1977	11	25	730	684	764	48.0	45.4	49.9
16 (EP40) Agapetes ScA	1978	9	24	970	932	996	57.8	55.6	61.2
17 (EP41) Oliver Ck	1977	11	25	718	644	792	44.4	43.2	45.6
18 (EP42) Iron Range	1977	9	25	442	418	554	37.0	32.2	43
19 (EP43) Mount Baldy	1978	10	24	750	698	784	65.1	64.2	66.2
20 (EP44) Fantail LA	1980	8	24	876	792	890	57.6	56.2	59.4

Table 12: Soil chemical analysis data from a preliminary survey of the first nineteen of the twenty CSIRO rainforest plots. These data represent analysis of a bulked sampling from 0 to 0.30 m depth at each plot. Available details of collection and analytical methods are presented in the main text. Abbreviations: LA – logging area, ScA – Scientific Area.

Plot	pH	Org.	Tot.	Tot.	Exchangeable cations				Sum
		C	N	P	Ca	Mg	K	Na	CEC
		%	%	%	(cmol(+) kg^{-1})				(cmol(+) kg^{-1})
1 (EP2) Downfall Creek	5.3	3.5	0.44	0.018	0.72	0.51	0.30	n.a.	14.5
2 (EP3) Mount Haig	4.5	7.8	0.51	0.031	0.32	2.10	0.10	n.a.	26.0
3 (EP4) Little Pine Creek	4.8	2.6	0.24	0.017	0.30	2.20	0.20	n.a.	8.2
4 (EP9) Robson LA	4.7	2.9	0.32	0.027	0.20	1.70	0.20	n.a.	16.4
5 (EP18) Mount Lewis	5.1	5.6	0.33	0.050	0.30	0.30	0.20	0.08	12.3
6 (EP19) Garrawalt	4.1	2.5	0.18	0.0763	0.30	0.50	0.15	0.09	13.2
7 (EP29) Mount Fisher	4.3	3.1	0.25	0.066	0.19	0.21	0.11	0.05	5.0
8 (EP30) Agapetes LA	4.4	3.3	0.22	0.013	0.38	0.66	0.30	0.07	9.4
9 (EP31) Woopen Creek	4.8	1.6	0.17	0.046	0.84	0.39	0.17	0.06	8.2
10 (EP32) McIlwraith Range	4.3	2.4	0.18	0.047	0.13	0.25	0.10	0.06	7.5
11 (EP33) Curtain Fig	6.5	3.0	0.42	0.379	20.30	3.30	1.01	0.14	35.1
12 (EP34) Russell River	4.7	2.7	0.32	0.161	0.82	0.54	0.28	0.11	15.2
13 (EP35) Whyanbeel	4.5	1.8	0.17	0.012	0.12	0.38	0.13	0.08	9.8
14 (EP37) Eungella	5.1	4.3	0.54	0.259	2.96	2.05	0.73	0.22	28.3
15 (EP38) The Crater	6.1	5.4	0.57	0.079	14.60	3.67	0.12	0.14	30.7
16 (EP40) Agapetes Scientific Area	5.8	1.2	0.08	0.011	3.13	0.58	0.26	0.06	4.3
17 (EP41) Oliver Creek	4.8	4.8	0.48	0.052	1.68	1.14	0.15	0.21	19.1
18 (EP42) Iron Range	5.6	2.6	0.23	0.038	7.64	2.07	0.18	0.11	12.6
19 (EP43) Mount Baldy	4.3	4.5	0.32	0.014	0.33	0.62	0.20	0.10	14.5

n.a. = data not available.

Table 13: The total number*# of plant species recorded at establishment for each of the twenty CSIRO rainforest plots together with the numbers of species represented in each of the life forms recognised. Groundstorey individuals less than 0.25 m in height were not recorded.

Plot	Species richness and life forms	Number of species in each life form														
		Tree	Palm tree	Tree fern	Tree pandanus	Tree cycad	Shrub	Palm shrub	Vines	Scrambler	Herb	Grass	Sedge	Epiphytes	Hemiepiphytes	Parasites
1 (EP2) Downfall Creek#	91 (8)	58	-	-	-	-	7	-	12	1	4	1	1	7	-	-
2 (EP3) Mount Haig	144 (9)	110	1	1	-	-	9	-	11	-	1	-	1	9	1	-
3 (EP4) Little Pine Ck	160 (11)	115	1	-	1	1	7	1	22	-	5	-	-	4	2	1
4 (EP9) Robson LA	189 (9)	142	-	1	1	-	13	-	15	-	4	-	1	9	3	-
5 (EP18) Mount Lewis	183 (9)	127	1	-	-	-	10	1	18	-	3	-	-	21	1	1
6 (EP19) Garrawalt	150 (8)	112	-	1*	1	-	5	-	17	-	4	-	-	7	3	-
7 (EP29) Mount Fisher	123 (7)	88	-	1	-	-	10	1	14	-	6	-	-	3	-	-
8 (EP30) Agapetes LA	147 (8)	110	-	1*	-	-	7	-	17	-	2	-	1	8	-	1
9 (EP31) Woopen Creek	153 (8)	101	1	-	-	-	19	1	12 [2]	-	11	-	-	5	3	-
10 (EP32) McIlwraith Ra	112 (9)	71	1	1	1	-	7	2	15	-	5	-	-	9	-	-
11 (EP33) Curtain Fig	116 (6)	75	-	-	-	-	12	-	16	-	6	-	-	6	1	-
12 (EP34) Russell River	154 (7)	99	-	-	-	-	15	1	17	-	8	-	-	10	4	-
13 (EP35) Whyanbeel	121 (11)	89	2	1*	1	1	11	1	5	-	1	-	-	7	2	-
14 (EP37) Eungella	84 (7)	48	1	-	-	-	4	-	9	-	6	-	-	13	3	-
15 (EP38) The Crater	141 (7)	95	-	-	-	-	11	-	21	1	9	-	-	2	2	-
16 (EP40) Agapetes ScA	118 (6)	86	-	-	-	-	11	-	12	-	4	-	1	4	-	-
17 (EP41) Oliver Creek	121 (8)	85	1	-	-	-	13	1	14	-	1	-	-	1	5	-
18 (EP42) Iron Range	111 (7)	84	-	-	-	-	8	1	10	-	4	-	-	2	2	-
19 (EP43) Mount Baldy	157 (8)	118	-	-	-	-	9	-	13	-	6	-	1	7	2	1
20 (EP44) Fantail LA#	119 (6)	89	-	- [1]	-	-	12	-	12	-	1	-	-	3 [+2]	2 [+1]	-

* Based on plot descriptions by Stocker (1983).

\# Entries in square parentheses were not included in plot lists by K. Sanderson and M. Bradford, in some cases possibly because some were unvouchered identifications. These data were not considered in site comparisons but have been added to species lists of Appendix 2.

FIGURES

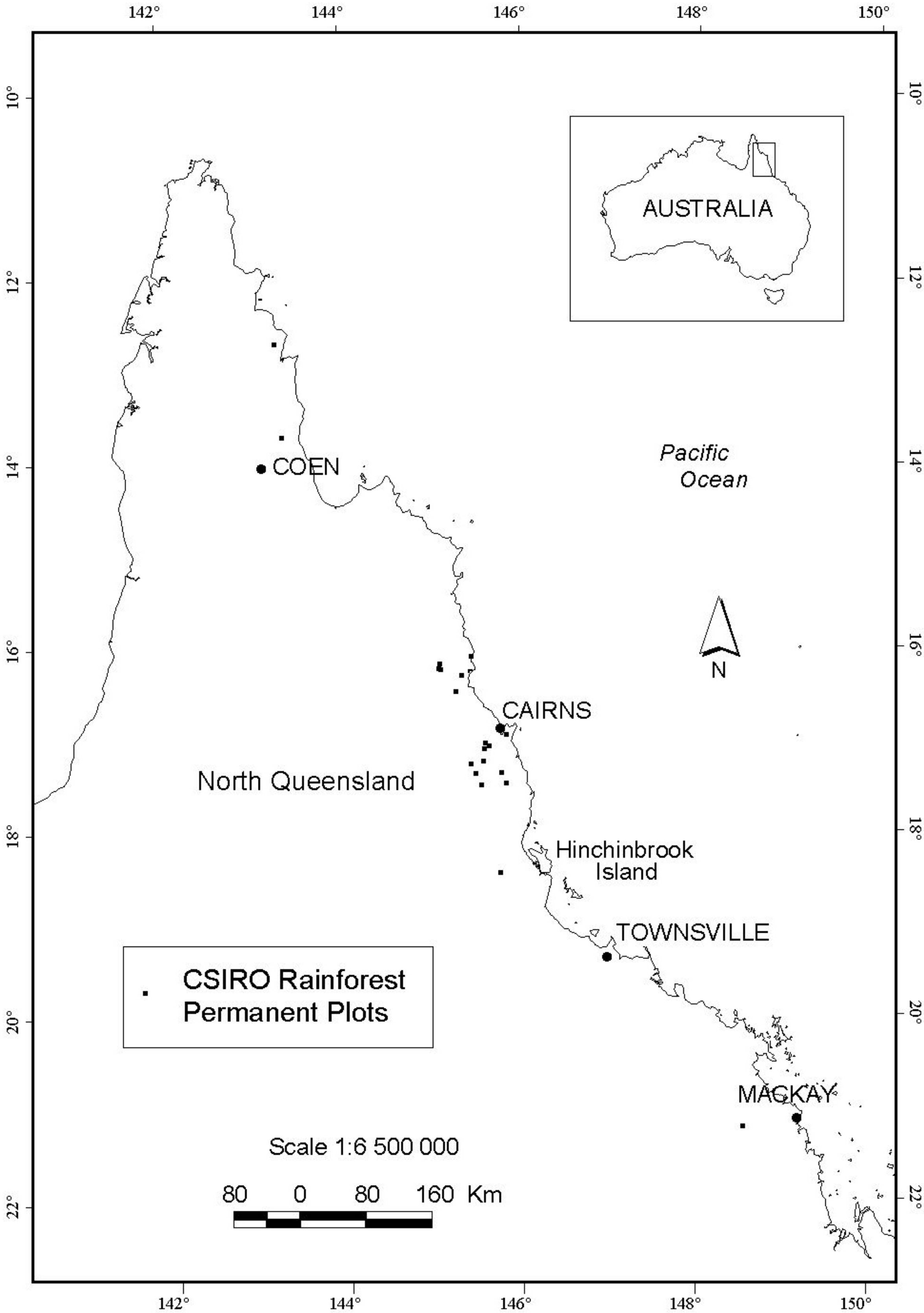


Figure 1: A map of the regional distribution of the twenty CSIRO Rainforest Permanent Plots in North and Far North Queensland.

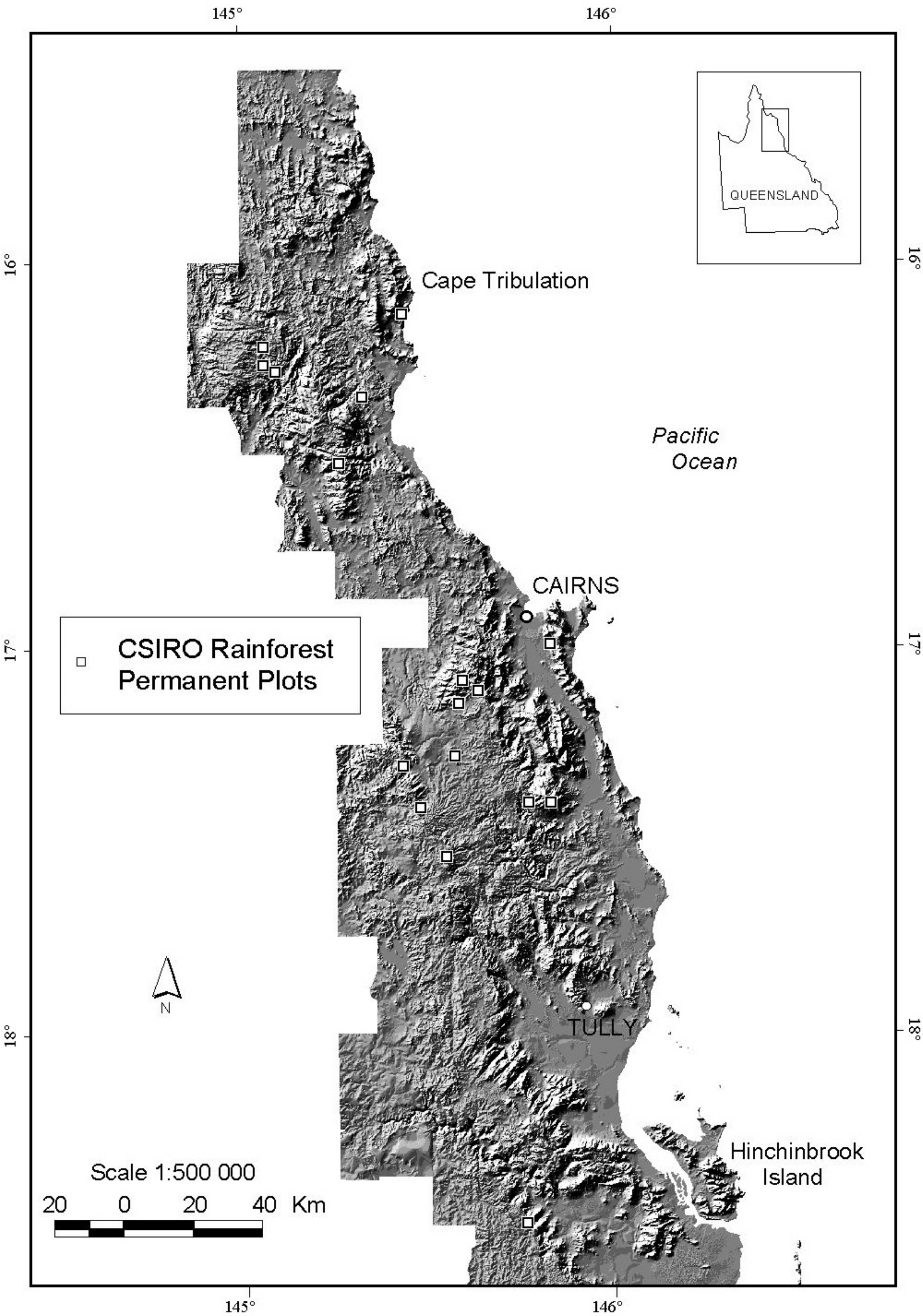


Figure 2: A map of the distribution of the seventeen CSIRO Rainforest Permanent Plots that lie within or adjacent to the Wet Tropics World Heritage Area in the humid tropical region of Far North Queensland.

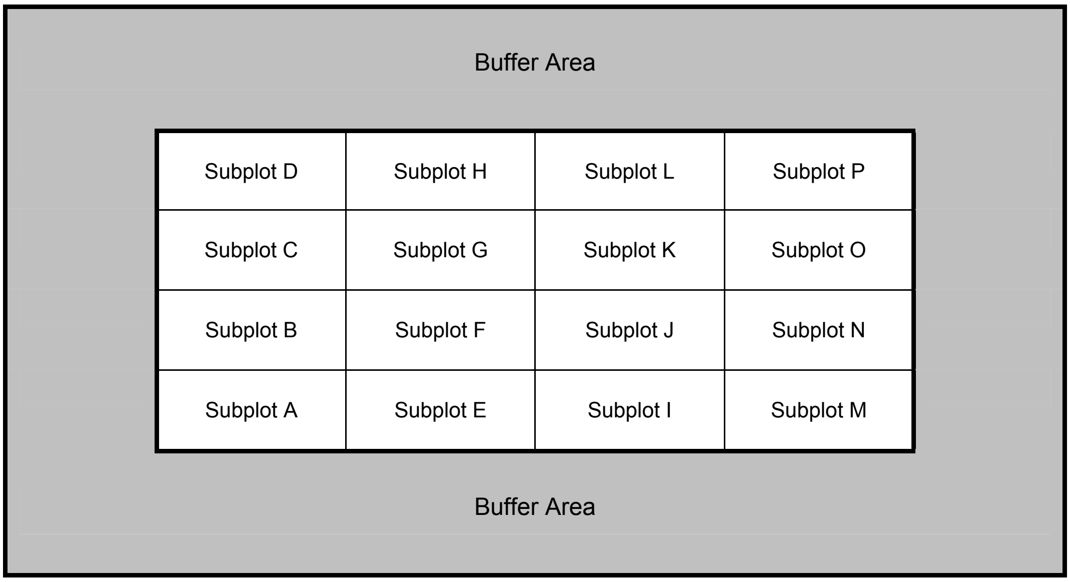


Figure 3: A diagrammatic representation of the layout of a 0.5 ha plot surrounded by a 20 m wide buffer zone. The central 100 x 50 m plot was subdivided into sixteen subplots. Note that the orientation of the subplot row layout varied between plots (see text for details).

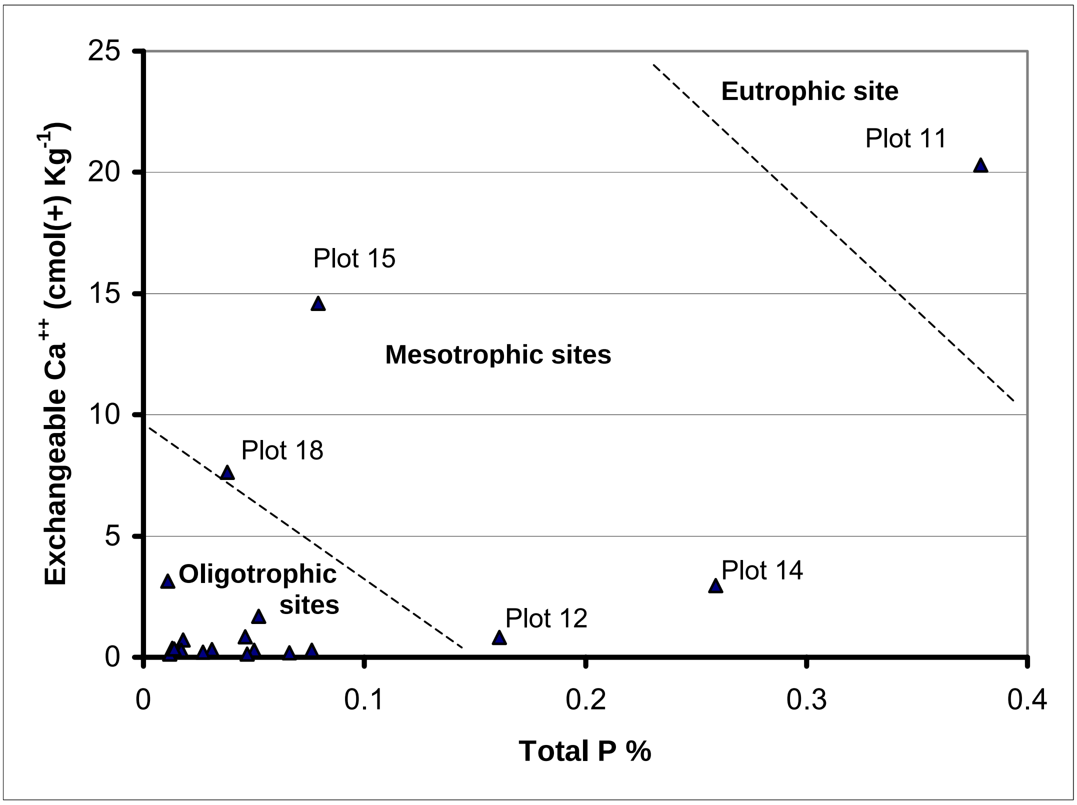


Figure 4: The soil fertility settings of the nineteen plots (Plots 1 to 19 of this report) for which both exchangeable soil Ca++ and total soil P data were available from the first series of soil analyses (0.0-0.3 m bulked samples) as presented on Table 12. The five eutrophic and mesotrophic plots identified on this diagram are Plot 11 (EP33) Curtain Fig, Plot 12 (EP34) Russell River, Plot 14 (EP37) Eungella, Plot 15 (EP38) The Crater, and Plot 18 (EP42) Iron Range.

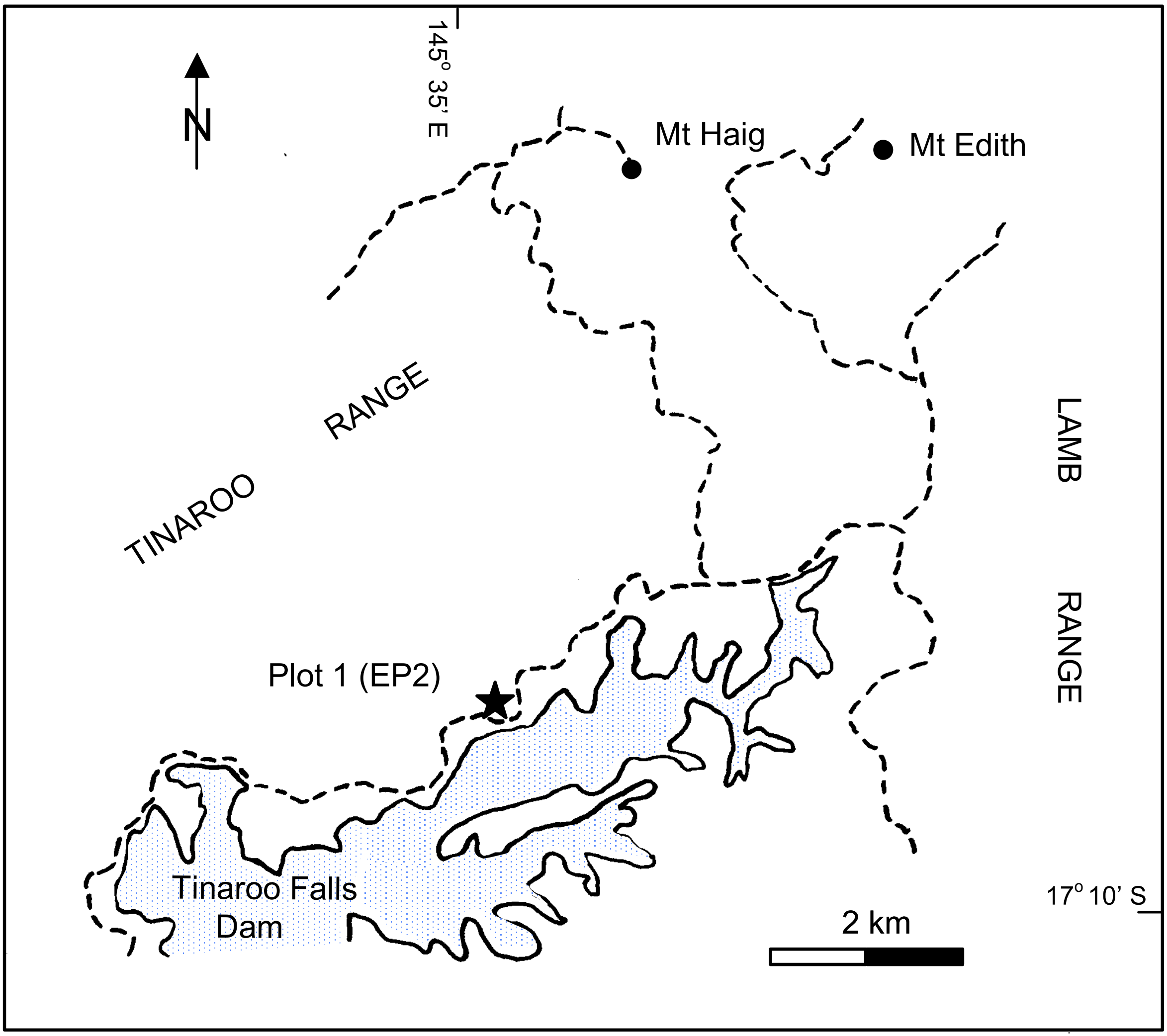
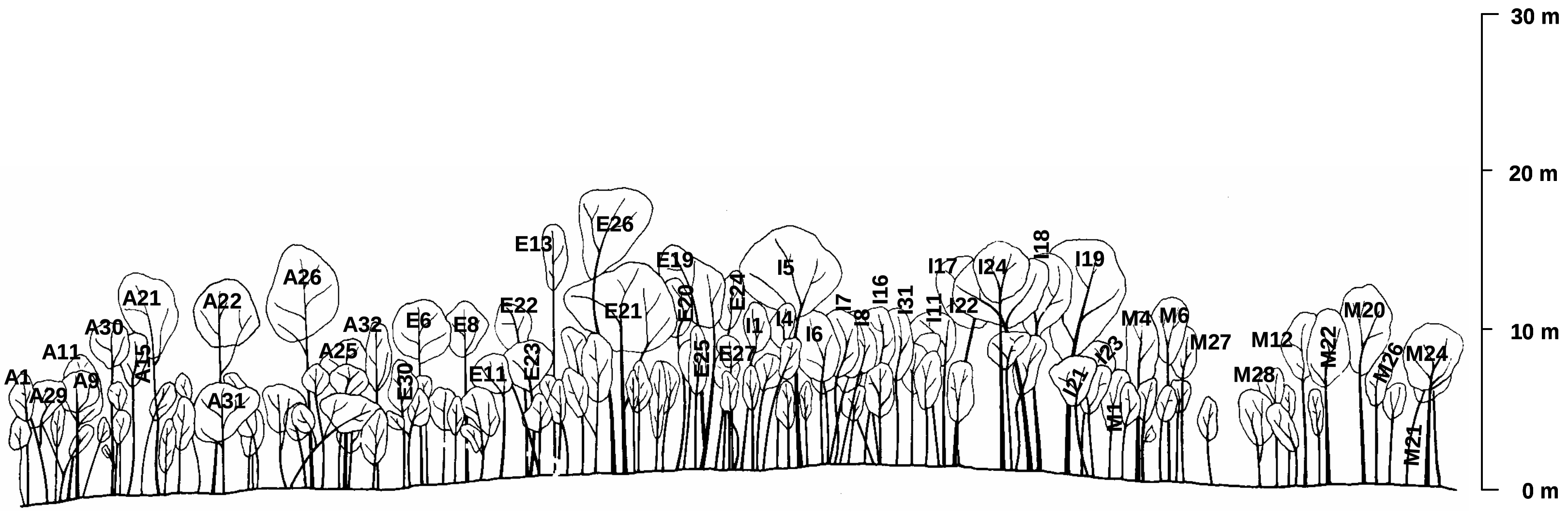


Figure 5: Location map for Plot 1 (EP 2) Downfall Creek.



A1 *Homalium circumpinnatum*, A9 *Mischocarpus pyriformis ssp. pyriformis*, A11 *Acronychia laevis*, A15 *Dinosperma erythrococcum*, A21 *Austromyrtus hillii*, A22 *Croton insularis*, A25 *Cleistanthus semiopacus*, A26 *Euroschinus falcatus var. falcatus*, A29 *Acronychia laevis*, A30 *Homalium circumpinnatum*, A31 *Acronychia laevis*, A32 *Austromyrtus hillii*, E6 *Polyalthia nitidissima*, E8 *Sarcomelicope simplicifolia ssp. simplicifolia*, E11 *Sarcomelicope simplicifolia ssp. simplicifolia*, E13 *Pseudoweinmannia lachnocarpa*, E19 *Glochidion sessiliflorum* var. *pedicellatum*, E20 *Glochidion sessiliflorum* var. *pedicellatum*, E21 *Cleistanthus semiopacus*, E22 *Homalium circumpinnatum*, E23 *Atractocarpus fitzalanii ssp. fitzalanii*, E24 *Alstonia muelleriana*, E25 *Rhodamnia spongiosa*, E26 *Alstonia muelleriana*, E27 *Decaspermum humile*, E30 *Pseudoweinmannia lachnocarpa*, I1 *Glochidion sessiliflorum* var. *pedicellatum*, I4 *Homalium circumpinnatum*, I5 *Euroschinus falcata* var. *falcata*, I6 *Pseudoweinmannia lachnocarpa*, I7 *Euroschinus falcatus* var. *falcatus*, I8 *Pseudoweinmannia lachnocarpa*, I11 *Sarcomelicope simplicifolia ssp. simplicifolia*, I16 *Polyalthia nitidissima*, I17 *Glochidion sessiliflorum* var. *pedicellatum*, I18 *Cleistanthus semiopacus*, I19 *Polyalthia nitidissima*, I21 *Mischocarpus pyriformis* ssp. *pyriformis*, I22 *Cleistanthus semiopacus*, I23 *Cleistanthus semiopacus*, I24 *Brachychiton acerifolius*, I31 *Polyalthia nitidissima*, M1 *Acronychia laevis*, M4 *Cleistanthus semiopacus*, M6 *Rhodamnia spongiosa*, M12 *Croton insularis*, M20 *Dinosperma erythrococcum*, M21 *Dinosperma erythrococcum*, M22 *Glochidion sessiliflorum* var. *pedicellatum*, M24 *Cleistanthus semiopacus*, M26 *Dinosperma erythrococcum*, M27 *Croton insularis*, M28 *Acronychia laevis.*

Figure 6: Canopy profile prepared from a 100 x 5 m transect through Plot 1 (EP2) Downfall Creek at the time of plot establishment.

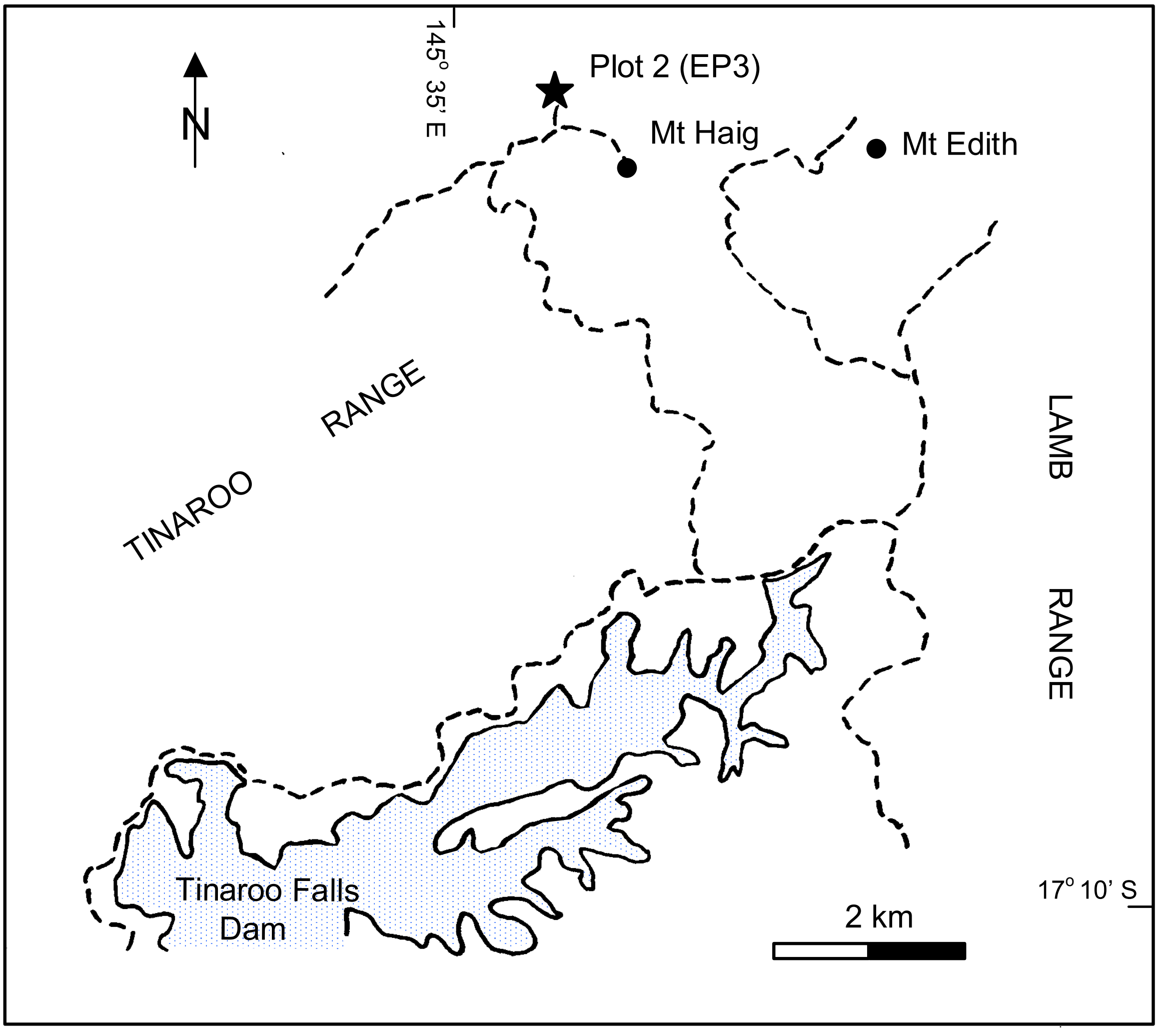


Figure 7: Location map for Plot 2 (EP 3) Mount Haig.

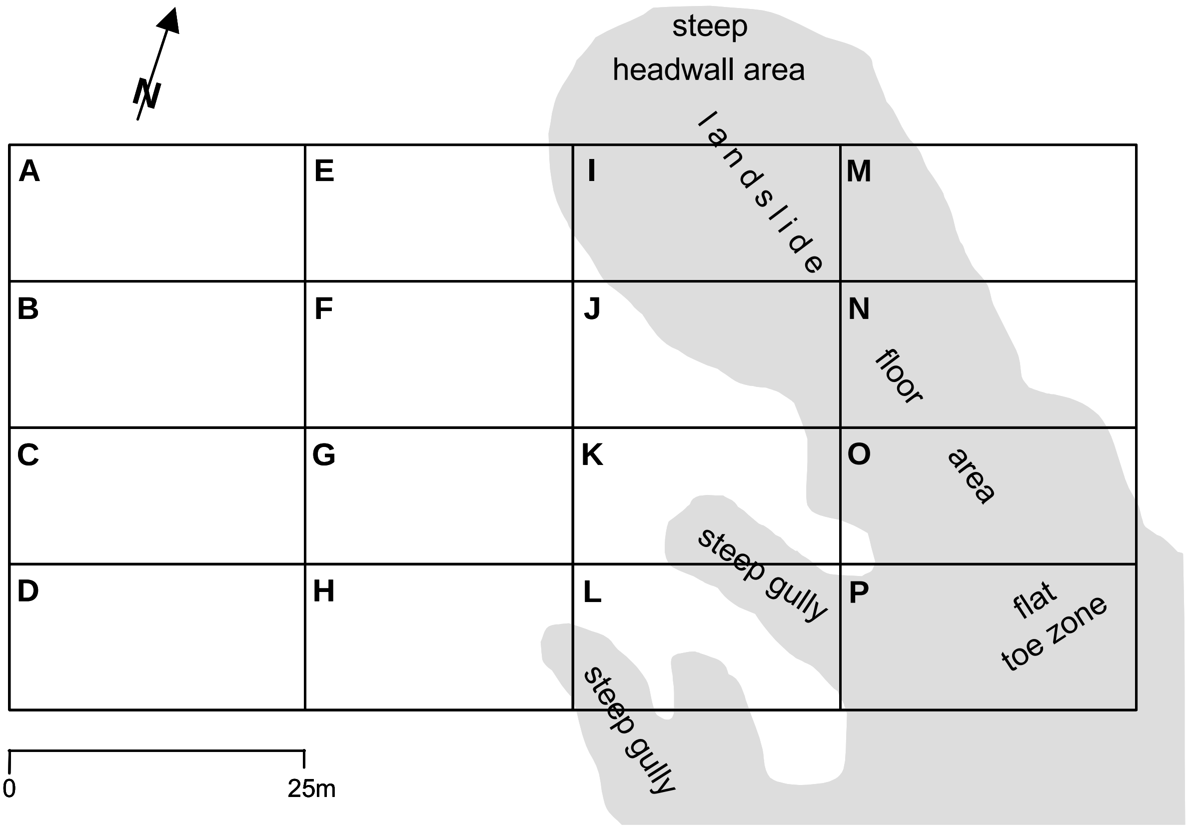
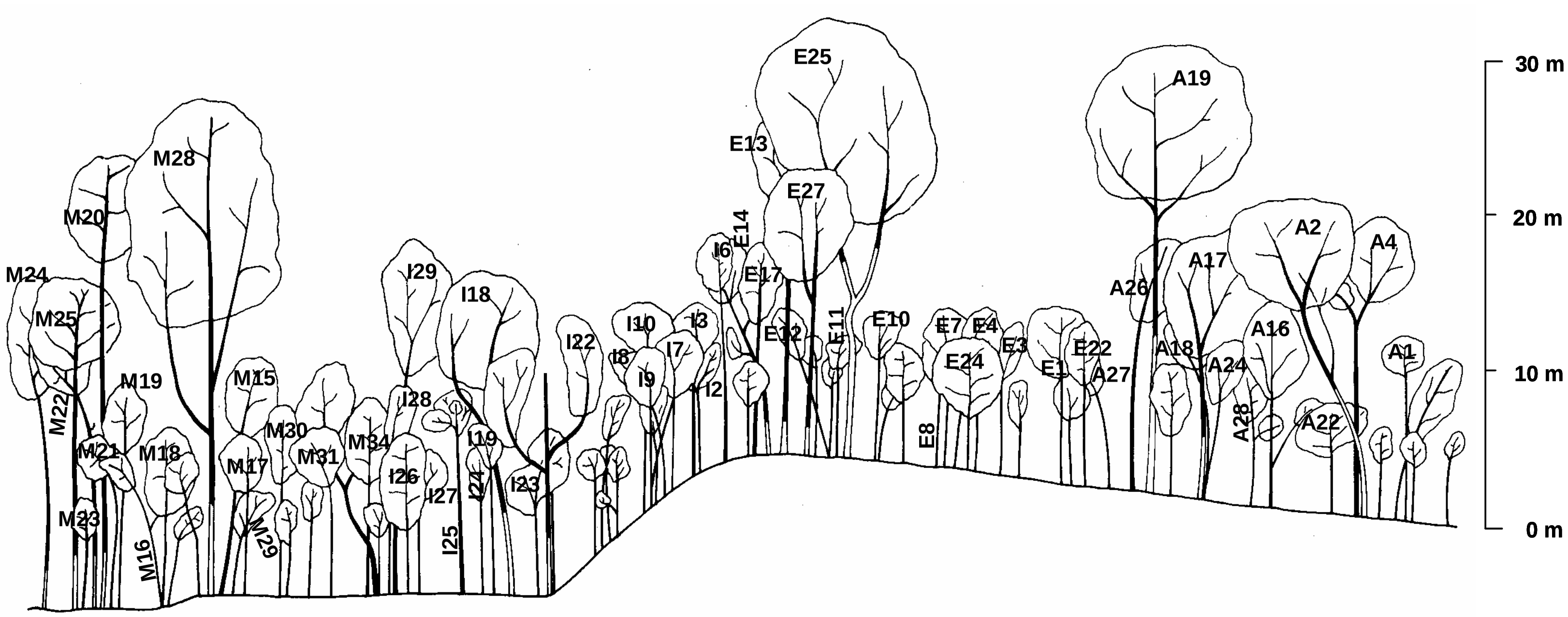


Figure 8: A sketch of the site at Plot 2 (EP 3) Mount Haig showing the location of an ancient landslide. This geomorphic feature effectively partitions the site into two contrasting site-stability settings.



M15 ***Garcinia*** **sp. (Davies Creek JGT 14745), M16** ***Sarcotoechia cuneata,*** **M17** ***Bobea myrtoides*****, M18** ***Brackenridgea*** **australiana, M19** ***Cryptocarya angulata,*** **M20** ***Agathis atropurpurea*****, M21** ***Rapanea achradiifolia*****, M22** ***Elaeocarpus sericopetalus,*** **M23** ***Bobea myrtoides,*** **M24** ***Beilschmiedia collina,*** **M25** ***Musgravea stenostachya,*** **M28** ***Syzygium luehmannii*****, M30** ***Cryptocarya lividula*****, M31** ***Sphenostemon lobosporus*****, M34** ***Cryptocarya densiflora,*** **I2** ***Syzygium johnsonii*****, I3** ***Cryptocarya densiflora*****, I6** ***Alloxylon wickhamii*****, I7** ***Cryptocarya densiflora,*** **I8** ***Sarcotoechia cuneata*****, I9** ***Ceratopetalum succirubrum*****, I10** ***Rapanea achradiifolia*****, I18** ***Elaeocarpus elliffii*****, I19** ***Ceratopetalum succirubrum*****, I22** ***Ceratopetalum succirubrum*****, I23** ***Brackenridgea australiana*****, I24** ***Rhodamnia blairiana*****, I25** ***Syzygium cormiflorum*****, I26** ***Apodytes brachystylis*****, I27** ***Sphenostemon lobosporus*****, I28** ***Polyosma alangiacea*****, I29** ***Elaeocarpus sericopetalus*****, E1** ***Canarium australasicum*****, E3** ***Bobea myrtoides*****, E4** ***Bobea myrtoides*****, E7** ***Sphenostemon lobosporus,*** **E8** ***Cryptocarya lividula*****, E10** ***Polyosma alangiacea*****, E11** ***Rapanea achradiifolia,*** **E12** ***Rapanea porosa,*** **E13** ***Elaeocarpus sericopetalus*****, E14** ***Rapanea porosa,*** **E17** ***Balanops australiana,*** **E22** ***Flindersia bourjotiana*****, E24** ***Brackenridgea australiana*****, E25** ***Flindersia bourjotiana,*** **E27** ***Garcinia*** **sp. (Davies Creek JGT 14745), A1** ***Flindersia bourjotiana,*** **A2** ***Elaeocarpus sericopetalus*****, A4** ***Syzygium endophloium,*** **A16 Sarcotoechia cuneata, A17** ***Musgravea stenostachya*****, A18** ***Cryptocarya densiflora,*** **A19** ***Syzygium endophloium,*** **A22** ***Brackenridgea australiana,*** **A24** ***Brackenridgea australiana,*** **A26** ***Agathis atropurpurea*****, A27** ***Garcinia*** **sp. (Davies Creek JGT 14745), A28** ***Brackenridgea*** **australiana.**

Figure 9: Canopy profile prepared from a 100 x 5 m transect through Plot 2 (EP3) Mount Haig at the time of establishment.

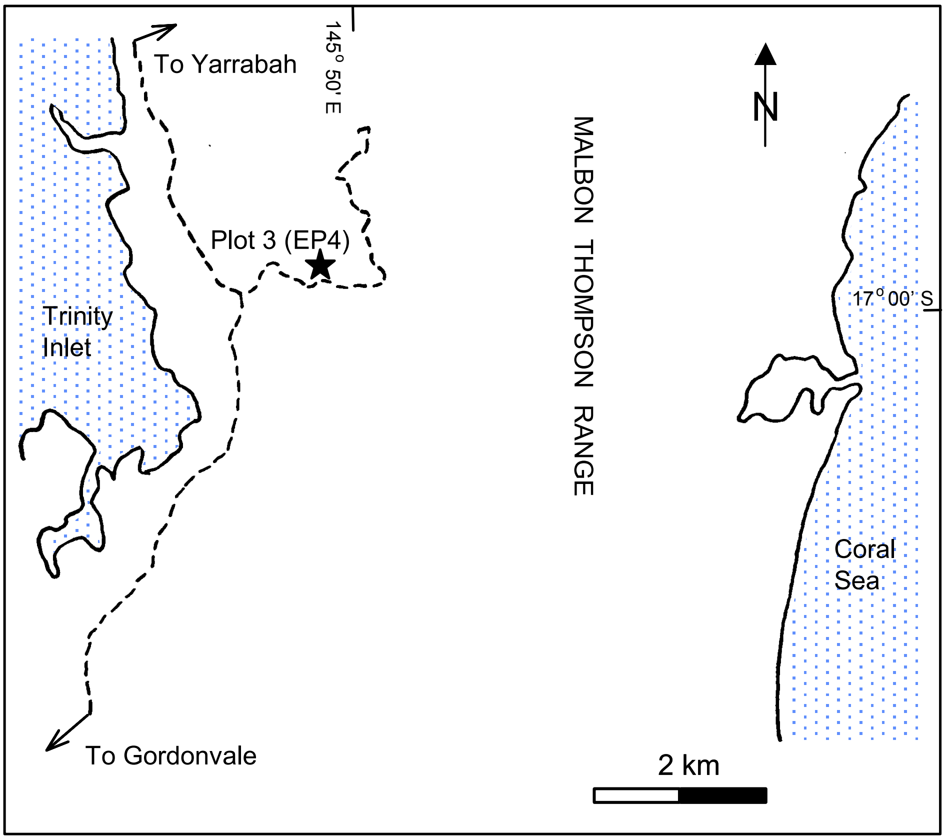
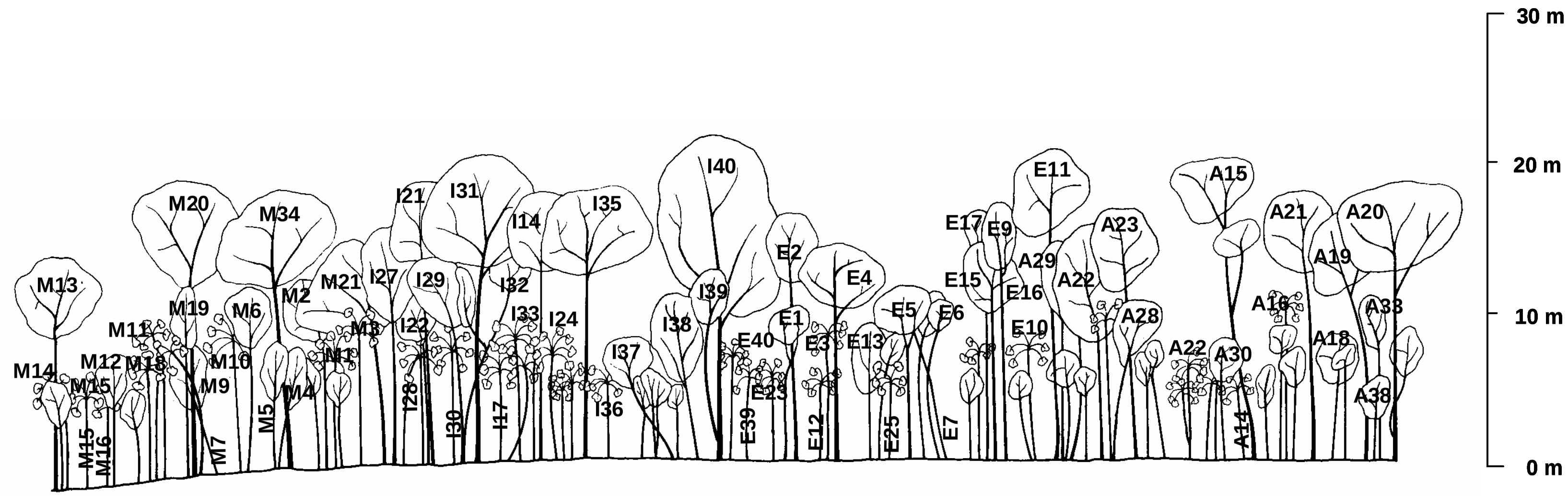


Figure 10: Location map for Plot 3 (EP4) Little Pine Creek.



M1 ***Licuala ramsayi*****, M2** ***Blepharocarya involucrigera*****, M3** ***Licuala ramsayi*****, M4** ***Macaranga subdentata*****, M5** ***Polyscias australiana*****, M6** ***Elaeocarpus bancroftii*****, M7** ***Licuala ramsayi*****, M9** ***Macaranga subdentata*****, M10** ***Licuala ramsayi*****, M11** ***Licuala ramsayi*****, M12** ***Macaranga subdentata*****, M13** ***Syzygium cormiflorum*****, M14** ***Licuala ramsayi*****, M15** ***Licuala ramsayi*****, M16** ***Licuala ramsayi*****, M18** ***Licuala ramsayi*****, M19** ***Stenocarpus reticulatus*****, M20** ***Alstonia muelleriana*****, M21** ***Carnarvonia araliifolia*** **var.** ***araliifolia*****, M34** ***Carnarvonia araliifolia*** **var.** ***araliifolia*****, I14** ***Cryptocarya cunninghamii*****, I17** ***Licuala ramsayi*****, I21** ***Endiandra impressicosta*****, I22** ***Stenocarpus reticulatus*****, I24** ***Licuala ramsayi*****, I27** ***Syzygium luehmannii*****, I28** ***Licuala ramsayi*****, I29** ***Grevillea baileyana*****, I30** ***Licuala ramsayi*****, I31** ***Podocarpus grayae*****, I32** ***Pouteria chartacea*****, I33** ***Licuala ramsayi*****, I35** ***Flindersia bourjotiana*****, I36** ***Licuala ramsayi*****, I37** ***Macaranga subdentata*****, I38** ***Macaranga subdentata*****, I39** ***Franciscodendron laurifolium*****, I40** ***Flindersia bourjotiana*****, E1** ***Polyscias australiana*****, E2** ***Carnarvonia araliifolia*** **var.** ***araliifolia*****, E3** ***Licuala ramsayi*****, E4** ***Syzygium cormiflorum*****, E5** ***Acronychia acronychioides*****, E6** ***Polyalthia*** **sp. (Wyvuri BH 2632RFK), E7** ***Licuala ramsayi*****, E9** ***Canarium muelleri*****, E10** ***Licuala ramsayi*****, E11** ***Flindersia bourjotiana*****, E12** ***Licuala ramsayi*****, E13** ***Macaranga subdentata*****, E15** ***Pouteria chartacea*****, E16** ***Franciscodendron laurifolium*****, E17** ***Grevillea baileyana*****, E23** ***Licuala ramsayi*****, E25** ***Licuala ramsayi*****, E39** ***Licuala ramsayi*****, E40** ***Licuala ramsayi*****, A14** ***Licuala ramsayi*****, A15** ***Carnarvonia araliifolia*** **var.** ***araliifolia*****, A16** ***Licuala ramsayi*****, A18** ***Acacia*** **celsa, A20** ***Acacia*** **sp. celsa, A21** ***Alstonia muelleriana*****, A22** ***Licuala ramsayi*****, A23** ***Franciscodendron laurifolium*****, A28** ***Macaranga subdentata*****, A29** ***Macaranga subdentata*****, A30** ***Macaranga subdentata*****, A33** ***Acacia*** **celsa, A38** ***Flindersia pimenteliana*****.**

Figure 11: Canopy profile prepared from a 100 x 5 m transect through Plot 3 (EP4) Little Pine Creek at the time of establishment.

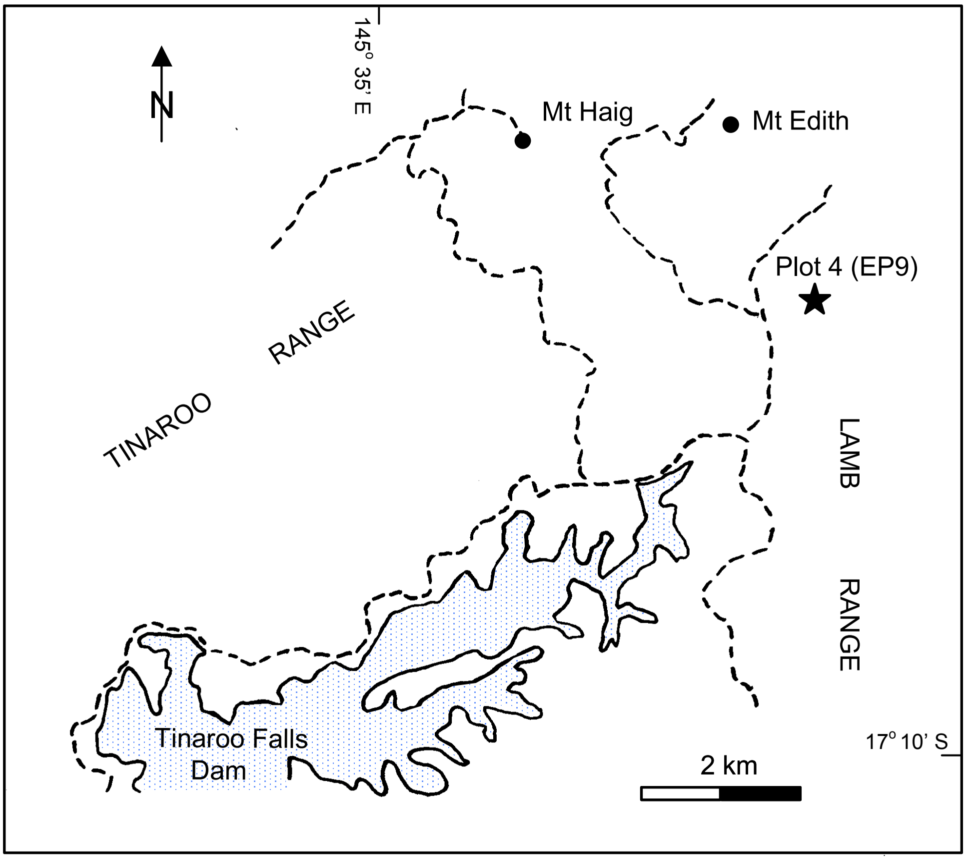
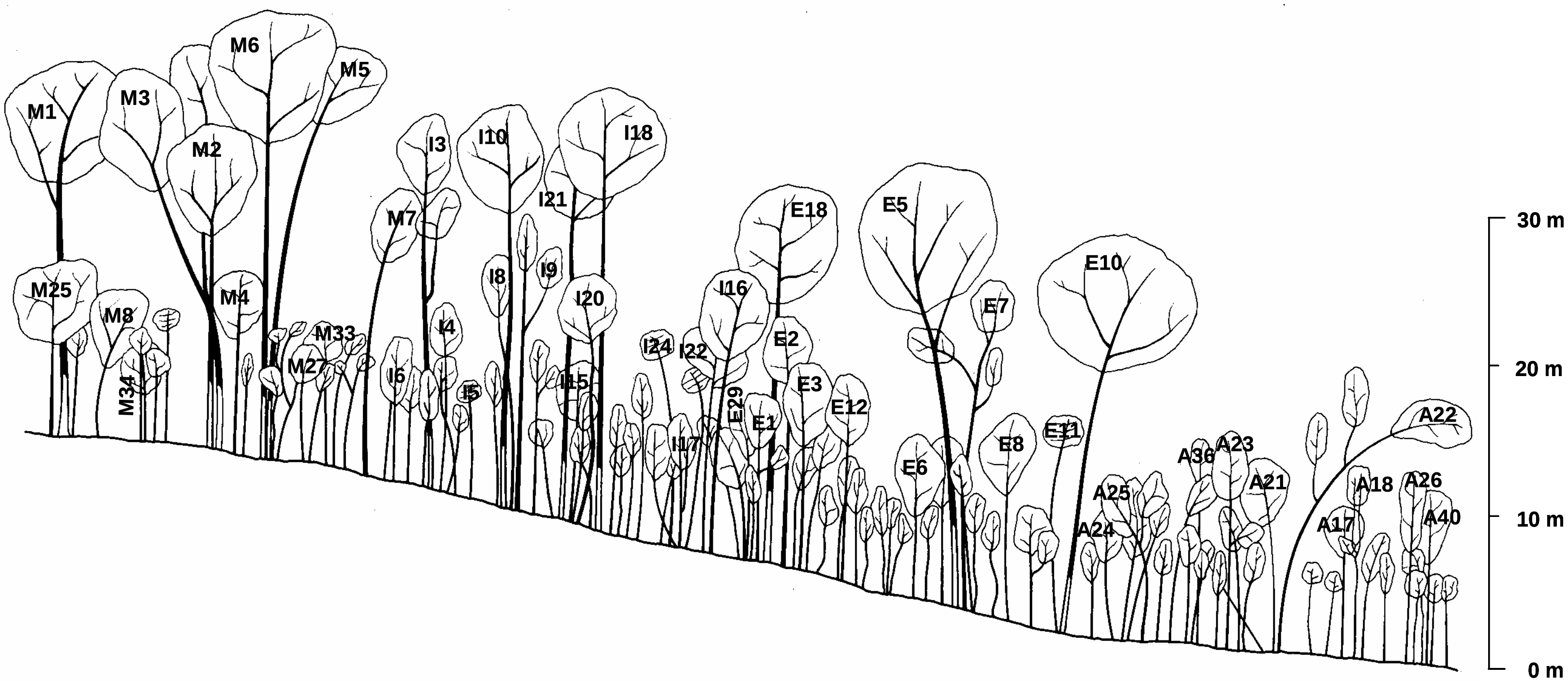


Figure 12: Location map for Plot 4 (EP 9) Robson Logging Area.



M1 *Flindersia pimenteliana*, M2 *Flindersia pimenteliana*, M3 *Darlingia darlingiana*, M4 *Citronella smythii*, M5 *Flindersia laevicarpa* var. *laevicarpa,* M6 *Flindersia laevicarpa* var. *laevicarpa,* M7 *Cryptocarya murrayi*, M8 *Bobea myrtoides,* M25 *Medicosma fareana,* M27 *Polyscias australiana,* M33 *Alphitonia whitei,* M34 *Apodytes brachystylis*, I3 *Xanthophyllum octandrum* I4 *Streblus glaber* var. *australianus,* I5 *Franciscodendron laurifolium,* I6 *Franciscodendron laurifolium, I8 Canarium muelleri,* I9 *Flindersia laevicarpa* var. *laevicarpa,* I10 *Beilschmiedia collina*, I15 *Lethedon setosa,* I16 *Alphitonia petriei*, I17 *Medicosma fareana*, I18 *Flindersia laevicarpa* var. *laevicarpa*, I20 *Beilschmiedia collina*, I21 *Flindersia laevicarpa* var. *laevicarpa*, I22 *Alphitonia petriei* I24 *Polyscias murrayi,* E1 *Bubbia semecarpoides,* E2 *Citronella smythii,* E3 *Endiandra monothyra* ssp. *monothyra,* E5 *Flindersia laevicarpa* var. *laevicarpa,* E6 *Sphenostemon lobosporus,* E7 *Xanthophyllum octandrum*, E8 *Elaeocarpus largiflorens* ssp. *largiflorens,* E10 *Alphitonia whitei,* E11 *Polyscias murrayi,* E12 *Flindersia bourjotiana,* E18 *Flindersia laevicarpa* var. *laevicarpa,* E29 *Macaranga subdentata*, A17 *Medicosma fareana,* A18 *Medicosma fareana,* A21 *Gevuina bleasdalei,* A22 *Gevuina bleasdalei,* A23 *Medicosma fareana,* A24 *Irvingbaileya australis,* A25 *Citronella smythii,* A26 *Flindersia laevicarpa* var. *laevicarpa,* A36 *Flindersia laevicarpa* var. *laevicarpa,* A40 *Acronychia acidula.*

Figure 13: Canopy profile prepared from a 100 x 5 m transect through Plot 4 (EP 9) Robson Logging Area at the time of establishment.

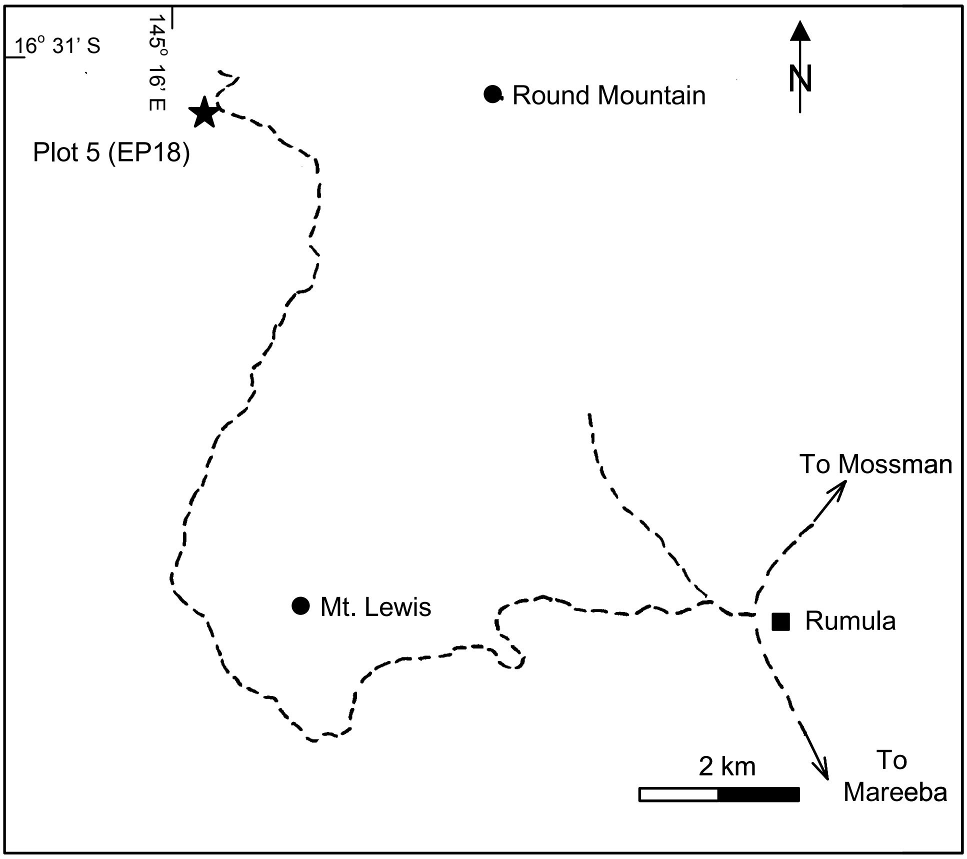


Figure 14: Location map for Plot 5 (EP 18) Mount Lewis.

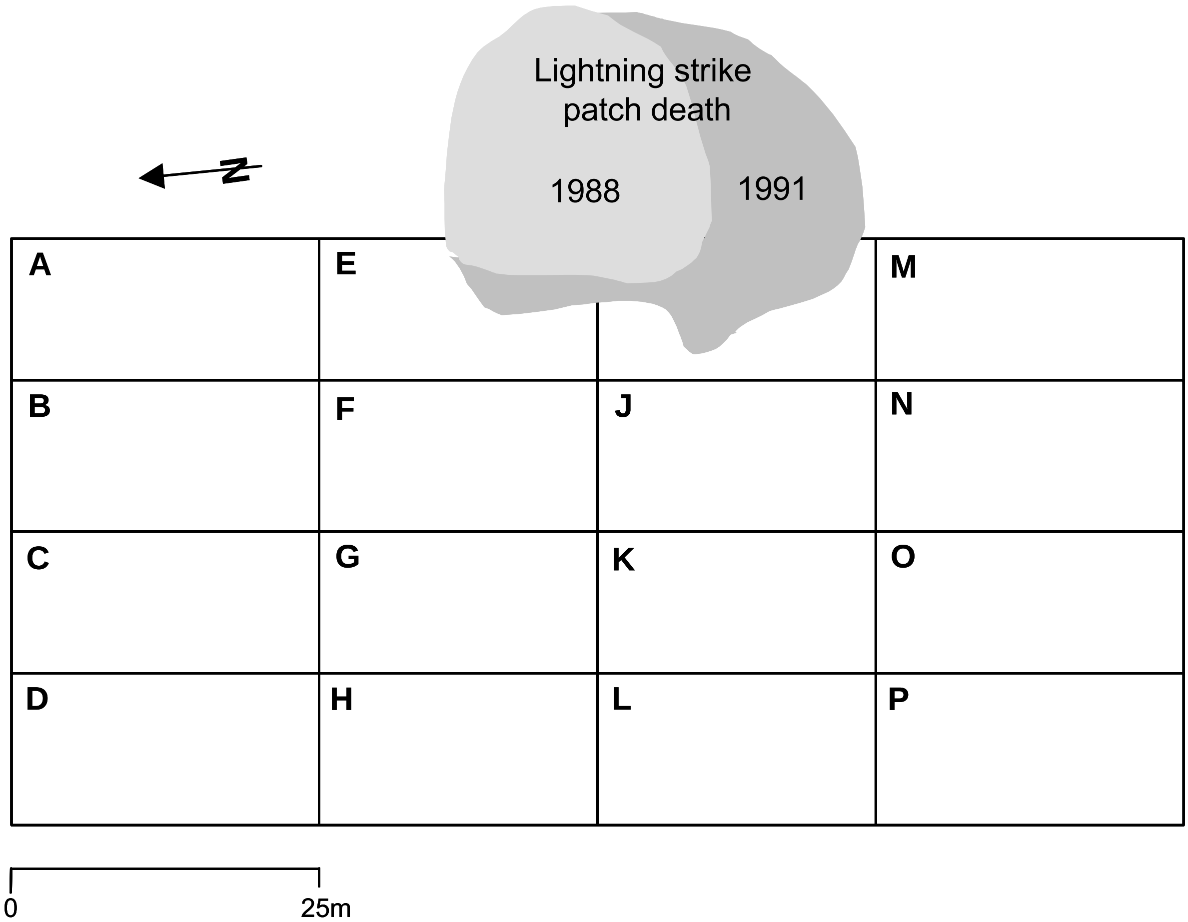
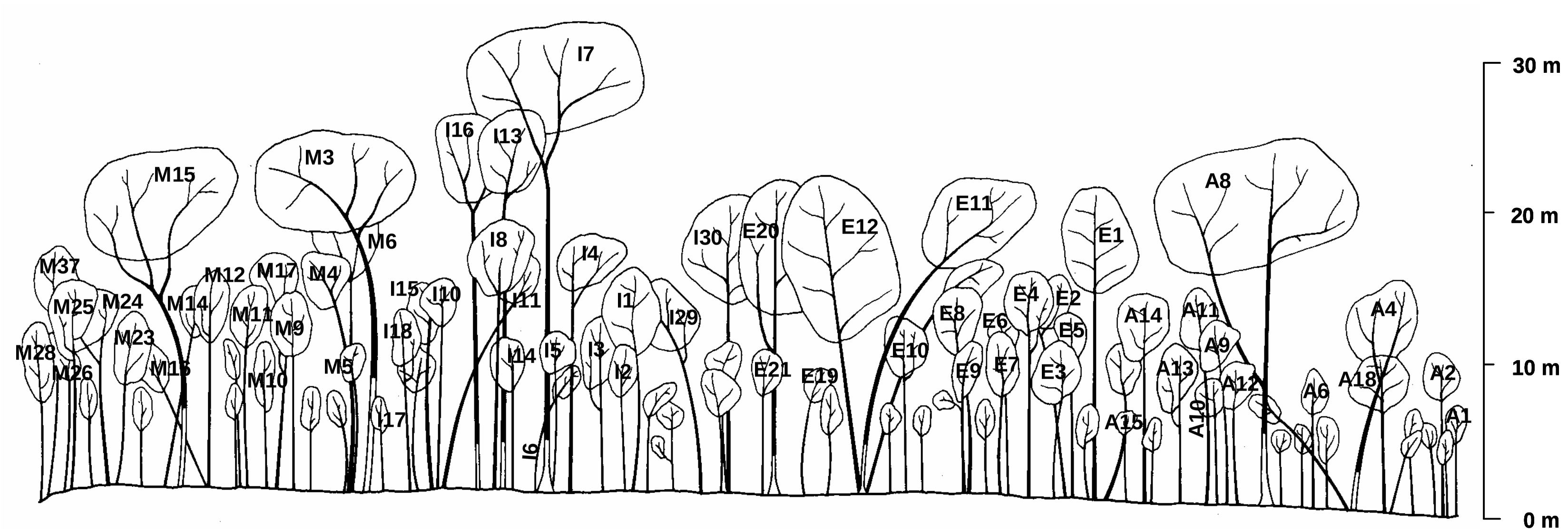


Figure 15: The sequential extent of canopy dieback that developed after a lightning strike around 1987 at Plot 5 (EP 18) Mount Lewis.



M3 ***Sphalmium racemosum***, M4 ***Placospermum coriaceum,*** M5 ***Pouteria euphlebia, M6 Garcinia*** sp. (Davies Creek JGT 14745), M9 ***Cryptocarya lividula,*** M10 ***Pouteria*** sp. (Mt Lewis BH 579), M11 ***Pouteria*** sp. (Mt Lewis BH 579), M12 ***Cryptocarya lividula,*** M14 ***Beilschmiedia collina,*** M15 ***Carnarvonia araliifolia*** var. ***montana,*** M16 ***Pouteria*** sp. (Mt Lewis BH 579), M23 ***Rapanea achradiifolia,*** M24 ***Cryptocarya lividula,*** M25 ***Beilschmiedia collina,*** M26 ***Planchonella macrocarpa,*** M28 ***Pouteria*** sp. (Mt Lewis BH 579), M37 ***Pouteria euphlebia,*** I1 ***Garcinia*** sp. (Davies Creek JGT 14745), I2 ***Pouteria euphlebia,*** I3 ***Endiandra montana,*** I4 ***Cardwellia sublimis,*** I5 ***Endiandra dielsiana***, I6 ***Sarcopteryx montana***, I7 ***Placospermum coriaceum,*** I8 ***Syzygium endophloium,*** I10 ***Rapanea achradiifolia***, I11 ***Garcinia*** sp. (Davies Creek JGT 14745), I13 ***Sphalmium racemosum,*** I14 ***Pouteria*** sp. (Mt Lewis BH 579), I15 ***Pouteria*** sp. (Mt Lewis BH 579), I16 ***Austromyrtus*** sp. (Mt Lewis BG 831), I17 ***Goniothalamus australis***, I18 ***Balanops australiana***, I31 ***Sarcotoechia cuneata,*** I30 ***Garcinia*** sp. (Davies Creek JGT 14745), E1 ***Garcinia*** sp. (Davies Creek JGT 14745), E2 ***Cnesmocarpon dasyantha,*** E3 ***Cryptocarya corrugata,*** E4 ***Pouteria euphlebia,*** E5 ***Elaeocarpus largiflorens*** ssp. ***retinervis,*** E6 ***Endiandra phaeocarpa,*** E7 ***Goniothalamus australis,*** E8 ***Pouteria*** sp. (Mt Lewis BH 579), E9 ***Cryptocarya corrugata,*** E10 ***Pouteria euphlebia,*** E11 ***Elaeocarpus sericopetalus,*** E12 ***Garcinia*** sp. (Davies Creek JGT 14745), E19 ***Archidendron vaillantii***, E20 ***Pouteria euphlebia***, E21 ***Cryptocarya lividula,*** A1 ***Pouteria*** sp. (Mt Lewis BH 579), A2 ***Synima cordierorum,*** A4 ***Archidendron vaillantii,*** A6 ***Endiandra montana,*** A8 ***Flindersia bourjotiana,*** A9 ***Pouteria*** sp. (Mt Lewis BH 579), A10 ***Apodytes brachystylis,*** A11 ***Pouteria*** sp. (Mt Lewis BH 579), A12 ***Endiandra dielsiana,*** A13 ***Casearia costulata,*** A14 ***Cryptocarya grandis,*** A15 ***Diospyros*** sp. (Mt Lewis LSS 10107), A18 ***Sloanea macbrydei.***

Figure 16: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 5 (EP 18) Mount Lewis at the time of plot establishment.

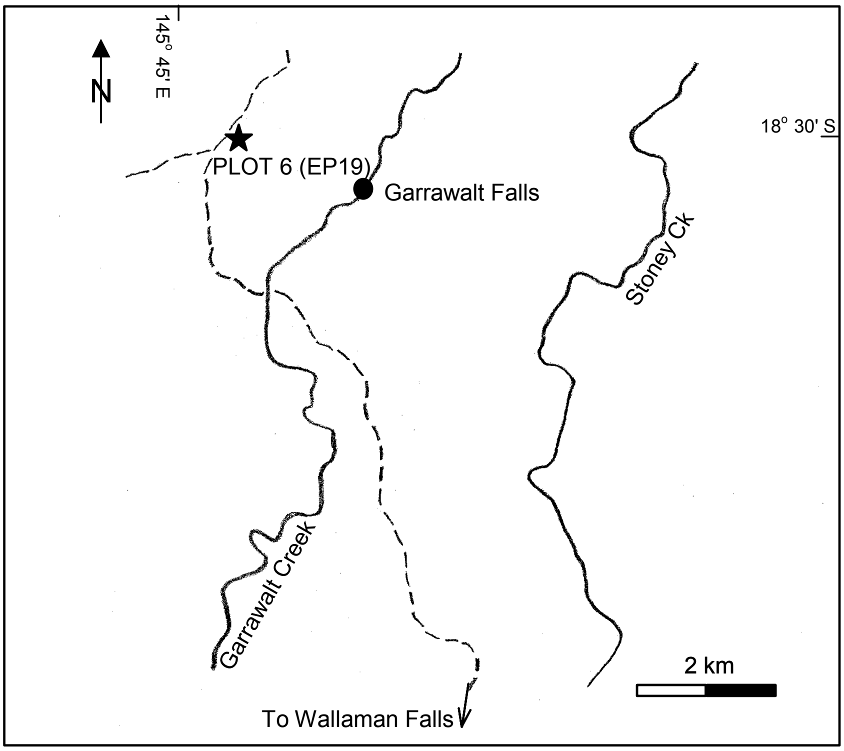


Figure 17: Location map for Plot 6 (EP 19) Garrawalt.

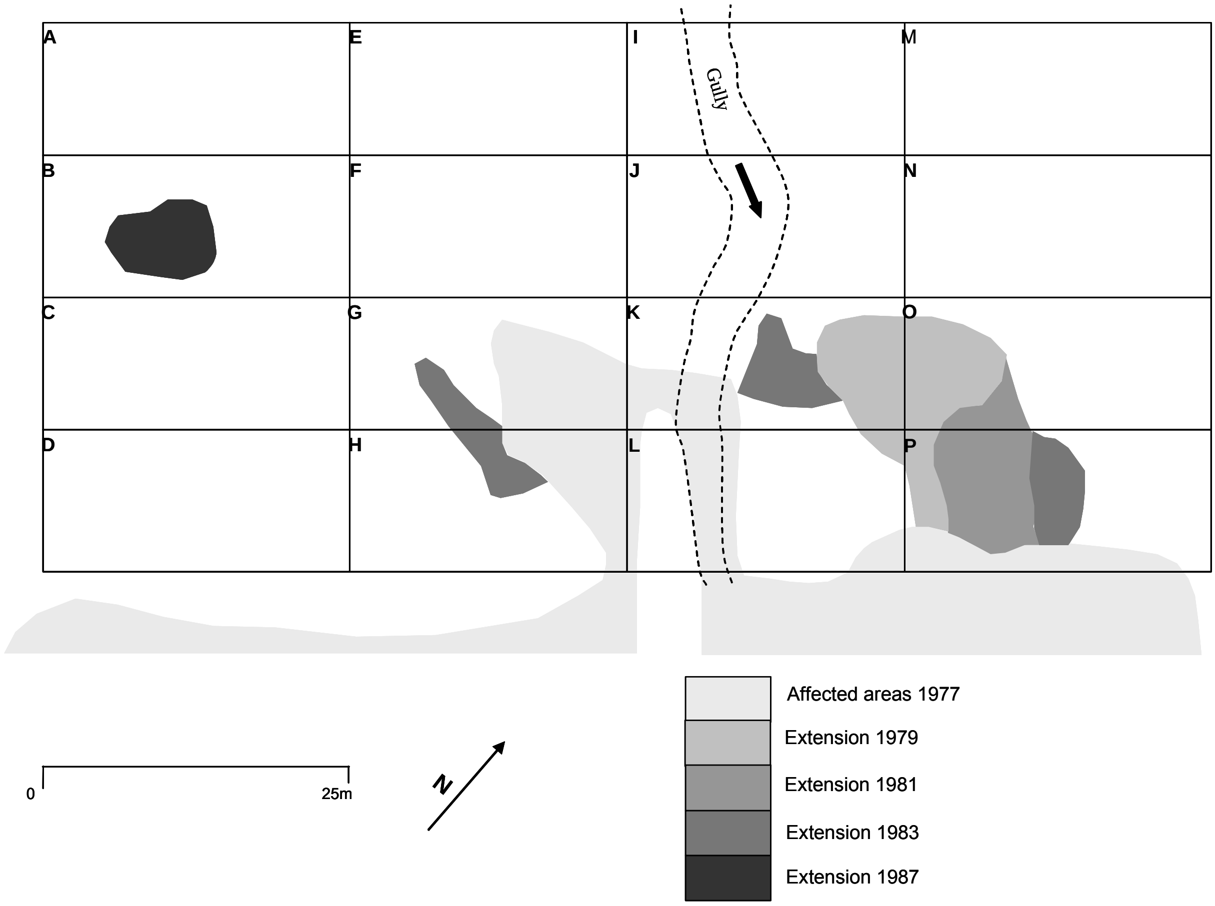


Figure 18: The sequential extent of canopy dieback associated with a confirmed occurrence of the root-rot fungus *Phytophthora cinnamomi* at Plot 6 (EP 19) Garrawalt.

M20 ***Cnesmocarpon dasyantha*****, M22** ***Endiandra leptodendron*****, M23** ***Xylopia maccreae*****, M24** ***Sarcotoechia cuneata*****, M26** ***Cryptocarya mackinnoniana*****, M27** ***Rhodamnia sessiliflora*****, M31** ***Apodytes brachystylis*****, M32** ***Antirhea tenuiflora*****, I5** ***Flindersia bourjotiana*****, I12** ***Flindersia bourjotiana*****, I14** ***Beilschmiedia recurva*****, I15** ***Apodytes brachystylis*****, I20** ***Sarcotoechia cuneata*****, I21** ***Cardwellia sublimis*****, I22** ***Brombya platynema*****, I23** ***Flindersia brayleyana*****, E1** ***Acacia*** **celsa, E2** ***Flindersia bourjotiana*****, E3** ***Flindersia bourjotiana*****, E11** ***Flindersia bourjotiana*****, E12** ***Flindersia bourjotiana*****, E26** ***Litsea leefeana*****, E31** ***Cardwellia sublimis*****, E38** ***Halfordia kendack*****, E41** ***Helicia nortoniana*****, E42** ***Cnesmocarpon dasyantha*****, E43** ***Flindersia brayleyana*****, E44** ***Flindersia bourjotiana*****, A4** ***Flindersia bourjotiana*****, A5** ***Cryptocarya putida*****, A9** ***Flindersia bourjotiana*****, A10** ***Cryptocarya mackinnoniana*****, A11** ***Flindersia bourjotiana*****, A12** ***Cryptocarya angulata*****, A13** ***Flindersia bourjotiana*****, A18** ***Sarcotoechia cuneata.***

Figure 19: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 6 (EP 19) Garrawalt at the time of plot establishment.

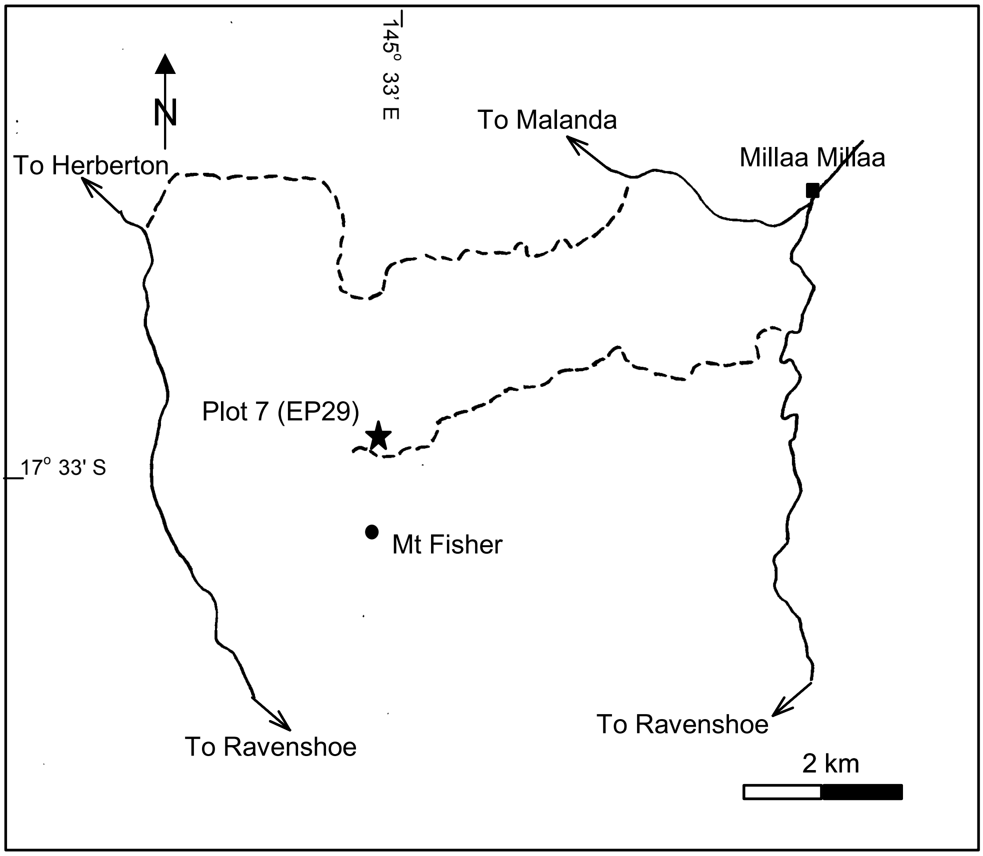
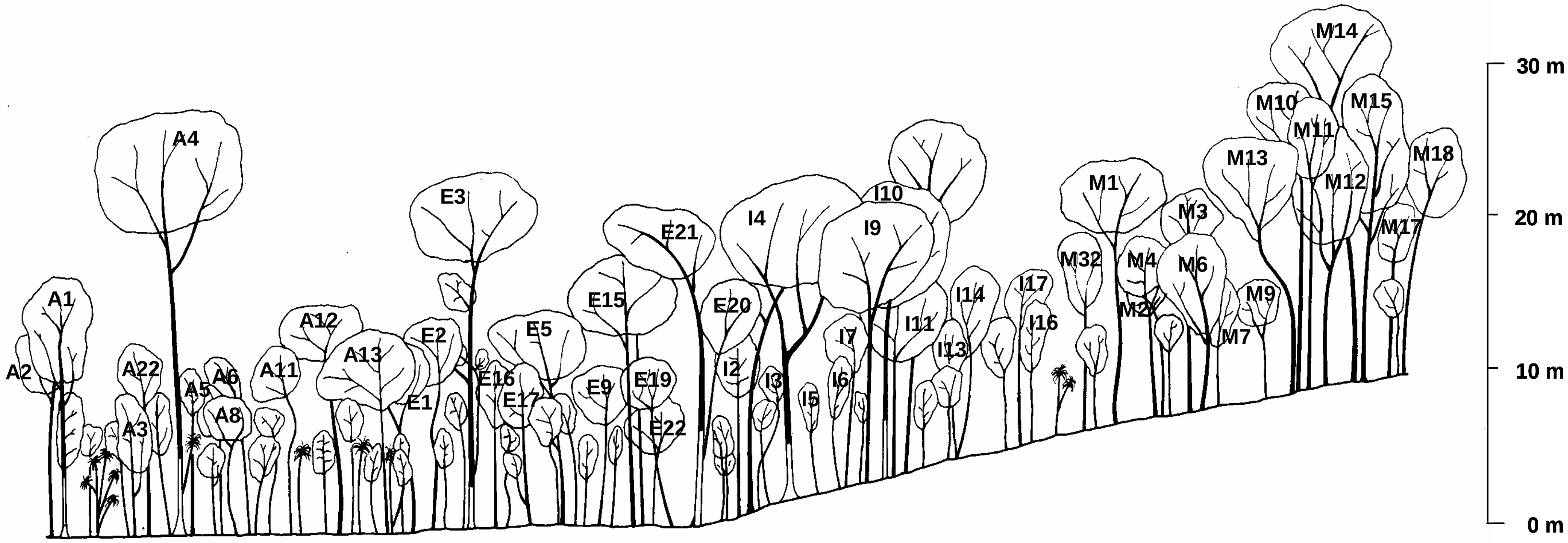


Figure 20: Location map for Plot 7 (EP 29) Mount Fisher.



A1 ***Sphenostemon lobosporus,*** **A2** ***Elaeocarpus foveolatus*****, A3** ***Apodytes brachystylis,*** **A4** ***Syzygium endophloium,*** **A5** ***Cryptocarya corrugata,*** **A6** ***Elaeocarpus ferruginiflorus,*** **A7** ***Steganthera macooraia,*** **A8** ***Cryptocarya densiflora,*** **A9** ***Steganthera macooraia,*** **A11** ***Pullea stutzeri,*** **A12** ***Rhodamnia blairiana,*** **A13** ***Cryptocarya densiflora,*** **A22** ***Endiandra dichrophylla,*** **E1** ***Cryptocarya corrugata,*** **E2** ***Cryptocarya corrugata,*** **E3** ***Cardwellia sublimis,*** **E5** ***Rhodamnia blairiana,*** **E6** ***Cryptocarya densiflora,*** **E7** ***Flindersia bourjotiana,*** **E9** ***Cryptocarya densiflora*****, E15** ***Cryptocarya densiflora,*** **E17** ***Sphenostemon lobosporus,*** **E18** ***Irvingbaileya australis*****, E19** ***Cryptocarya densiflora,*** **E20** ***Guioa montana,*** **E21** ***Halfordia kendack,*** **E22** ***Chionanthus axillaris*****, I2** ***Alphitonia whitei*****, I3** ***Elaeocarpus largiflorens*** **ssp.** ***largiflorens,*** **I4** ***Elaeocarpus foveolatus,*** **I5** ***Apodytes brachystylis,*** **I6** ***Cryptocarya densiflora*****, I7** ***Cardwellia sublimis,*** **I8** ***Guioa montana*****, I9** ***Halfordia kendack,*** **I10** ***Rhodamnia blairiana*****, I11** ***Cryptocarya densiflora,*** **I13** ***Cryptocarya densiflora,*** **I14** ***Elaeocarpus largiflorens*** **ssp.** ***largiflorens,*** **I16** ***Elaeocarpus sericopetalus,*** **I17** ***Elaeocarpus foveolatus,*** **M1** ***Elaeocarpus ferruginiflorus,*** **M2** ***Cryptocarya angulata,*** **M3** ***Syzygium luehmannii,*** **M4** ***Rhodamnia blairiana,*** **M6** ***Rhodamnia blairiana,*** **M7** ***Rhodamnia blairiana,*** **M9** ***Rhodamnia blairiana,*** **M10** ***Xanthophyllum octandrum,*** **M11** ***Xanthophyllum octandrum,*** **M12** ***Sphenostemon lobosporus,*** **M13** ***Guioa montana,*** **M14** ***Syzygium endophloium,*** **M15** ***Syzygium wesa*****, M17** ***Bobea myrtoides,*** **M18** ***Elaeocarpus ferruginiflorus,*** **E32** ***Polyosma alangiacea.***

Figure 21: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 7 (EP 29) Mount Fisher at the time of plot establishment.

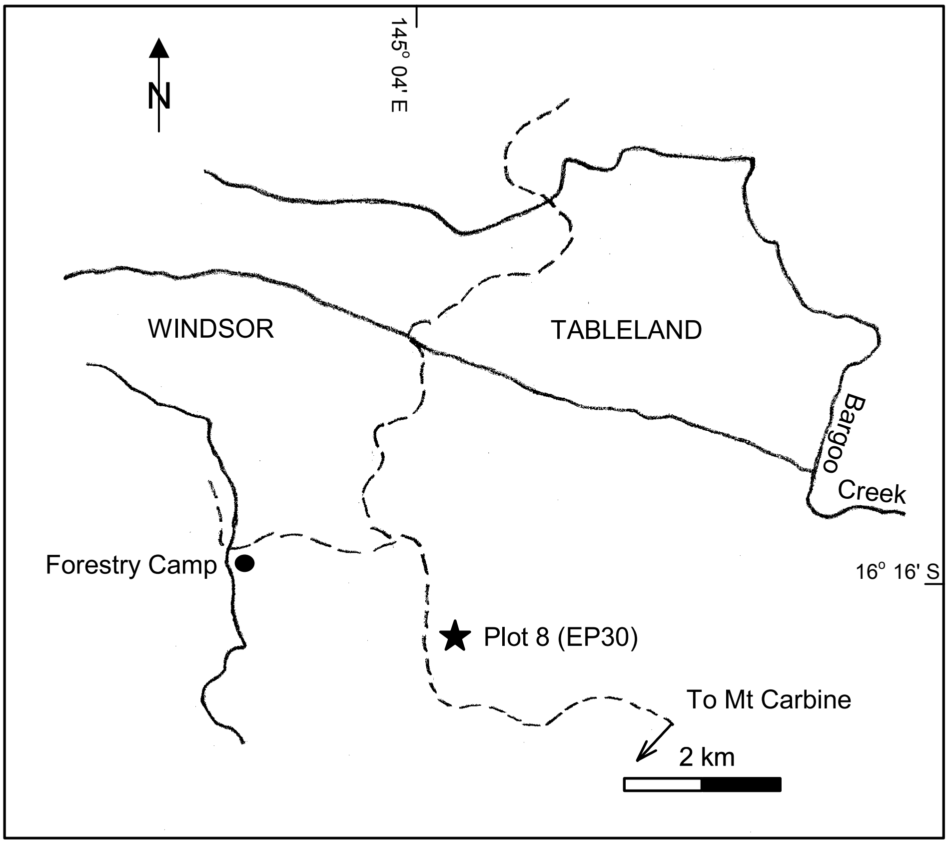
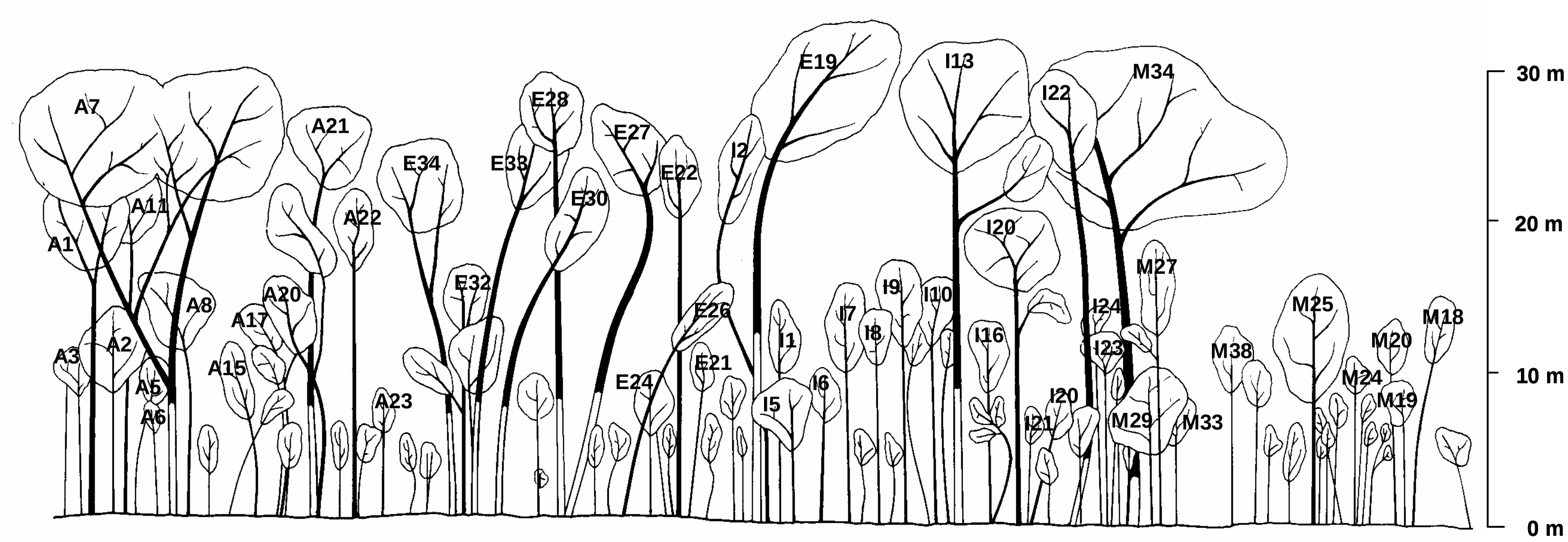


Figure 22: Location map for Plot 8 (EP 30) Agapetes Logging Area.



A1 *Flindersia brayleyana,* A2 *Polyosma alangiacea,* A3 *Flindersia bourjotiana,* A5 *Flindersia bourjotiana,* A6 *Flindersia bourjotiana,* A7 *Acacia* celsa, A8 *Flindersia bourjotiana,* A11 *Elaeocarpus* sp. (Windsor Tableland BH 5541), A15 *Polyosma alangiacea,* A17 *Darlingia darlingiana,* A20 *Ceratopetalum succirubrum,* A21 *Flindersia brayleyana,* A22 *Syzygium kuranda,* A23 *Flindersia acuminata,* E19 *Flindersia bourjotiana,* E21 *Brombya platynema,* E22 *Flindersia acuminata*, E24 *Brombya platynema*, E26 *Cardwellia sublimis*, E27 *Flindersia bourjotiana,* E28 *Flindersia brayleyana,* E30 *Litsea connorsii,* E32 *Syzygium kuranda,* E33 *Litsea connorsii,* E34 *Flindersia brayleyana,* I1 *Streblus glaber* var. *australianus,* I2 *Flindersia acuminata,* I5 *Brombya platynema*, I6 *Brombya platynema,* I7 *Beilschmiedia collina,* I8 *Ceratopetalum succirubrum,* I9 *Ceratopetalum succirubrum,* I10 *Elaeocarpus sericopetalus*, I13 *Flindersia bourjotiana,* I16 *Darlingia darlingiana*, I18 *Brombya platynema,* I20 *Syzygium kuranda,* I21 *Brombya platynema*, I22 *Flindersia acuminata*, I23 *Sarcotoechia cuneata,* I24 *Cryptocarya lividula,* M18 *Ceratopetalum succirubrum,* M19 *Brombya platynema* M20 *Beilschmiedia collina,* M24 *Syzygium kuranda,* M25 *Ceratopetalum succirubrum,* M27 *Neorites kevediana,* M29 *Brombya platynema,* M33 *Brombya platynema,* M34 *Elaeocarpus bancroftii,* M38 *Ceratopetalum succirubrum.*

Figure 23: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 8 (EP 30) Agapetes Logging Area at the time of plot establishment.

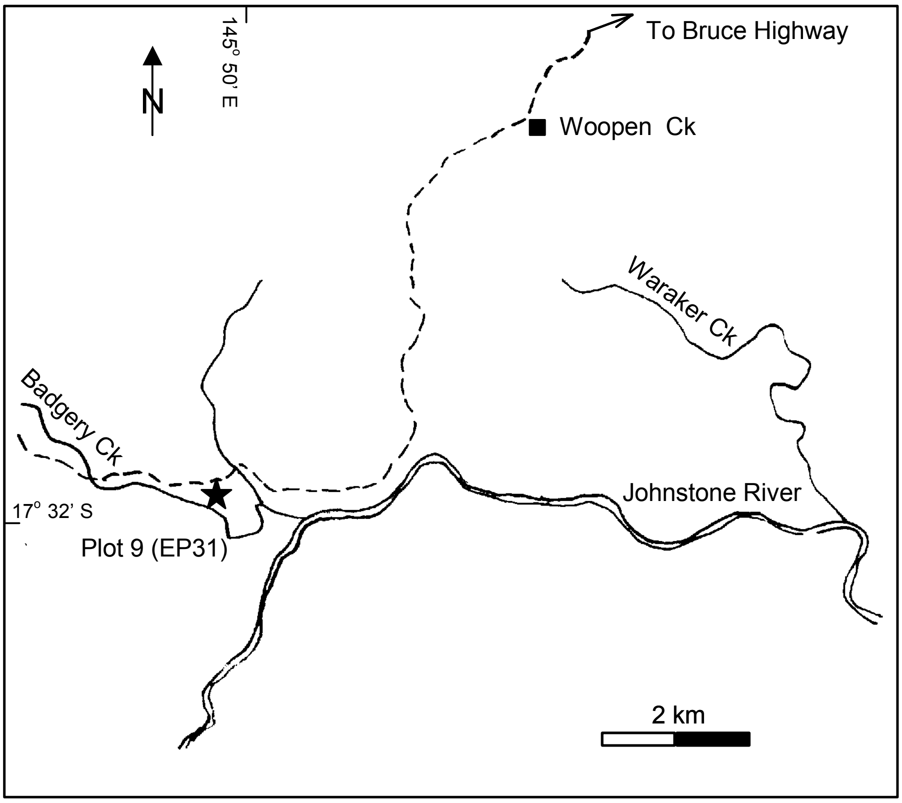
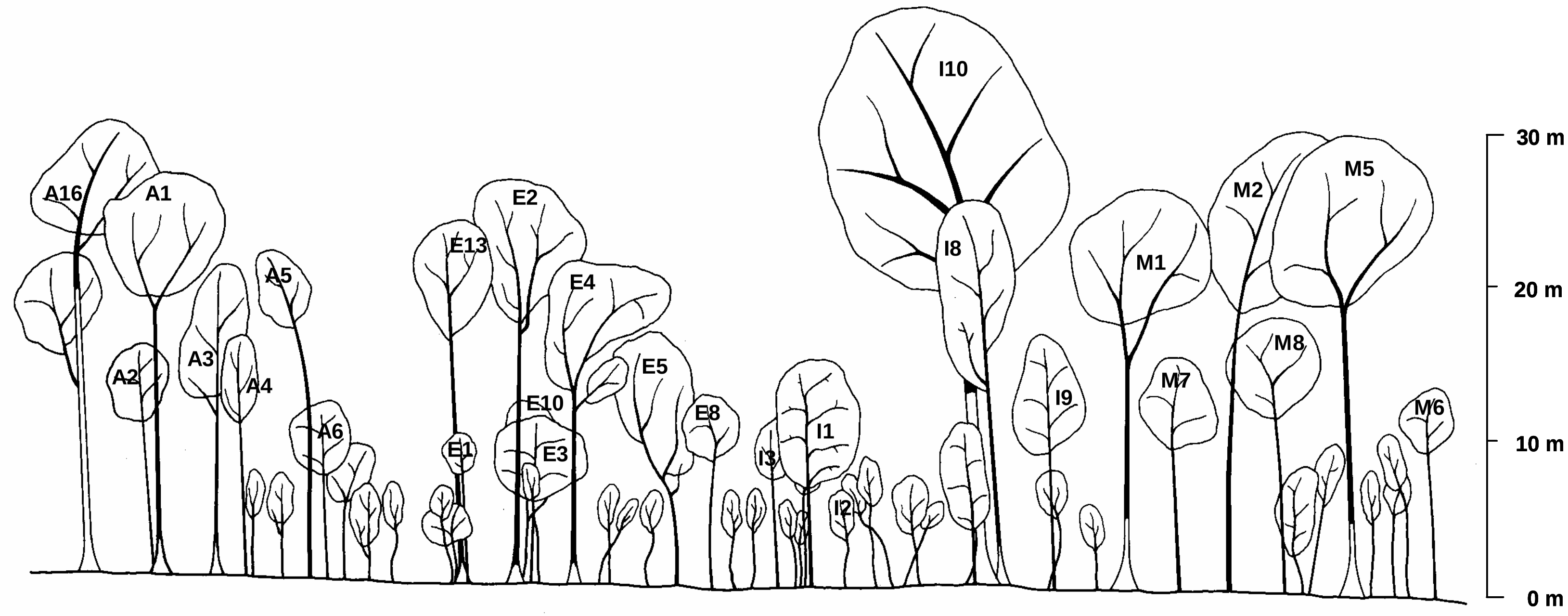


Figure 24: Location map for Plot 9 (EP 31) Woopen Creek.



A1 ***Backhousia bancroftii,*** A2 ***Backhousia bancroftii,*** A3 ***Backhousia bancroftii,*** A4 ***Backhousia bancroftii,*** A5 ***Cryptocarya murrayi,*** A6 ***Myristica muelleri ssp. globosa***, A16 ***Backhousia bancroftii,*** E1 ***Backhousia bancroftii,*** E2 ***Backhousia bancroftii,*** E3 ***Myristica muelleri ssp. globosa***, E4 ***Backhousia bancroftii,*** E5 ***Myristica muelleri ssp. globosa,*** E6 ***Myristica muelleri ssp. globosa,*** E10 ***Backhousia bancroftii,*** E13 ***Backhousia bancroftii,*** I1 ***Myristica muelleri ssp. globosa,*** I2 ***Xanthophyllum octandrum,*** I3 ***Myristica muelleri ssp. globosa***, I8 ***Backhousia bancroftii,*** I9 ***Backhousia bancroftii,*** I10 ***Backhousia bancroftii,*** M1 ***Dysoxylum pettigrewianum,*** M2 ***Backhousia bancroftii,*** M5 ***Backhousia bancroftii,*** M6 ***Barongia lophandra,*** M7 ***Myristica muelleri ssp. globosa,*** M8 ***Myristica muelleri ssp. globosa.***

Figure 25: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 9 (EP 31) Woopen Creek at the time of plot establishment.

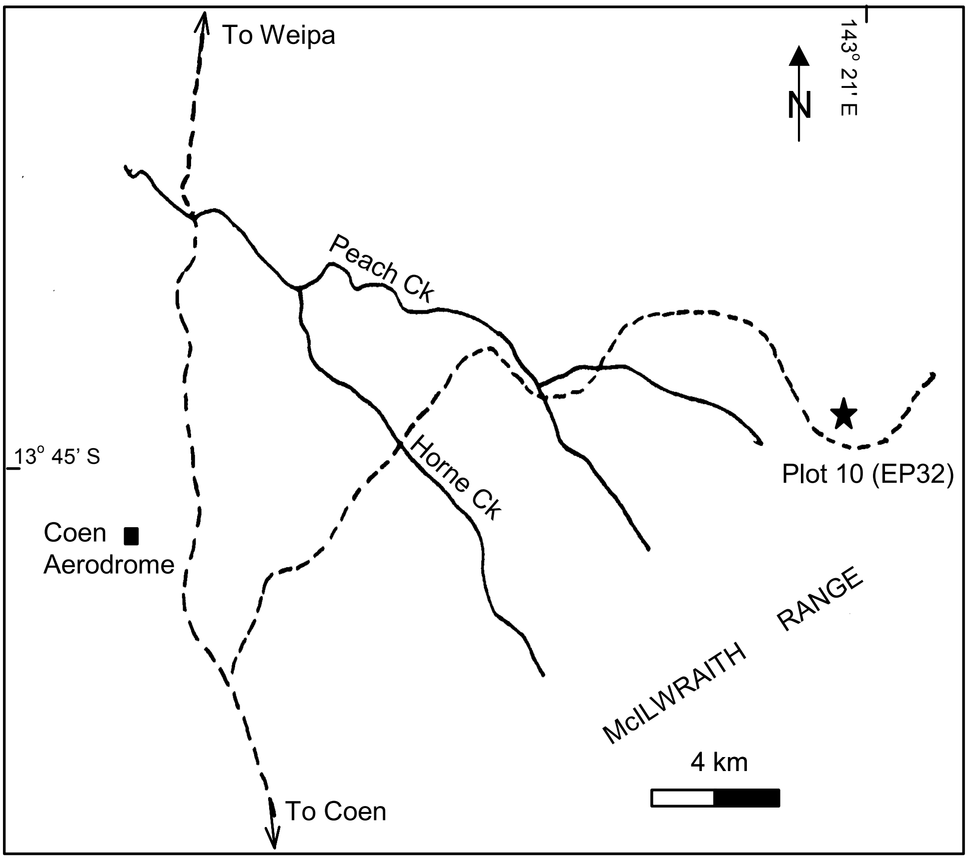
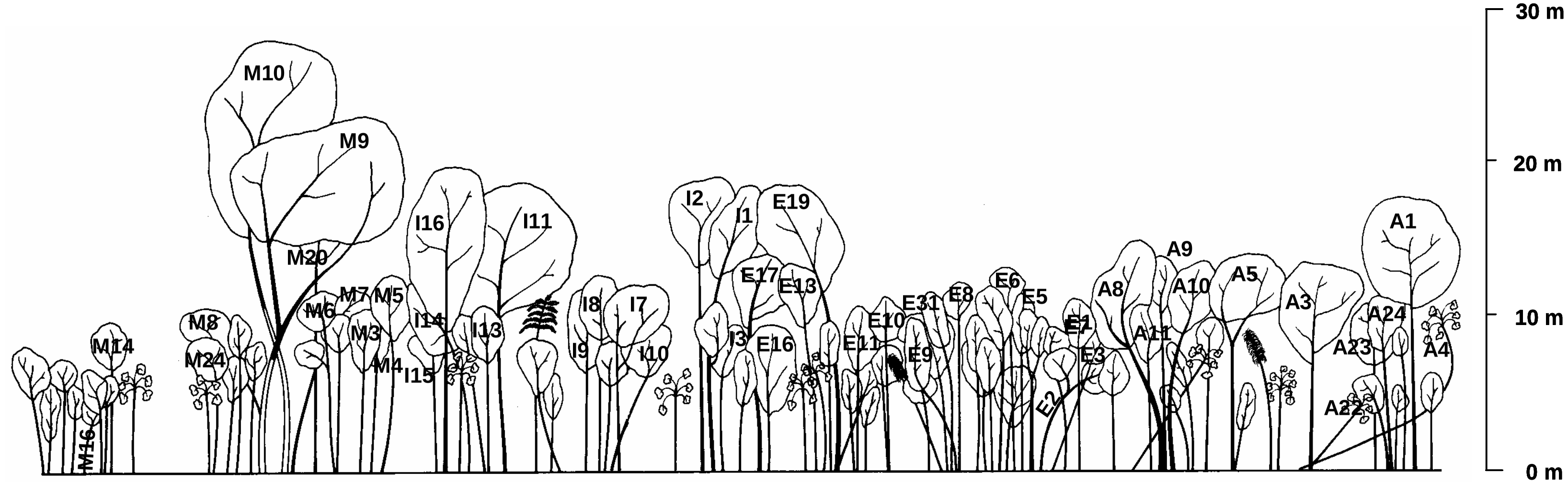


Figure 26: Location map for Plot 10 (EP 32) McIlwraith Range.



M3 ***Xanthophyllum octandrum,*** **M4** ***Cryptocarya mackinnoniana,*** **M5** ***Cryptocarya vulgaris,*** **M6** ***Beilschmiedia peninsularis,*** **M7** ***Canthium*** **sp. (Mt Rose ARB 1978), M8** ***Acronychia acronychioides,*** **M9** ***Blepharocarya involucrigera,*** **M10** ***Acmena hemilampra*** **ssp.** ***hemilampra,*** **M14** ***Cryptocarya vulgaris,*** **M16** ***Canthium*** **sp. (Mt Rose ARB 1978), M20** ***Xanthophyllum octandrum,*** **M24** ***Grevillea baileyana,*** **I1** ***Acronychia acronychioides,*** **I2** ***Grevillea baileyana,*** **I3** ***Cryptocarya mackinnoniana*****, I7** ***Cryptocarya vulgaris,*** **I8** ***Cryptocarya mackinnoniana*****, I9** ***Symplocos cochinchinensis*** **var.** ***pilosiuscula*****, I10** ***Elaeocarpus eumundi*****, I11** ***Blepharocarya involucrigera,*** **I13** ***Garcinia warrenii*****, I14** ***Cryptocarya vulgaris,*** **I15** ***Cryptocarya mackinnoniana,*** **I16** ***Cryptocarya vulgaris,*** **E1** ***Rapanea porosa,*** **E2** ***Antirhea tenuiflora,*** **E3** ***Rapanea porosa,*** **E5** ***Xanthophyllum octandrum,*** **E6** ***Canthium*** **sp. (Mt Rose ARB 1978), E7** ***Cleistanthus hylandii*** **E8** ***Cleistanthus hylandii,*** **E9** ***Syzygium apodophyllum,*** **E10** ***Cryptocarya mackinnoniana,*** **E11** ***Atractocarpus sessilis,*** **E13** ***Cinnamomum baileyanum,*** **E16** ***Endiandra glauca,*** **E17** ***Xanthophyllum octandrum,*** **E19** ***Cinnamomum baileyanum,*** **E31** ***Cleistanthus hylandii,*** **A1** ***Cryptocarya vulgaris,*** **A3** ***Cryptocarya vulgaris,*** **A4** ***Licuala ramsayi,*** **A5** ***Acronychia acronychioides,*** **A8** ***Endiandra dielsiana,*** **A9** ***Cryptocarya vulgaris,*** **A10** ***Sloanea macbrydei,*** **A11** ***Cryptocarya vulgaris,*** **A22** ***Licuala ramsayi,*** **A23** ***Sarcopteryx*** **sp. (McIlwraith Range BH 3261RFK), A24** ***Acronychia acronychioides.***

Figure 27: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 10 (EP 32) McIlwraith Range at the time of plot establishment.

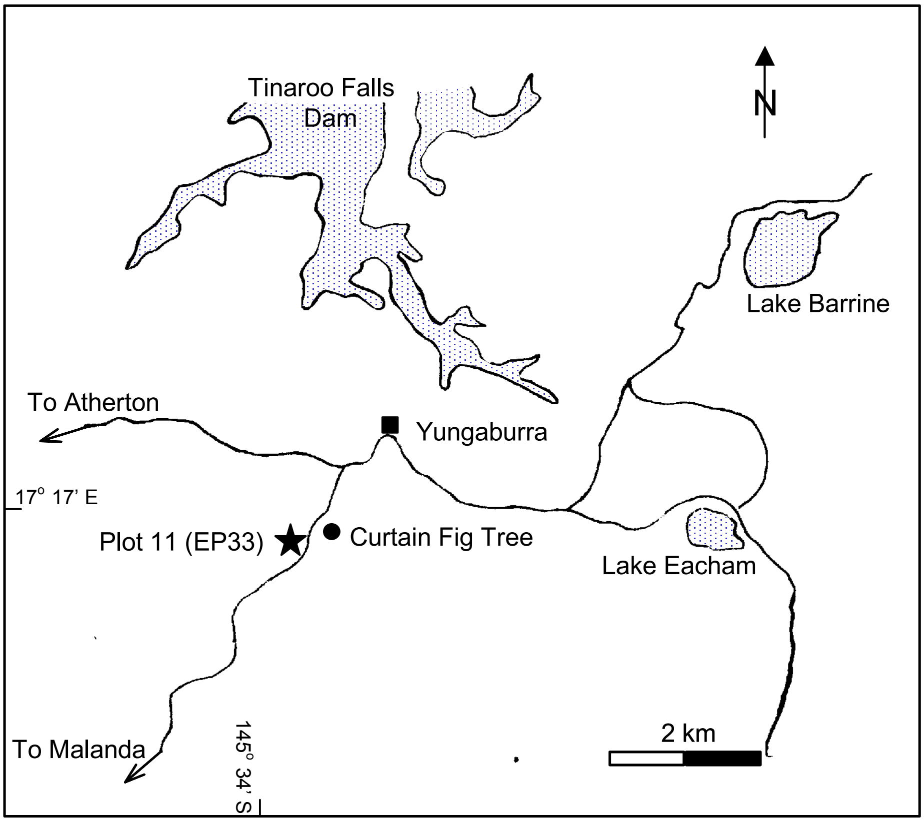


Figure 28: Location map for Plot 11 (EP 33) Curtain Fig.

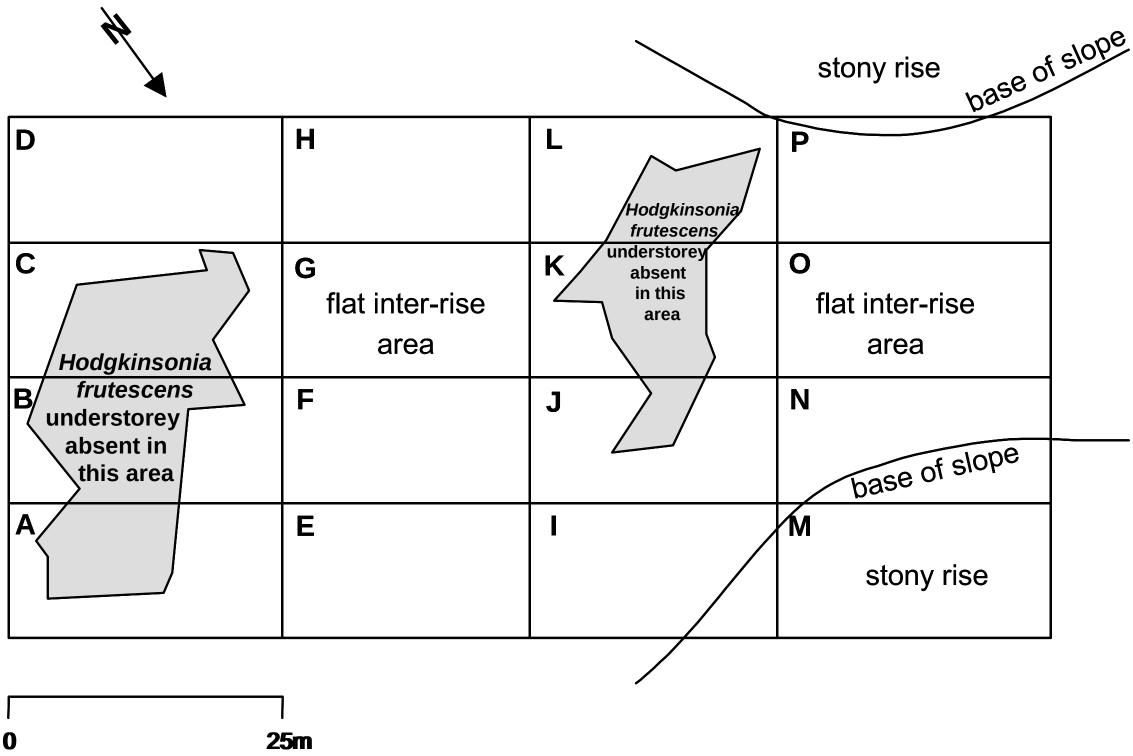
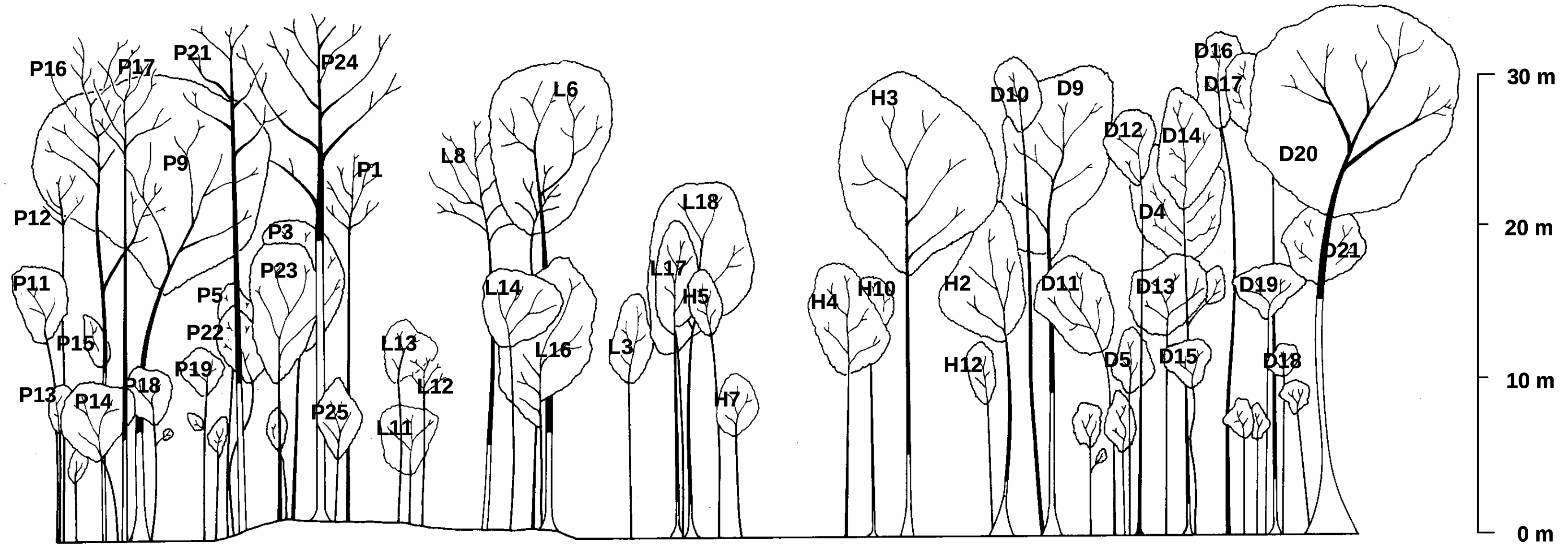


Figure 29: A semi-diagrammatic map of Plot 11 (EP 33) Curtain Fig showing the position of the stony rises and those areas of the plot where *Hodgkinsonia frutescens* is absent in the understorey.



P1 *Toona ciliata*, P3 *Dendrocnide photinophylla*, P5 *Dendrocnide photinophylla*, P9 *Dysoxylum pettigrewianum*, P11 *Dendrocnide photinophylla*, P12 *Toona ciliata*, P13 *Dendrocnide photinophylla*, P14 *Dendrocnide photinophylla*, P15 *Dendrocnide photinophylla*, P16 *Toona ciliata*, P17 *Toona ciliata*, P18 *Dendrocnide photinophylla*, P19 *Dendrocnide photinophylla*, P21 *Toona ciliata*, P22 *Tetrasynandra laxiflora*, P23 *Endiandra insignis*, P24 *Toona ciliata*, P25 *Argyrodendron* sp. (Boonjee BH 2139RFK), L3 *Endiandra monothyra* ssp. *monothyra*, L6 *Aleurites rockinghamensis*, L8 *Toona ciliata*, L11 *Aglaia sapindina*, L12 *Toona ciliata*, L13 *Ficus rubiginosa*, L14 *Daphnandra repandula*, L15 *Toona ciliata*, L16 *Dysoxylum pettigrewianum*, L17 *Argyrodendron* sp. (Boonjee BH 2139RFK), L18 *Diploglottis diphyllostegia*, H2 *Argyrodendron* sp. (Boonjee BH 2139RFK), H3 *Flindersia brayleyana*, H4 *Mallotus polyadenos*, H5 *Daphnandra repandula*, H7 *Ternstroemia cherryi*, H10 *Dendrocnide photinophylla*, H12 *Litsea leefeana*, D4 *Dendrocnide photinophylla*, D5 *Argyrodendron* sp. (Boonjee BH 2139RFK), D9 *Dendrocnide photinophylla*, D10 *Cryptocarya hypospodia*, D11 *Endiandra insignis*, D12 *Endiandra monothyra* ssp. *monothyra*, D13 *Siphonodon membranaceus*, D14 *Endiandra monothyra* ssp. *monothyra*, D15 *Eupomatia laurina*, D16 *Endiandra cowleyana*, D17 *Firmiana papuana*, D18 *Mallotus polyadenos*, D19 *Daphnandra repandula*, D20 *Dysoxylum pettigrewianum* D21 *Dysoxylum pettigrewianum*.

Figure 30: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 11 (EP 33) Curtain Fig at the time of plot establishment.

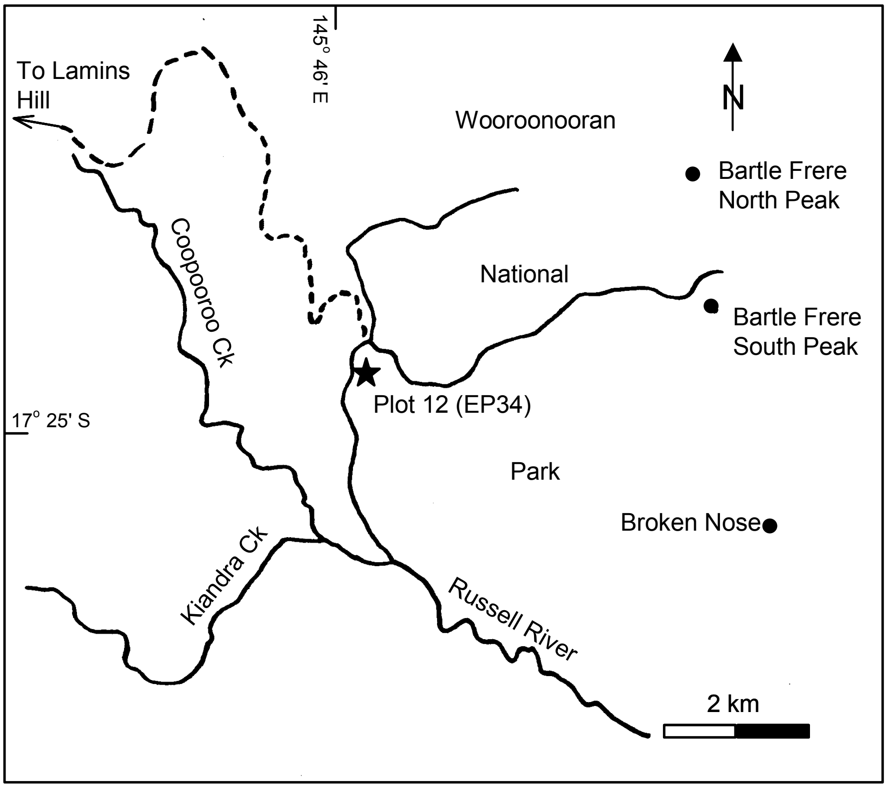


Figure 31: Location map for Plot 12 (EP 34) Russell River.

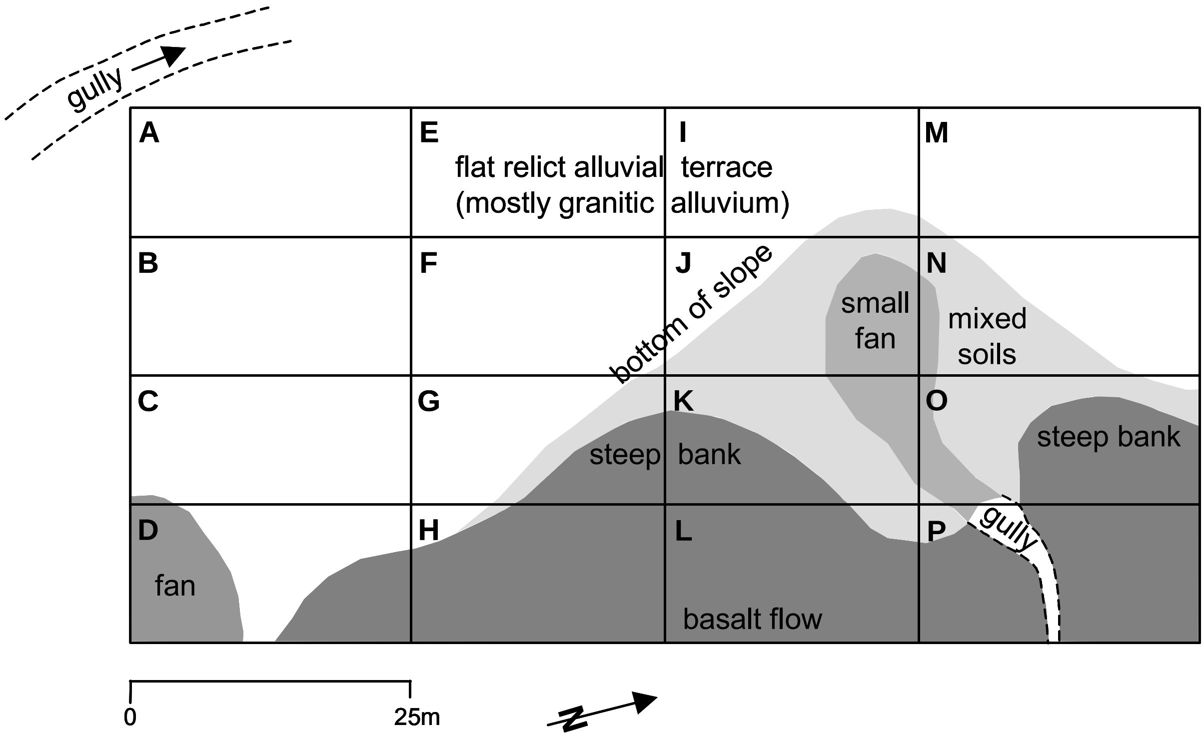
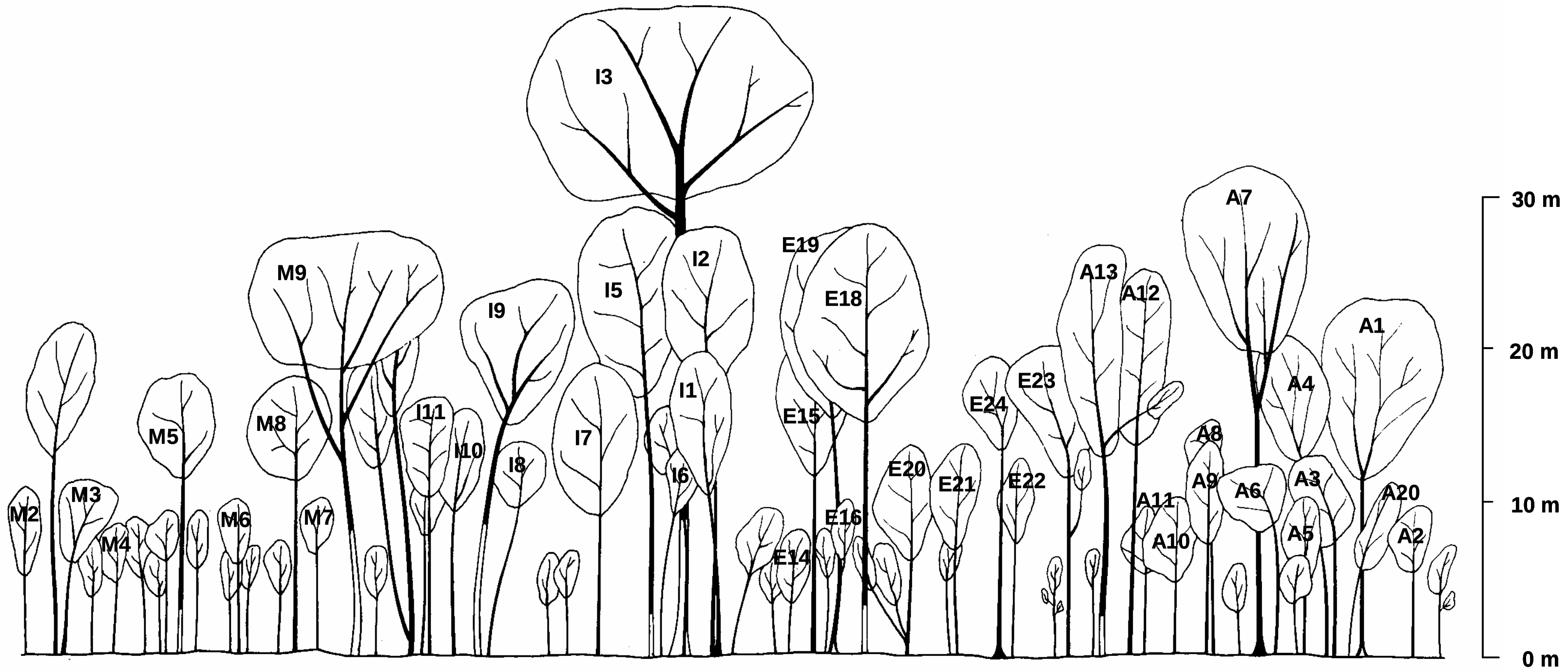


Figure 32: A sketch of the site at Plot 12 (EP 34) Russell River showing the location of the major geomorphic features. Details of the origin of the basaltic lava flow are given in the text.



M2 *Opisthiolepis heterophylla,* M3 *Toechima erythrocarpum,* M4 *Macaranga inamoena,* M5 *Cryptocarya murrayi,* M6 *Xanthophyllum octandrum*, M7 *Pilidiostigma tropicum,* M8 *Endiandra monothyra* ssp. *monothyra,* M9 *Cardwellia sublimis*, I1 *Beilschmiedia volckii*, I2 *Doryphora aromatica*, I3 *Alstonia scholaris*, I5 *Syzygium sayeri,* I6 *Doryphora aromatica*, I7 *Opisthiolepis heterophylla*, I8 *Endiandra monothyra* ssp. *monothyra*, I9 *Ficus pleurocarpa*, I10 *Endiandra monothyra* ssp. *monothyra,* I11 *Argyrodendron trifoliolatum,* E14 *Hollandaea sayeriana,* E15 *Argyrodendron peralatum,* E16 *Citronella smythii,* E18 *Opisthiolepis heterophylla,* E19 *Alstonia scholaris,* E20 *Apodytes brachystylis,* E21 *Toechima erythrocarpum,* E22 *Beilschmiedia tooram,* E23 *Toechima erythrocarpum,* E24 *Sloanea australis* ssp. *parviflora,* A1 *Sloanea australis* ssp. *parviflora,* A2 *Haplostichanthus* sp. (Johnstone River LWJ 471), A3 *Apodytes brachystylis,* A4 *Tetrasynandra laxiflora,* A5 *Beilschmiedia bancroftii,* A6 *Alangium villosum* ssp. *polyosmoides,* A7 *Syzygium gustavioides*, A8 *Hylandia dockrillii,* A9 *Beilschmiedia tooram,* A10 *Rockinghamia angustifolia* A11 *Rockinghamia angustifolia,* A12 *Opisthiolepis heterophylla*, A13 *Endiandra bessaphila,* A20 *Beilschmiedia tooram.*

Figure 33: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 12 (EP 34) Russell River at the time of plot establishment.

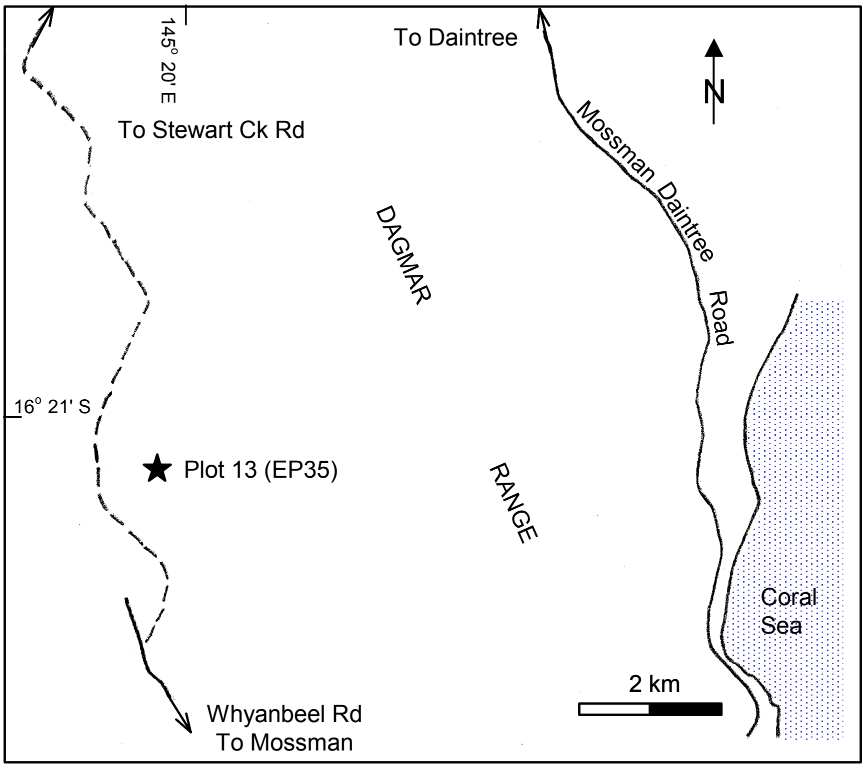


Figure 34: Location map for Plot 13 (EP 35) Whyanbeel.

M16 *Endiandra wolfei,* M17 *Elaeocarpus bancroftii,* M22 *Musgravea stenostachya,* M23 *Flindersia bourjotiana,* M24 *Calophyllum sil,* M26 *Pouteria chartacea,* M27 *Calophyllum sil,* M28 *Cryptocarya lividula,* M29 *Sarcopteryx reticulata,* M30 *Canthium sp. (Copper-Lode Falls C.H.Gittens 2211),* M33 *Cryptocarya lividula,* M34 *Darlingia darlingiana,* M35 *Normanbya normanbyi,* M36 *Endiandra wolfei,* M37 *Ormosia ormondii,* M38 *Backhousia hughesii*, M44 *Flindersia bourjotiana*, I1 *Cryptocarya lividula,* I2 *Syzygium kuranda,* I3 *Musgravea stenostachya,* I4 *Cryptocarya lividula,* I8 *Litsea bindoniana*, I15 *Syzygium kuranda,* I16 *Elaeocarpus* sp. (Windsor Tableland LJB 18336), I18 *Flindersia bourjotiana,* I20 *Flindersia bourjotiana*, I21 *Flindersia pimenteliana,* I23 *Waterhousea unipunctata*, I24 *Polyscias australiana,* I25 *Syzygium johnsonii,* I26 *Alstonia muelleriana,* I27 *Flindersia pimenteliana,* I45 *Acacia celsa*, E10 *Musgravea stenostachya,* E14 *Litsea bindoniana,* E19 *Cryptocarya lividula,* E21 *Acacia* celsa, E23 *Musgravea stenostachya,* E24 *Polyscias australiana*, E25 *Waterhousea unipunctata,* E26 *Waterhousea unipunctata,* E29 *Endiandra wolfei,* E30 *Syzygium kuranda,* E31 *Syzygium kuranda,* E33 *Cryptocarya corrugata,* E34 *Endiandra wolfei,* E36 *Acmena divaricata,* E37 *Syzygium kuranda,* E39 *Cryptocarya lividula,* E40 *Neorites kevediana,* A1 *Diospyros hebecarpa,* A2 *Atractocarpus fitzalanii ssp. fitzalani,* A4 *Musgravea stenostachya,* A5 *Flindersia bourjotiana,* A6 *Beilschmiedia bancroftii,* A7 *Musgravea stenostachya,* A8 *Flindersia bourjotiana,* A9 *Neorites kevediana,* A10 *Pouteria chartacea,* A11 *Waterhousea unipunctata,* A13 *Syzygium kuranda,* A15 *Musgravea stenostachya,* A16 *Acronychia acronychioides,* A17 *Syzygium kuranda,* A24 *Elaeocarpus bancroftii.*

Figure 35: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 13 (EP 35) Whyanbeel at the time of plot establishment.

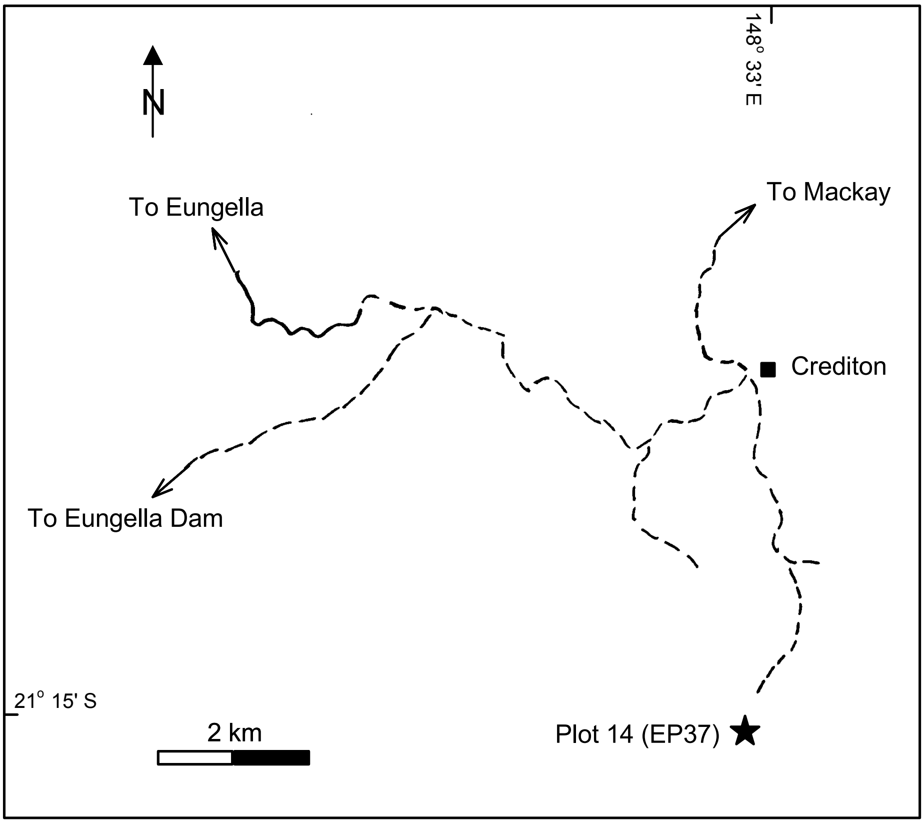
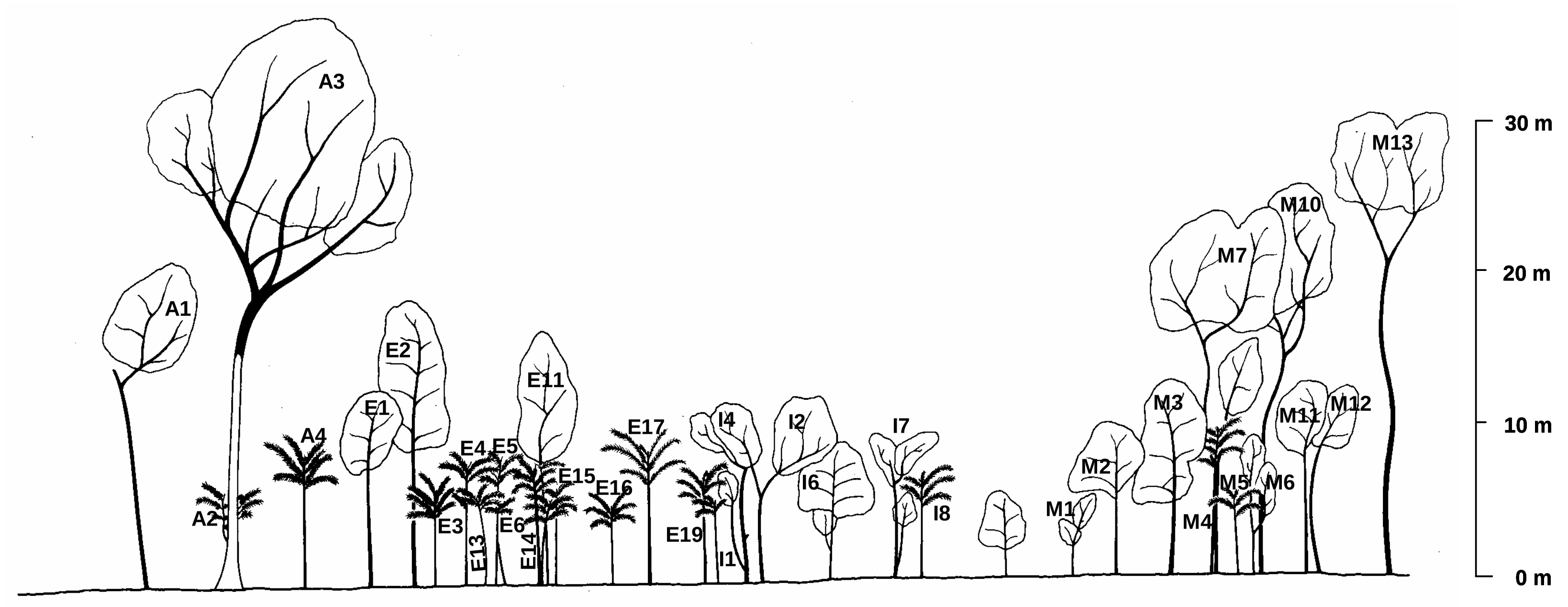


Figure 36: Location map for Plot 14 (EP 37) Eungella.



A1 ***Cryptocarya angulata,*** **A2** ***Archontophoenix cunninghamiana,*** **A3** ***Acmena resa,*** **A4** ***Archontophoenix cunninghamiana,*** **E1** ***Cryptocarya angulata,*** **E2** ***Cryptocarya angulata,*** **E3** ***Archontophoenix cunninghamiana,*** **E4** ***Archontophoenix cunninghamiana,*** **E5** ***Archontophoenix cunninghamiana,*** **E6** ***Archontophoenix cunninghamiana*****, E11** ***Cryptocarya angulata,*** **E13** ***Archontophoenix cunninghamiana,*** **E14** ***Archontophoenix cunninghamiana,*** **E15** ***Archontophoenix cunninghamiana,*** **E16** ***Archontophoenix cunninghamiana,*** **E17** ***Archontophoenix cunninghamiana,*** **E19** ***Archontophoenix cunninghamiana,*** **I1** ***Archontophoenix cunninghamiana,*** **I2** ***Dendrocnide photinophylla,*** **I4** ***Dendrocnide photinophylla,*** **I6** ***Cryptocarya angulata*****, I7** ***Dendrocnide photinophylla,*** **I8** ***Archontophoenix cunninghamiana,*** **M1** ***Dendrocnide photinophylla,*** **M2** ***Cryptocarya angulata*****, M3** ***Cryptocarya angulata*****, M4** ***Archontophoenix cunninghamiana,*** **M5** ***Archontophoenix cunninghamiana,*** **M6** ***Dendrocnide photinophylla,*** **M7** ***Cryptocarya angulata*****, M10** ***Cinnamomum laubatii,*** **M11** ***Cryptocarya angulata,*** **M12** ***Cryptocarya grandis,*** **M13** ***Cinnamomum laubatii.***

Figure 36: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 14 (EP 37) Eungella at the time of plot establishment.

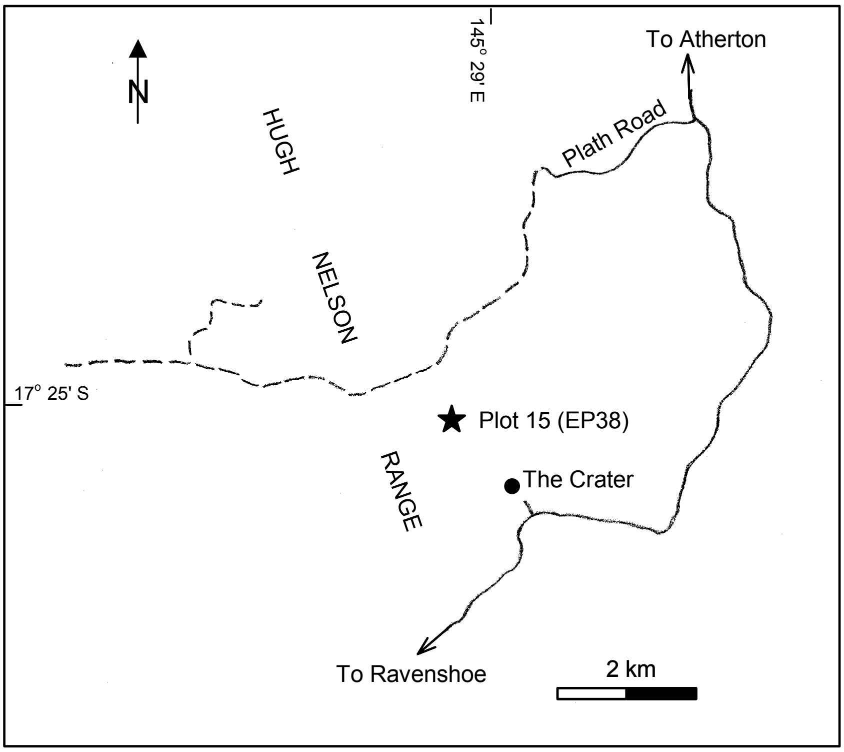
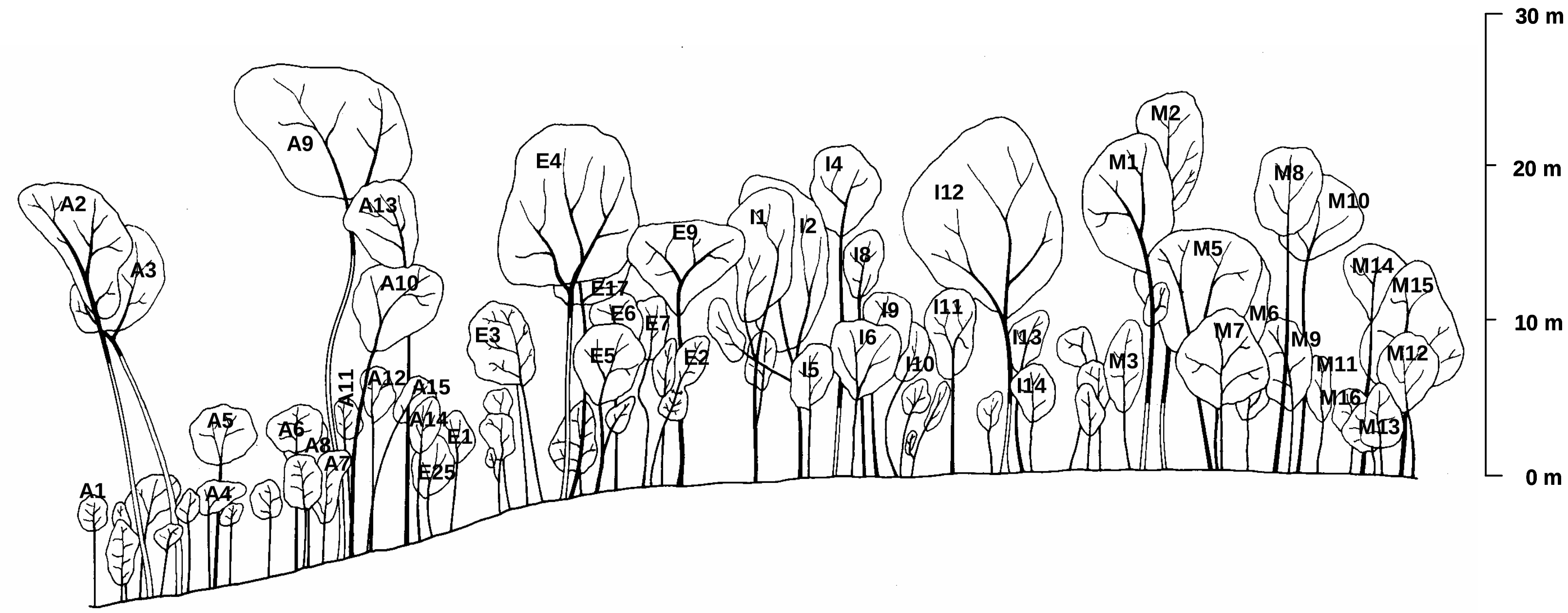


Figure 37: Location map for Plot 15 (EP 38) The Crater.



A1 *Pouteria brownlessiana,* A2 *Cryptocarya onoprienkoana,* A3 *Cryptocarya corrugata,* A4 *Fontainea picrosperma,* A5 *Endiandra insignis,* A6 *Myristica muelleri ssp. globosa,* A7 *Fontainea picrosperma,* A8 *Myristica muelleri ssp. globosa,* A9 *Cryptocarya corrugata,* A10 *Aleurites rockinghamensis,* A11 *Franciscodendron laurifolium,* A12 *Elaeocarpus ruminatus,* A13 *Alphitonia whitei,* A14 *Rhodamnia sessiliflora,* A15 *Acronychia acidula,* E1 *Diospyros* sp. (Mt Lewis LSS 10107), E2 *Cryptocarya onoprienkoana,* E3 *Cryptocarya onoprienkoana,* E4 *Franciscodendron laurifolium,* E5 *Tetrasynandra laxiflora,* E6 *Cryptocarya onoprienkoana,* E7 *Acronychia acidula,* E9 *Neolitsea dealbata,* E17 *Cryptocarya onoprienkoana,* E25 *Fontainea picrosperma,* I1 *Cryptocarya onoprienkoana*, I2 *Zanthoxylum veneficum*, I4 *Flindersia brayleyana*, I5 *Acronychia acidula,* I6 *Acronychia acidula,* I8 *Stenocarpus sinuatus*, I9 *Castanospora alphandii*, I10 *Franciscodendron laurifolium*, I11 *Dendrocnide photinophylla,* I12 *Zanthoxylum veneficum,* I13 *Stenocarpus sinuatus*, I14 *Neisosperma poweri,* M1 *Dendrocnide photinophylla,* M2 *Stenocarpus sinuatus,* M3 *Stenocarpus sinuatus,* M5 *Castanospora alphandii*, M6 *Litsea leefeana*, M7 *Endiandra insignis,* M8 *Brachychiton acerifolius,* M9 *Pouteria brownlessiana,* M10 *Cryptocarya onoprienkoana,* M11 *Daphnandra repandula,* M12 *Endiandra insignis,* M13 *Diospyros* sp. (Mt Lewis LSS 10107), M14 *Brachychiton acerifolius,* M15 *Endiandra insignis,* M16 *Pouteria brownlessiana.*

Figure 38: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 15 (EP 38) The Crater at the time of plot establishment.

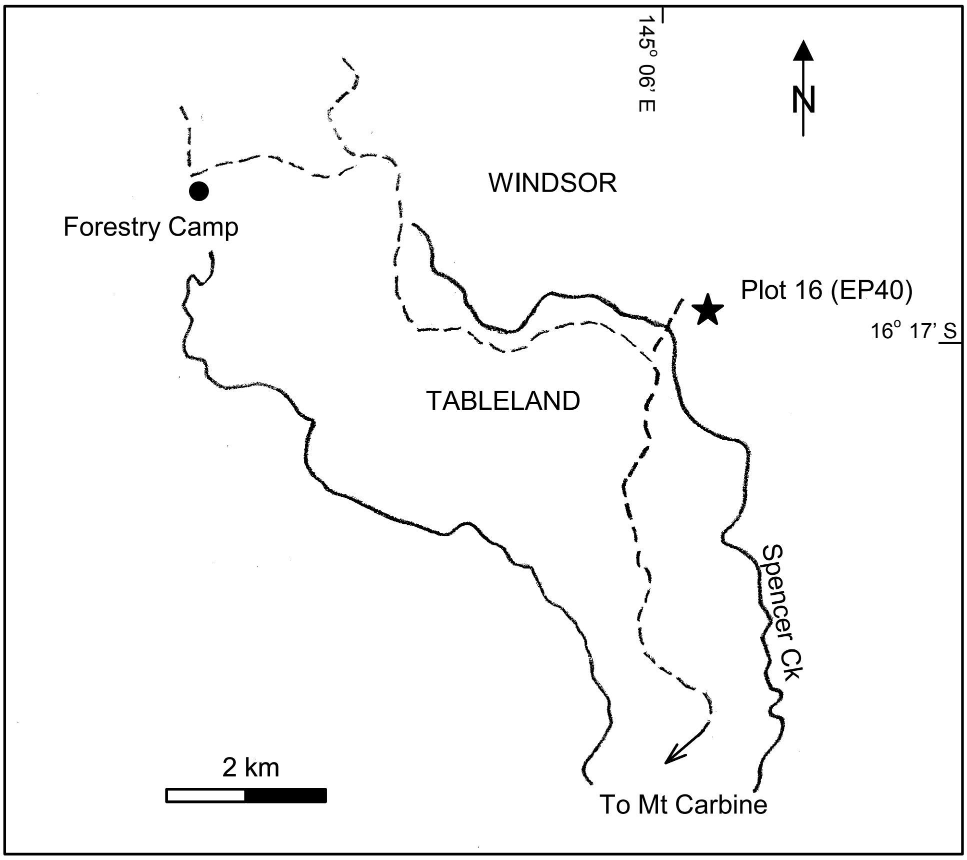


Figure 39: Location map for Plot 16 (EP 40) Agapetes Scientific Area.

A1 Acronychia laevis, A2 Rhodomyrtus macrocarpa, A3 Argyrodendron polyandrum, A4 Backhousia hughesii, A6 Mallotus polyadenos, A8 Flindersia ifflaiana, A9 Flindersia ifflaiana, A10 Backhousia hughesii, A14 Backhousia hughesii, A15 Argyrodendron polyandrum, E1 Flindersia ifflaiana, E5 Polyalthia nitidissima, E6 Backhousia hughesii, E7 Backhousia hughesii, E8 Argyrodendron polyandrum, E11 Mallotus polyadenos, E15 Backhousia hughesii, E16 Atractocarpus fitzalani ssp. tenuipes*, E17 *Acronychia laevis, E18 Elaeocarpus coorangooloo, I1 Argyrodendron polyandrum, I2 Podocarpus grayae, I3 Backhousia hughesii, I4 Backhousia hughesii, I5 Mallotus polyadenos, I6 Flindersia ifflaiana, I11 Mallotus polyadenos, I12 Acronychia laevis, I13 Mallotus polyadenos, I14 Agathis robusta, I15 Elaeodendron australe var. (Windsor Tableland BH 5574), I16 Polyscias elegans, I17 Argyrodendron polyandrum, M1 Agathis robusta, M5 Pseudoweinmannia lachnocarpa, M6 Mallotus polyadenos, M7 Pseudoweinmannia lachnocarpa, M8 Backhousia hughesii, M9 Polyalthia nitidissima, M10 Elaeodendron australe var. (Windsor Tableland BH 5574), M11 Polyalthia nitidissima, M12 Argyrodendron polyandrum, M13 Backhousia hughesii, M14 Argyrodendron polyandrum, M15 Mallotus polyadenos, M17 Argyrodendron polyandrum, M19 Backhousia hughesii.

Figure 40: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 16 (EP 40) Agapetes Scientific Area at the time of plot establishment.

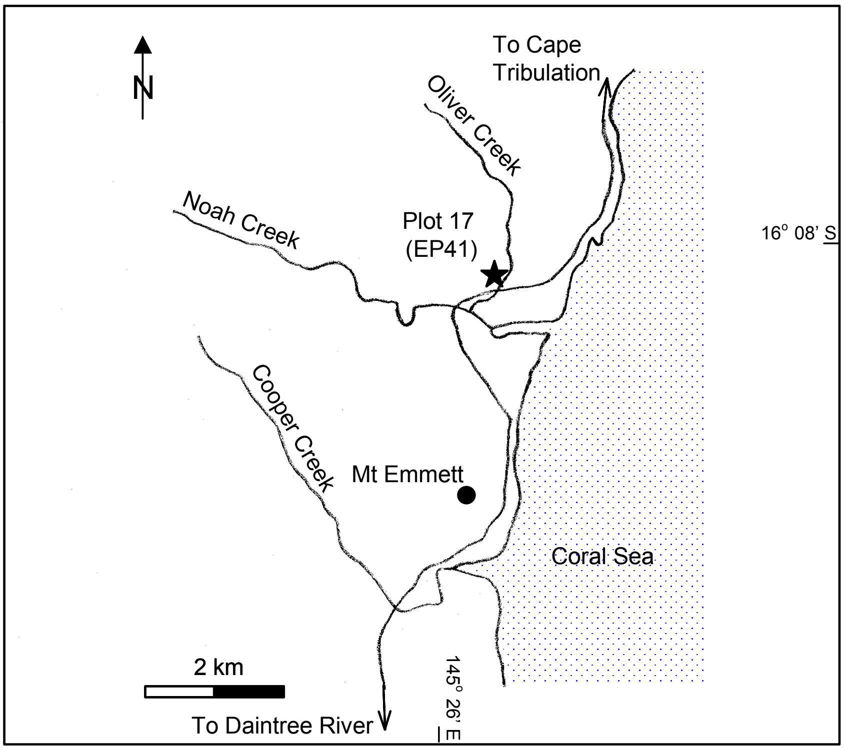


Figure 41: Location map for Plot 17 (EP 41) Oliver Creek.

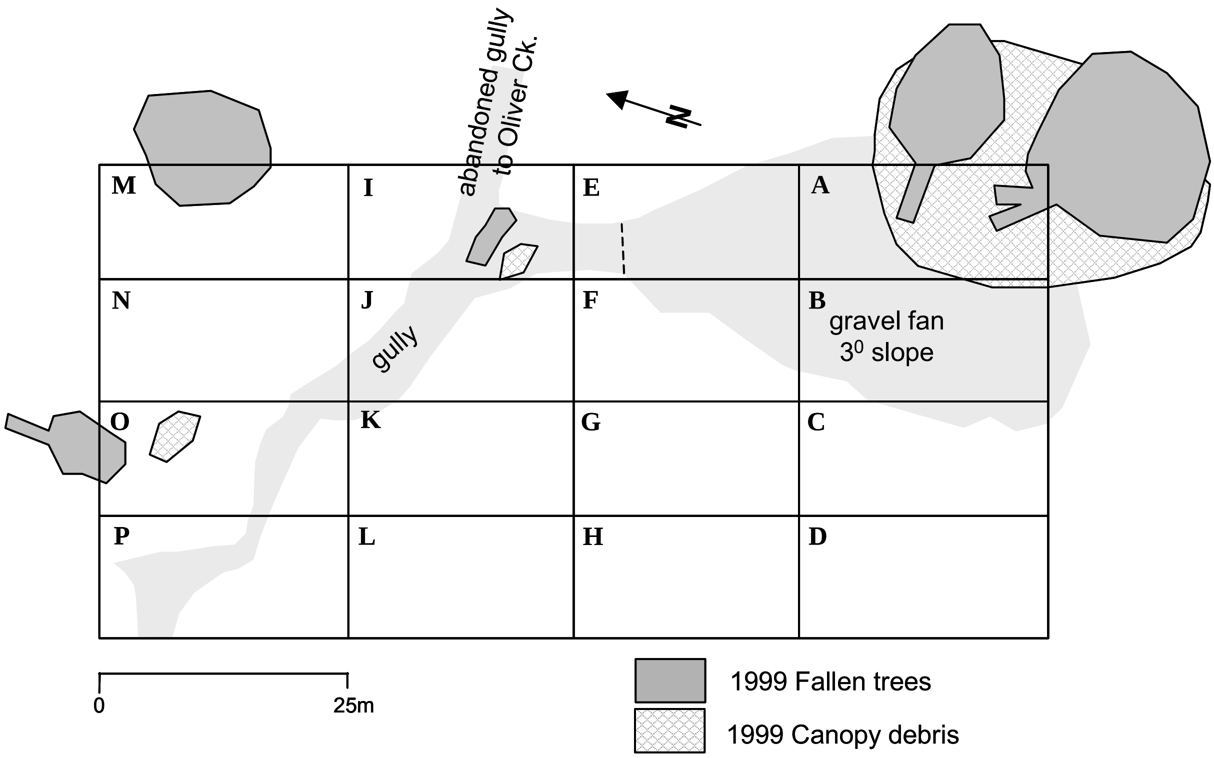


Figure 42: A sketch of the site at Plot 17 (EP41) Oliver Creek showing the location of the channel of the ephemeral creek and extent of coarse gravel and cobble movement and deposition across the plot. This depositional area was most recently re-disturbed during Tropical Cyclone *Rona* in 1999 when the mapped fallen trees and canopy debris were brought down.

A1 *Lindsayomyrtus racemoides*, A2 *Ryparosa javanica*, A3 *Lindsayomyrtus racemoides*, A4 *Storckiella australiensis*, A5 *Lindsayomyrtus racemoides*, A6 *Storckiella australiensis*, A7 *Lindsayomyrtus racemoides*, A8 *Lindsayomyrtus racemoides*, A9 *Lindsayomyrtus racemoides*, A10 *Lindsayomyrtus racemoides*, A11 *Ryparosa javanica*, A12 *Gillbeea whypallana*, A13 *Xanthophyllum octandrum*, A15 *Storckiella australiensis*, A16 *Lindsayomyrtus racemoides*, A17 *Idiospermum australiense*, A19 *Lindsayomyrtus racemoides*, E1 *Lindsayomyrtus racemoides*, E2 *Beilschmiedia bancroftii*, E3 *Ryparosa javanica*, E4 *Lindsayomyrtus racemoides*, E6 *Toechima erythrocarpum*, E7 *Lindsayomyrtus racemoides*, E8 *Medicosma fareana*, E9 *Ryparosa javanica*, E10 *Cleistanthus myrianthus*, E15 *Lindsayomyrtus racemoides*, I1 *Commersonia bartramia*, I2 *Storckiella australiensis*, I3 *Idiospermum australiense*, I4 *Lindsayomyrtus racemoides*, I5 *Cryptocarya grandis*, I6 *Storckiella australiensis*, I7 *Lindsayomyrtus racemoides*, I8 *Ristantia pachysperma*, I9 *Medicosma fareana*, I10 *Lindsayomyrtus racemoides*, I11 *Idiospermum australiense*, I12 *Ryparosa javanica*, I13 *Idiospermum australiense*, I14 *Beilschmiedia bancroftii*, I15 *Lindsayomyrtus racemoides*, M1 *Lindsayomyrtus racemoides*, M2 *Lindsayomyrtus racemoides*, M3 *Cleistanthus myrianthus*, M4 *Citronella smythii*, M5 *Xanthophyllum octandrum*, M6 *Gomphandra australiana*, M7 *Ryparosa javanica*, M8 *Idiospermum australiense*, M9 *Gillbeea whypallana*, M10 *Xanthophyllum octandrum*, M11 *Lindsayomyrtus racemoides*, M13 *Lindsayomyrtus racemoides*, M14 *Ryparosa javanica*, M26 *Cryptocarya mackinnoniana*.

Figure 43: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 17 (EP 41) Oliver Creek at the time of plot establishment.

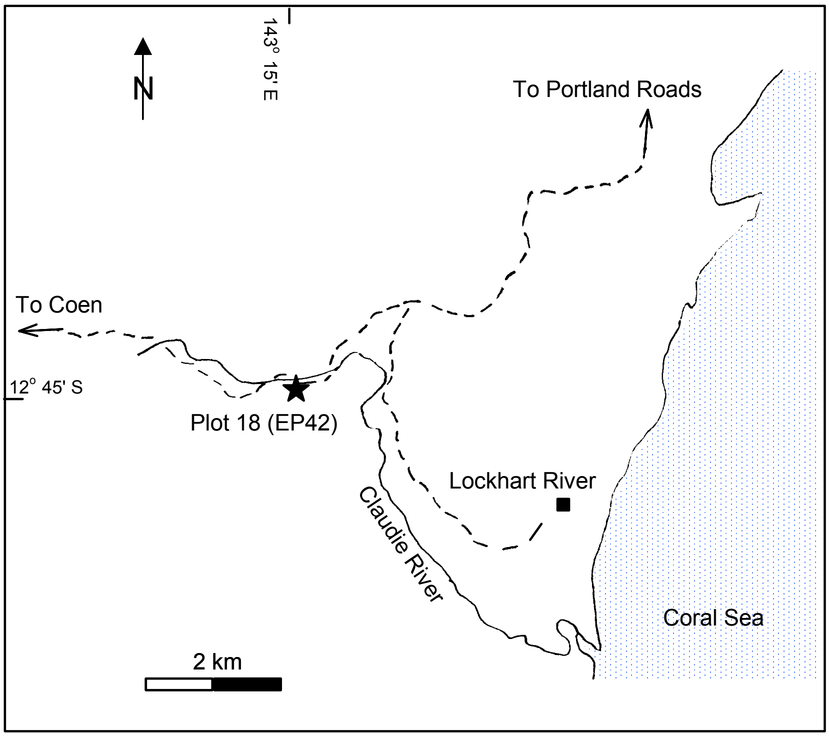


Figure 44: Location map for Plot 18 (EP 42) Iron Range.

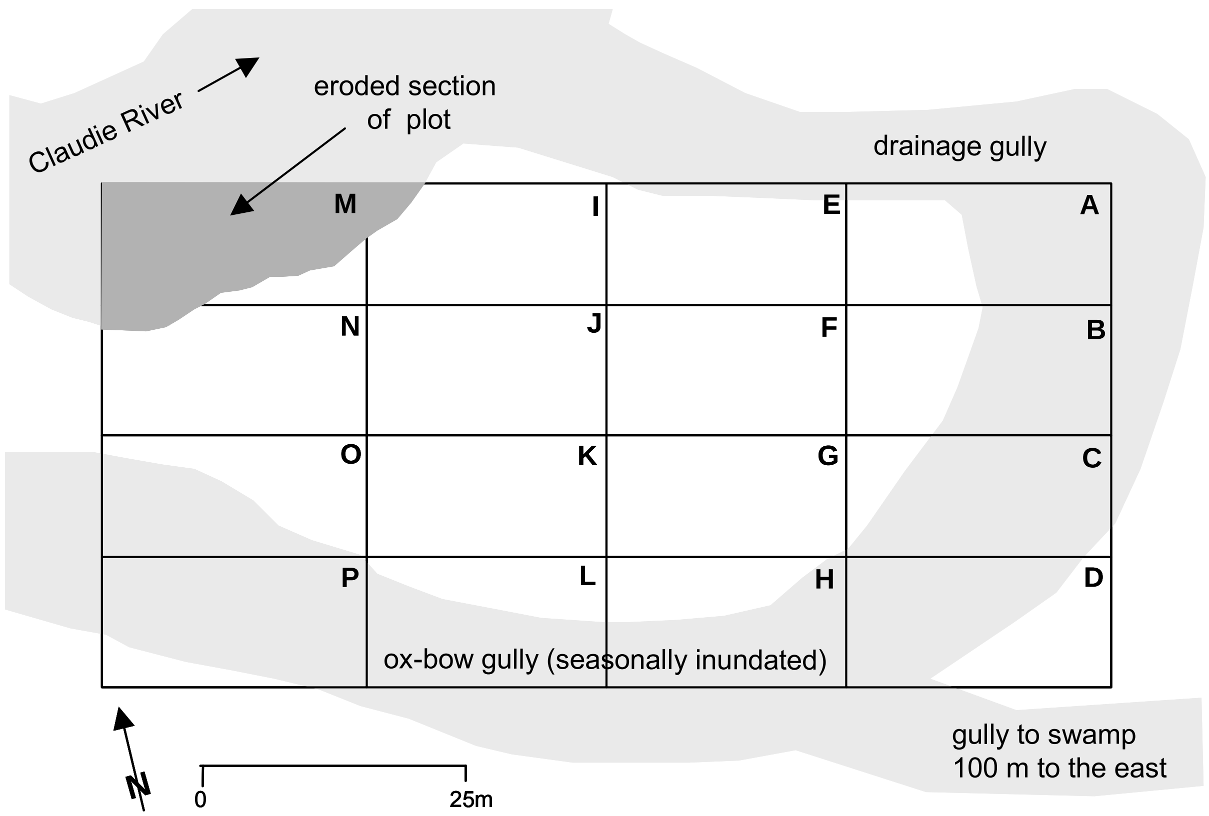
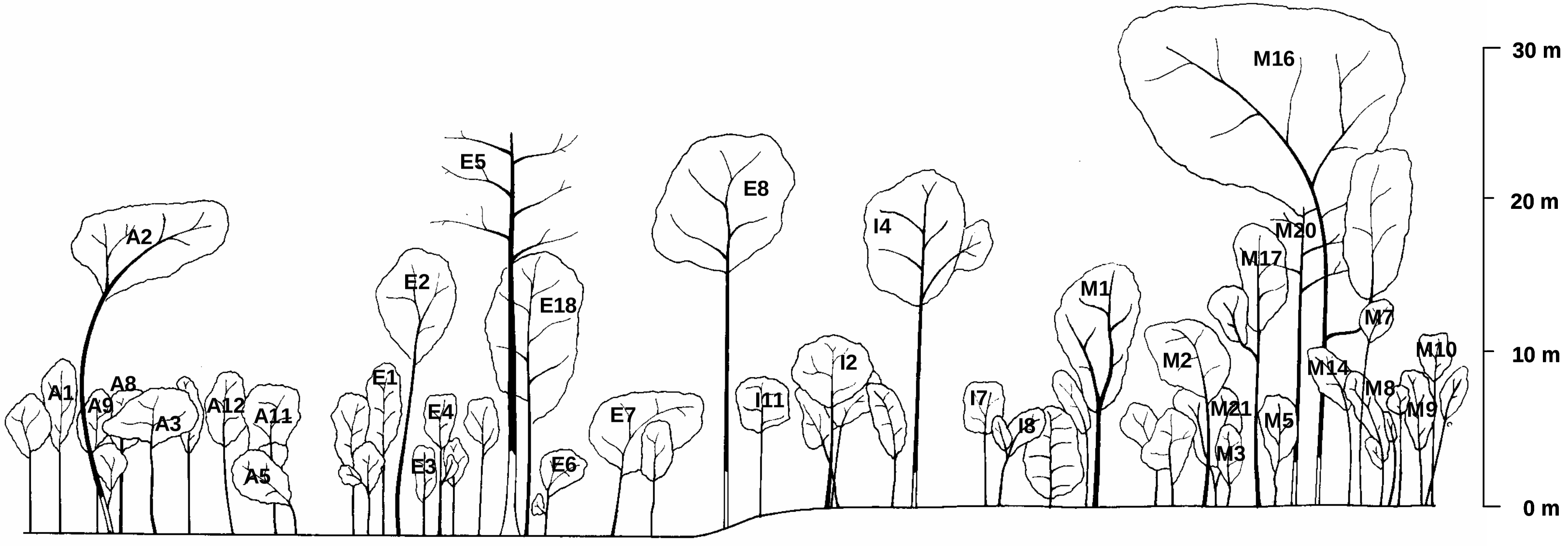


Figure 45: A sketch of the site at Plot 18 (EP 42) Iron Range showing the present position of the river bed, the locations of various landform elements and the section of the plot eroded by meander migration up to 1998.



A1 *Garcinia warrenii, A2 Beilschmiedia obtusifolia, A3 Beilschmiedia obtusifolia, A5 Pisonia umbellifera, A8 Pisonia umbellifera, A9 Cleidion spiciflorum, A11 Pisonia umbellifera, A12 Cleidion spiciflorum, E1 Mallotus polyadenos, E2 Beilschmiedia obtusifolia, E3 Pisonia umbellifera, E4 Pisonia umbellifera, E5 Nauclea orientalis, E6 Pisonia umbellifera, E7 Cleistanthus apodus, E8 Margaritaria indica, E18 Cryptocarya endiandrifolia, I2 Pisonia umbellifera, I4 Toechima daemelianum, I7 Myristica insipida, I8 Pisonia umbellifera, I11 Cananga odorata, M1 Arytera divaricata, M2 Mitrephora diversifolia, M3 Pisonia umbellifera, M5 Cryptocarya glaucocarpa, M7 Ailanthus integrifolia* ssp. *intregrifolia, M8 Alangium* sp. (Claudie River BH 2682RFK), M9 *Alangium* sp. (Claudie River BH 2682RFK), M10 *Alstonia scholaris, M14 Miliusa horsfieldii, M16 Castanospermum australe, M17 Wrightia laevis* ssp. *millgar, M20 Barringtonia calyptrata, M21 Cryptocarya glaucocarpa.*

Figure 46: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 18 (EP 42) Iron Range at the time of plot establishment.

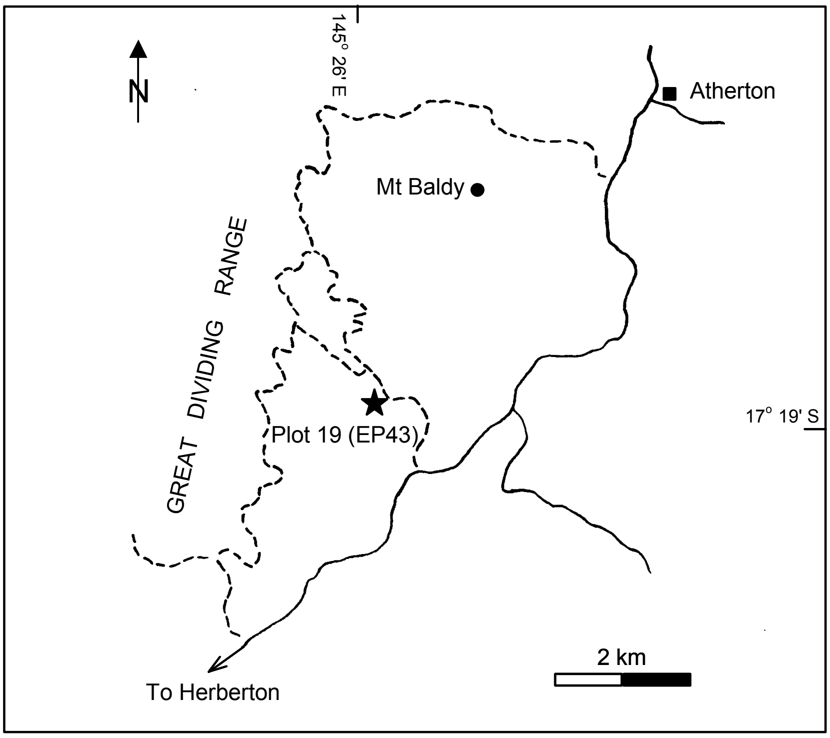
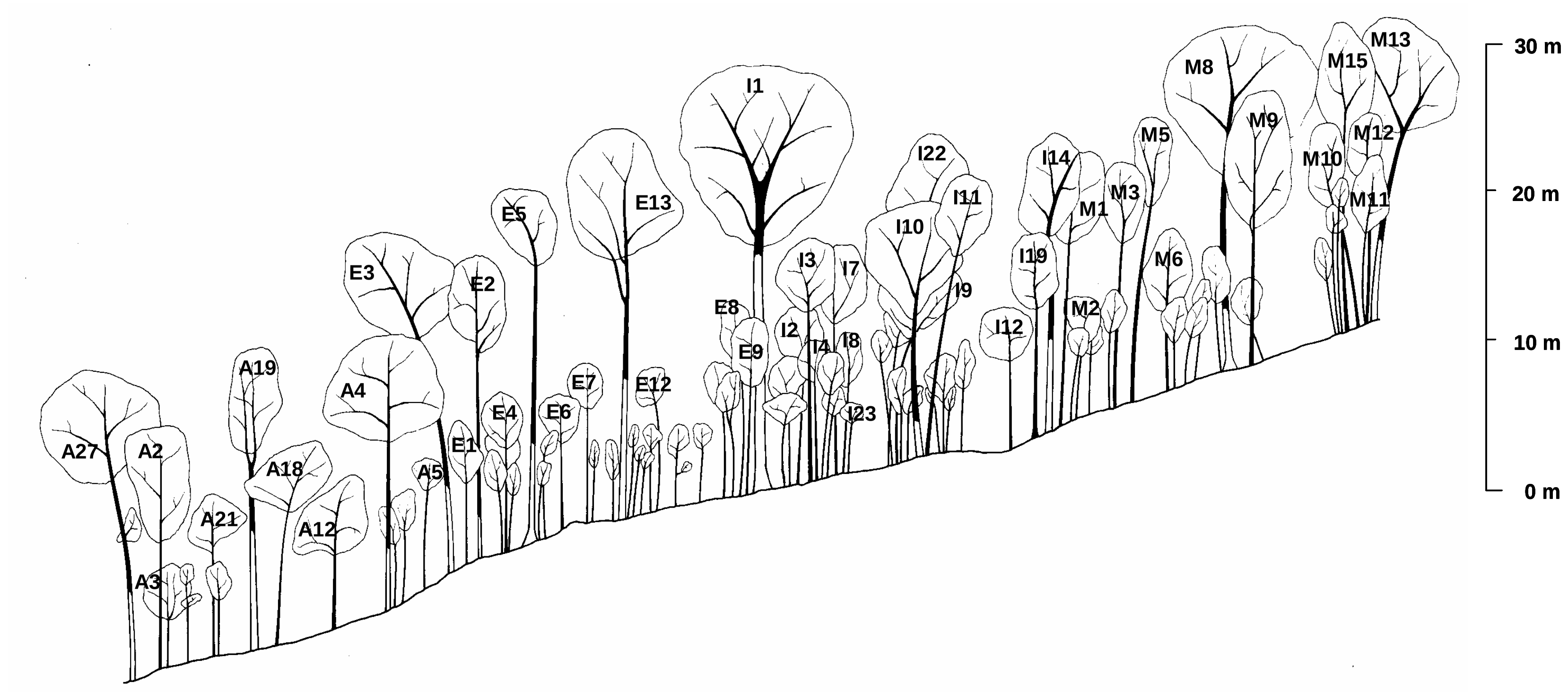


Figure 47: Location map for Plot 19 (EP 43) Mount Baldy.



A2 Doryphora aromatica, A4 Franciscodendron laurifolium, A5 Flindersia bourjotiana, A12 Rockinghamia angustifolia, A18 Franciscodendron laurifolium, A19 Doryphora aromatica, A21 Endiandra leptodendron, A27 Cryptocarya cocosoides, E1 Franciscodendron laurifolium, E2 Doryphora aromatica, E3 Cardwellia sublimis, E4 Apodytes brachystylis, E5 Opisthiolepis heterophylla, E6 Franciscodendron laurifolium, E7 Flindersia brayleyana, E8 Franciscodendron laurifolium, E9 Rockinghamia angustifolia, E13 Xanthophyllum octandrum, I1 Flindersia pimenteliana, I2 Franciscodendron laurifolium, I3 Cinnamomum laubatii, I4 Franciscodendron laurifolium, I7 Franciscodendron laurifolium, I8 Franciscodendron laurifolium, I9 Franciscodendron laurifolium, I10 Halfordia kendack, I11 Stenocarpus reticulatus, I12 Doryphora aromatica, I14 Doryphora aromatica, I19 Rockinghamia angustifolia, M1 Doryphora aromatica, M2 Flindersia brayleyana, M3 Doryphora aromatica, M5 Stenocarpus reticulatus, M6 Gardenia ovularis, M8 Flindersia pimenteliana, M9 Canarium australasicum, M10 Cardwellia sublimis, M11 Canarium australasicum, M12 Canthium sp. (Herberton Range SFK 1377), M13 Franciscodendron laurifolium, M15 Syzygium luehmannii.

Figure 48: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 19 (EP 43) Mount Baldy at the time of plot establishment.

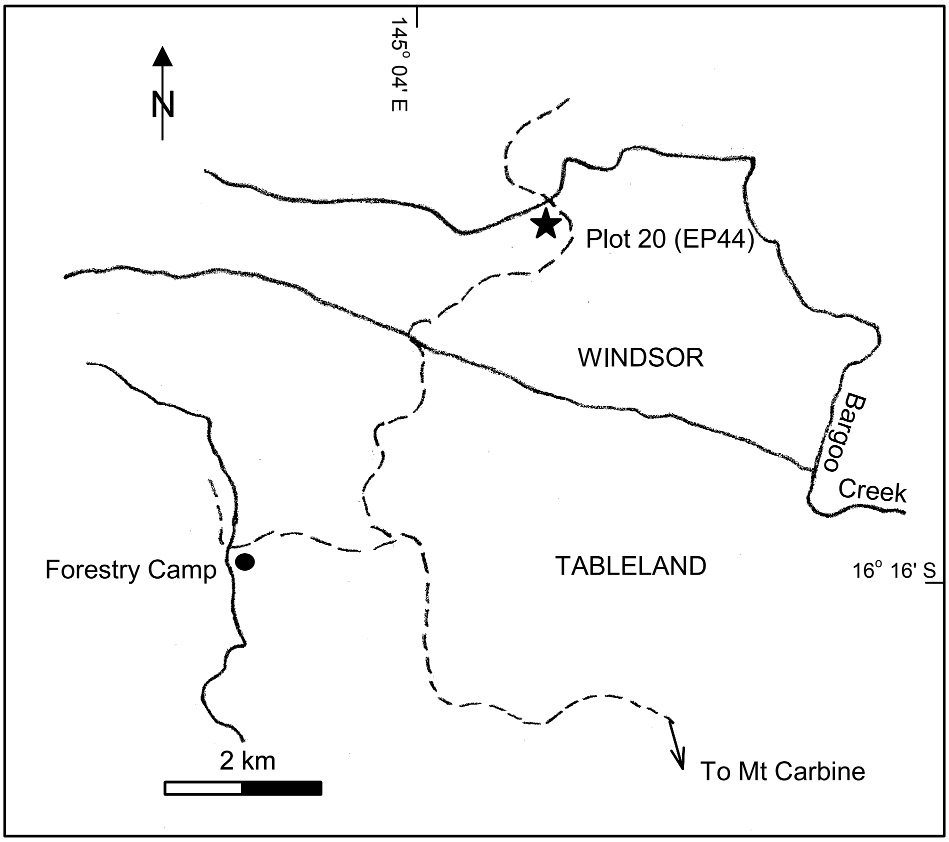
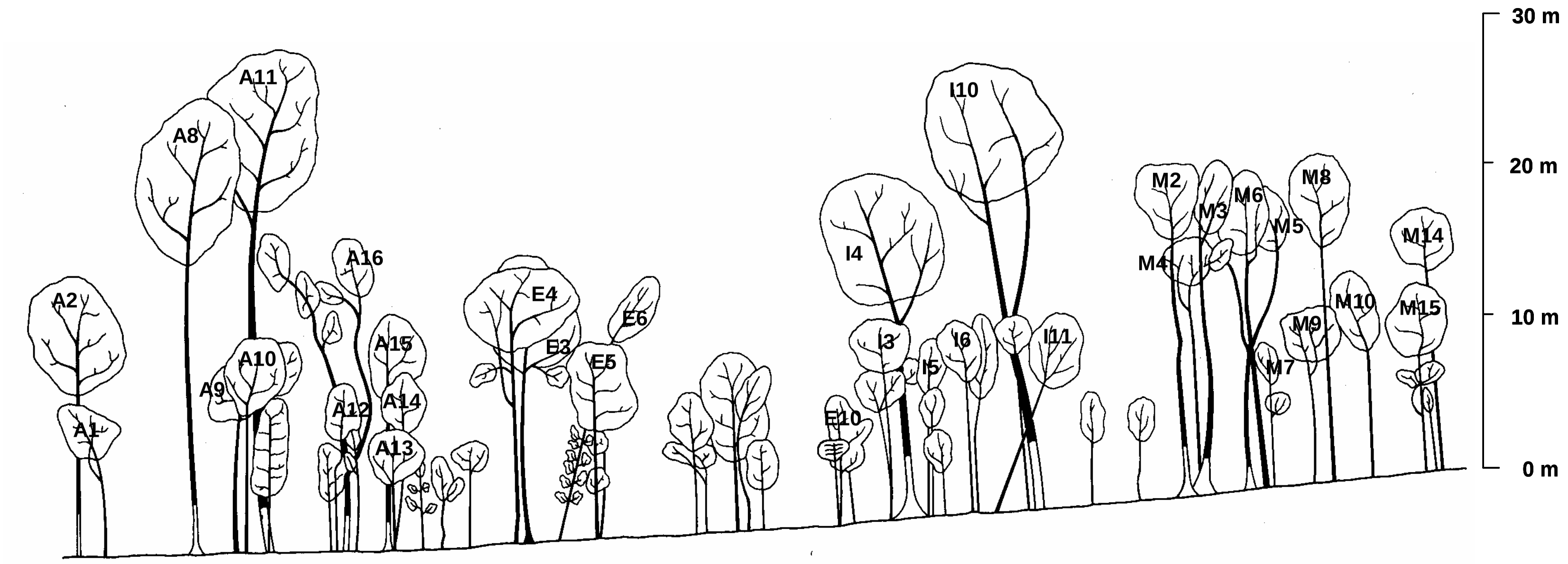


Figure 49: Location map for Plot 20 (EP 44) Fantail Logging Area.



A1 *Brombya platynema, A2 Franciscodendron laurifolium, A8 Franciscodendron laurifolium, A9 Siphonodon membranaceus, A10 Franciscodendron laurifolium A11 Flindersia brayleyana, A12 Franciscodendron laurifolium, A13 Medicosma fareana, A14 Brombya platynema, A15 Franciscodendron laurifolium, A16 Synoum muelleri, E3 Franciscodendron laurifolium, E4 Synoum muelleri, E5 Dysoxylum oppositifolium, E6 Endiandra wolfei, E10 Brombya platynema, I3 Franciscodendron laurifolium, I4 Sloanea langii, I5 Brombya platynema, I6 Franciscodendron laurifolium, I10 Beilschmiedia collina, I11 Brombya platynema, M2 Franciscodendron laurifolium, M3 Franciscodendron laurifolium, M4 Franciscodendron laurifolium, M5 Cryptocarya oblata, M6 Syzygium kuranda, M7 Syzygium kuranda, M8 Syzygium kuranda, M9 Brombya platynema, M10 Brombya platynema, M14 Neorites kevediana, M15 Brombya platynema.*

Figure 50: Canopy profile diagram prepared from a 100 x 5 m transect through Plot 20 (EP 44) Fantail Logging Area at the time of plot establishment.

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APPENDIX 1: SOIL DATA

I. S. Webb, R. W. Knowlton, K. D. Sanderson, A. Beech, S. Farr, M. G. Bradford, R. K. Hewett and A. W. Graham

SOIL SAMPLING AND ANALYTICAL METHODS

The range of physical and chemical analyses that were undertaken in this project varied between sites because of changing research directions over time. Full details are provided in the main text. With the exception of data from Plot 15 (EP38) The Crater and Plot 19 (EP 43) Mount Baldy, the analytical results in this Appendix are derived from a detailed and systematic soil survey in which, within each plot, soil samples for chemical analyses were sub-sampled from bulked samples collected at five randomly located positions using four adjacent auger holes (i.e. a total of 20 holes per plot). The standard sampling intervals were 0-0.05, 0.05-0.1, 0.1-0.2, 0.2-0.3, 0.3-0.6, 0.6-0.90 and 0.9-1.20 m.

When possible, a soil pit site was selected adjacent to the plot boundary in an area representative of the aspect and slope of the plot. These pits were excavated typically to a depth of 2 m and the morphology of the profile was described. Field texture classes were assigned according to Northcote (1979) and colour descriptions were made using the Munsell nomenclature following Soil Survey Staff (1951). In the walls of the pits, four bulk density samples were taken at various depths by firing a thin walled brass cylinder (50 mm long by 74 mm internal diameter) vertically into the exposed profile using a modified Ramset nail gun. Bulk density determinations were recorded as the mean of four samples at each designated depth.

With the exception of data from Plot 15 (EP38) The Crater, all chemical analyses were conducted at the analytical laboratory in Atherton. Soil pH was measured in 1:5 soil/water, 1:5 soil/1N KCl and 1:5 soil/0.01M $CaCl_2$ suspensions using a glass electrode with calomel electrode reference. Organic carbon was determined using the Walkey and Black (1934) wet oxidation method. Total nitrogen was measured using a modification of the Kjeldahl method (Honda 1962). In the initial survey only, total P was determined by a rapid perchloric acid digestion procedure (Summers and Nelson 1972). The method of Gillman (1979) was used for an estimation of CEC and exchangeable cations. Cations of Ca, Mg, K and Na were extracted with 0.1m $BaCl_2$. Acidity and Al extracted by KCl were determined by the method of Yuan (1959).

All particle size analyses undertaken prior to 2003 were carried out in Atherton by the sieve and pipette method (Coventry and Fett 1979) with size limits based on the International System (silt 2µm to 20 µm, fine sand 20 µm to 200 µm).

For Plot 19 (EP 43) Mount Baldy, the particle size analyses were undertaken in 2003 at CSIRO Land and Water facilities in Glen Osmund, South Australia. For these samples oven-dry moisture content and moisture factor were determined using method 2A1 in Rayment and Higginson (1992). A sub-sample of as-received soil was dried overnight at 105°C and the moisture content calculated from the weight loss on an oven-dry basis:

$$M\% = 100*(\text{wt moisture})/(\text{wt oven-dry soil})$$

This is reported on an oven-dry basis. A moisture factor is used to convert the PSA analytical data (and other data as appropriate) determined on the as-received basis to an oven-dry basis by multiplying the as-received result by the moisture factor where M.F. = (100+M%)/100.

Particle size was determined by removing the organic matter with hydrogen peroxide treatment, dispersion using sodium carbonate / sodium hexametaphosphate solution then determining the silt and clay fractions by pipette aliquot after sedimentation. Coarse and fine sand fractions were then determined by wet sieving and weighing. The method is a slight modification of the USDA Soil Survey Laboratory Methods Manual method 3A1 (USDA 1996). The modification is that the peroxide-treated sample is not oven dried to determine the residual weight as this can cause dispersion difficulties.

In more detail, 10 g soil is treated with dilute hydrogen peroxide to remove organic cementing agents. After removing excess soluble salts the sample is transferred to 250 ml PP bottle using water. A sodium carbonate / sodium hexametaphosphate solution is added to aid dispersion and the sample mixed end-over-end for 16 hours. The sample is transferred to a 500 ml PP measuring cylinder, diluted to 500 ml and mixed. The sample is maintained at constant temperature. At time zero the sample was agitated and at an appropriate time (12 mins at 20°C) a 25 ml aliquot was pipetted out from a depth of 250 mm into a weighed vial, oven dried and the weight of residue less weight of dispersing agent determined as silt+clay. Subsequently at an appropriate time (20 hours at 20°C) a 25 ml aliquot was again pipetted out from a depth of 250 mm into a weighed vial, oven dried and the weight of residue less weight of dispersing agent determined as clay. Silt is determined by difference. A blank was carried through the procedure to determine the contribution of the dispersing agent to the residue weight. Clay is defined as behaving like a spherical particle with a density of 2.65 g cc^{-1} and a diameter of less than 2 µm. Silt is defined as behaving like a spherical particle with a density of 2.65 g cc^{-1} and a diameter of between 2 and 20 µm. Excess silt and clay was syphoned off and the residue transferred to a 600 ml beaker. Water was added and the suspension mixed and allowed to settle for an appropriate time so that particles greater than 20 µm had settled 100 mm (4 mins 45 secs at 20°C) and the suspension syphoned off. This was repeated until there was no more silt or clay in the suspension - usually about 5 or 6 times. The clear supernatant was syphoned off and the sand wet-sieved through a 212 µm sieve to separate fine and coarse sand which was dried and weighed. The individual fractions were calculated, the moisture factor applied and the sum determined as a check on integrity of the analysis.

Particle density analysis utilized the methods specified by Blake (date unknown, Paper No. 4949 of the Scientific Journal Series, Minnesota Agr. Exp. Sta., St. Paul following the procedures set out in Am. Soc. Testing Mater., 1958, p.80 and U.S. Dept. Agr., 1954, p.122). Full details of these methods are recorded in the soil records section of the Permanent Plot files.

Soil moisture retention characteristics and hydraulic conductivity were determined in the Atherton analytical laboratory using standard pressure plate techniques. Details of the methods employed are provided at the conclusion of this appendix.

As no stratified soil data were available from Plot 15 (EP38) The Crater, a site with a complex geomorphic setting, a detailed sampling program, stratified both by landform element position and depth, was undertaken in 2000 specifically to address possible confusion relating to the soil nutrient status, rock outcrops and the forest structural typology in the vicinity of this plot. These analyses were conducted at the CSIRO Land and Water facilities at Townsville, North Queensland, and in Glen Osmund, South Australia using the standard techniques (the alpha-numeric code reference) of Rayment and Higginson (1992): pH by a 1:5 soil/water suspension [4A1]; electrical conductivity in a soil/water suspension [3A1]; exchange acidity (hydrogen and aluminium) by 1M potassium chloride [15G1], Yuan (1959); exchangeable bases and cation exchange capacity by compulsive exchange [15E1], 0.1M $BaCl_2$/0.1M NH_4Cl (Gillman and Sumpter 1986); bicarbonate-extractable phosphorus [9B2], 0.5M $NaHCO_3$ (Colwell 1963), and colorimetric finish based on the method of Murphy and Riley (1962). Total organic carbon was determined by a 1994 Leco CNS-2000 high temperature resistance furnace with infrared detection of total carbon only [cf 6B3]. Total nitrogen was determined using a Leco CNS-2000 high temperature resistance furnace using thermal conductivity for the detection of nitrogen after the sample is combusted in the high temperature resistance furnace (see Etheridge et al 1998, Matejovic 1997). Details of the CNS-2000 multi-functional analyser are given at the conclusion of this appendix.

ANALYTICAL DATA

Table 1: Plot 1 (EP2) Downfall Creek – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.10	Light brownish grey (10YR6/2); sandy clay loam; moderate 5-10mm subangular blocky; <5mm cracks; dry; slightly sticky; normal plasticity; 2-10% 6-20mm, angular, dispersed granite gravel; abundant roots; abrupt smooth change to -
0.10 to 0.20	Pale brown (10YR6/3); coarse sandy clay loam; moderate 5-10mm subangular blocky; <5mm cracks; dry; slightly sticky; normal plasticity; 2-10% 6-20mm, angular, dispersed granite gravel; many roots; abrupt wavy change to -
0.20 to 0.30	Pale brown (10YR6/3); coarse sandy clay loam; moderate 5-10mm subangular blocky; <5mm cracks; dry; moderately strong; slightly sticky; normal plasticity; 2-10% 6-20mm, angular, dispersed granite gravel; common roots; clear irregular change to -
0.30 to 0.60	Very pale brown (10YR7/3); coarse sandy loam; moderate 5-10mm subangular blocky; <5mm cracks; dry; moderately strong; slightly sticky; normal plasticity; 2-10% 6-20mm, angular, stratified, granite gravel; few roots; clear irregular change to -
0.60 to 1.30	Very pale brown (10YR8/3); loamy coarse sandy; massive; <5mm cracks; dry; moderately strong; non-sticky normal plasticity; 10-20% 6-20mm, angular, undisturbed granite gravel; few roots.

Table 2: Plot 1 (EP2) Downfall Creek – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.10	1.30	5.0	4.8	-	3.75	-	7.60	1.53	0.39	0.16	0.08	0.29	0.37	9.3	10.05
0.10 - 0.20	-	5.2	4.7	-	1.60	-	3.20	0.82	0.36	0.14	0.17	0.21	0.38	4.8	4.90
0.20 - 0.30	1.40	5.2	4.6	-	1.35	-	2.20	0.72	0.29	0.12	0.45	0.23	0.68	3.6	1.01
0.30 - 0.60	1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.60 - 0.90	-	5.1	4.2	-	0.30	-	0.19	0.55	0.67	0.25	2.14	0.16	2.30	2.8	3.96
0.90 - 1.20	-	5.2	4.2	-	0.15	-	0.24	0.63	0.36	0.32	1.97	0.21	2.18	2.5	3.73

Table 3: Plot 1 (EP2) Downfall Creek – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.02 - 0.07	1.329	0.316	0.237	0.197	0.181	0.174	0.145	0.139	0.126
0.22 - 0.27	1.438	0.273	0.215	0.179	0.166	0.146	0.125	0.097	0.092
0.45 - 0.50	1.484	0.254	0.226	0.187	0.171	0.150	0.133	0.150	0.098

Table 4: Plot 1 (EP2) Downfall Creek – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.02 - 0.07	9.3*	9.3
0.20 - 0.25	4.7	
0.20 - 0.25	6.3	
0.20 - 0.25	11.5	
0.20 - 0.25	12.9	8.85
0.22 - 0.27	6.4	
0.22 - 0.27	7.4	
0.22 - 0.27	22.5	
0.22 - 0.27	9.3	11.4
0.40 -0.45	1. 6	
0.40 - 0.45	3.3	
0.40 - 0.45	1.5	
0.40 - 0.45	3.1	2.4

* Soil collapsed in other replicate cylinders.

Table 5: Plot 1 (EP2) Downfall Creek – soil particle size mean data for samples collected in the original soil survey (data from file notes).

Depth (m)	Sand %	Silt %	Clay %
0.00-0.30	61	22	17

Table 6: Plot 1 (EP2) Downfall Creek – soil particle density data for samples collected in the original soil survey (data from file notes).

Profile depth (m)	Sample depth (m)	Particle density (kg m^{-3})
0.20-0.30	0.07-0.12	2.55
0.30-0.60	0.35-0.40	2.58

Table 7: Plot 2 (EP3) Mount Haig – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark brown (7.5YR3/4); loam; strong 5-10mm subangular blocky; moist; very weak; <2% 2-6mm, angular, dispersed, quartz gravel; abundant roots; abrupt smooth change to -
0.05 to 0.08	Strong brown (7.5YR5/8); 20-50% 15 - 30mm distinct brown (7.5YR5/4) mottles; strong 5-10mm subangular blocky; moist; very weak; <2% 2-6mm, angular, dispersed, quartz gravel; abundant roots; abrupt smooth change to -
0.08 to 0.30	Reddish yellow (7.5YR6/8); 10-20% 5-15mm distinct mottles; sandy clay loam; moderate 5-10mm subangular blocky; rough-ped fabric; moist; moderately weak; <2% 2-6mm, angular, dispersed, quartz gravel; many roots; gradual wavy change to -
0.30 to 0.60	Yellowish red (5YR5/8); sandy light clay; moderate 20-50mm subangular blocky; smooth-ped fabric; moist; moderately firm; 2-10% 2-6mm, angular, dispersed, quartz gravel; common roots;
0.60 to 0.90	Yellowish red (5YR5/8); <5mm prominent mottles; light clay; moderate 20-50mm subangular blocky; smooth-ped fabric; moist; moderately firm; <2% 2-6mm; angular, dispersed, quartz gravel; few roots; diffuse irregular change to -
0.90 to 1.50	Red (2.5YR4/8); <5mm prominent mottles; light clay; weak 10-20mm subangular blocky; smooth-ped fabric; moist; moderately firm; <2% 2-6mm, angular, dispersed, quartz gravel; few roots.

Table 8: Plot 2 (EP3) Mount Haig – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0.00 - 0.05	0.79	4.4	4.0	4.0	11.8	-	0.30	1.33	0.49	0.27	2.64	0.24	2.88	6.88	5.27
0.50 - 0.10	-	4.6	4.0	4.0	5.84	-	0.10	0.38	0.13	0.17	2.56	0.00	2.56	4.10	3.34
0.10 - 0.20	-	4.6	4.0	4.1	3.75	-	0.07	0.31	0.18	0.12	2.04	0.00	2.04	2.68	2.72
0.20 - 0.30	0.92	4.6	4.1	4.2	2.12	-	0.07	0.37	0.12	0.14	1.92	0.00	1.92	3.20	2.62
0.30 - 0.60	1.30	4.7	4.2	4.2	1.56	-	0.05	0.34	0.06	0.11	1.44	0.00	1.44	2.40	2.00
0.60 - 0.90	1.40	4.6	4.2	4.2	1.11	-	0.01	0.21	0.07	0.09	1.84	0.04	1.88	3.20	2.26
0.90 - 1.20	-	4.2	-	-	1.08	-	0.05	0.15	0.07	0.09	2.00	0.03	2.03	-	2.39
1.20 - 1.50	-	4.2	-	-	0.99	-	0.03	0.14	0.05	0.10	1.96	0.12	2.08	-	2.40
1.50 - 1.80	-	4.2	-	-	0.93	-	0.03	0.14	0.08	0.09	2.64	0.05	2.69	-	3.03
1.80 - 2.10	-	4.2	-	-	0.72	-	0.01	0.13	0.08	0.09	1.80	0.00	-	-	-
2.10 - 2.40	-	4.2	-	-	0.90	-	0.01	0.11	0.06	0.11	1.96	0.16	-	-	-

Table 9: Plot 2 (EP3) Mount Haig – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.20 - 0.25	0.928	0.697	0.545	0.505	0.449	0.392	0.371	0.267	0.222
0.45 - 0.50	1.226	0.411	0.407	0.379	0.361	0.348	0.322	-	0.257
0.75 - 0.80	1.388	0.330	0.323	0.312	0.298	0.291	0.275	-	0.238

Table 10: Plot 2 (EP3) Mount Haig – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.20 - 0.25	17.0	
0.20 - 0.25	4.7	
0.20 - 0.25	6.3	
0.20 - 0.25	11.5	
0.20 - 0.25	12.9	10.5

Table 11: Plot 2 (EP3) Mount Haig – soil particle size data for samples collected on 20.10.1983 from a soil pit adjacent to the plot on granitic soil.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
0.00 - 0.05	25	7	24	44
0.05 - 0.10	36	6	10	48
0.10 - 0.20	25	8	11	56
0.20 - 0.30	-	-	-	-
0.30 - 0.60	-	-	-	-
0.60 - 0.90	26	7	18	49
0.90 - 1.20	24	8	19	49
1.20 - 1.50	20	8	16	56
1.80 - 2.10	-	-	-	-
2.10 - 2.40	-	-	-	-

Table 12: Plot 3 (EP4) Little Pine Creek – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark yellowish brown (10YR4/4); 10-20% 5-15mm faint mottles; sandy light clay; moderate 10-20mm subangular blocky; moist; moderately weak; slightly sticky; abundant roots; abrupt smooth change to -
0.05 to 0.20	Dark yellowish brown (10YR4/6): 2-10% 5-15mm faint mottles; sandy light clay; moderate 20-50mm subangular blocky; moist; moderately weak; non sticky; abundant roots; clear wavy change to -
0.20 to 0.90	Strong brown (7.5YR5/8); light medium clay; weak 50-100mm angular blocky; rough-ped fabric; moist; moderately firm; slightly sticky; many roots; gradual wavy change to -
0.9 to 1.20	Reddish yellow (7.5YR6/8); light medium clay massive; earthy fabric; moist; very firm; <10% of ped faces or walls coated with cutans; common roots; gradual irregular change to -
1.20 to 1.50	Red (2.5YR5/8); light medium clay; weak 100-200mm angular blocky; smooth-ped fabric; moist; very firm; <10% of ped faces or walls coated with cutans; few roots; diffuse irregular change to -
1.50 to 2.90	Red (2.5YR5/8); 20-50% 15-30mm distinct mottles; sandy light clay; massive; moist; very firm; weakly cemented; few roots.

Table 13: Plot 3 (EP4) Little Pine Creek – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0 00 - 0.05	0.84	4.9	4.4	4.0	3.54	0.295	1.12	1.36	0.33	0.07	0.63	0.13	0.76	4.10	3.70
0.05 - 0.10	-	4.8	4.3	4.0	3.15	0.2549	0.33	0.71	0.25	0.05	0.86	0.21	1.08	2.90	2.47
0.10 - 0.20	1.07	4.8	4.3	4.0	1.69	0.154	0.12	0.38	0.15	0.02	1.05	0.19	1.13	2.20	1.85
0.20 - 0.30	-	4.8	4.3	-	1.20	0.1109	0.04	0.45	0.10	0.02	0.63	0.07	0.95	2.10	1.61
0.30 - 0.60	1.21	4.8	4.4	-	0.67	0.0659	0.02	0.46	0.07	0.00	0.97	0.03	0.95	2.20	1.55
0.60 - 0.90	1.37	4.8	4.3	-	0.28	0.0327	0.02	0.38	0.06	0.00	0.97	0.14	1.10	2.30	1.61
0.90 - 1.20	1.34	4.8	4.3	-	0.11	0.010	0.03	0.32	0.06	0.02	1.29	0.19	1.43	2.30	1.91
1.20 - 1.50	-	4.8	4.3	-	0.06	0.004	0.02	0.37	0.06	0.02	1.67	0.15	1.81	2.50	2.34
1.50 - 1.80	1.35	4.8	4.3	-	0.06	0.005	0.22	0.34	0.06	0.02	1.85	0.17	1.94	2.98	2.63
1.80 - 2.10	-	4.8	4.3	-	0.06	0.0545	0.0	0.29	0.06	0.00	2.04	0.15	2.06	2.98	2.46
2.10 - 2.40	-	4.8	4.3	-	0.06	0.002	0.02	0.26	0.06	0.00	2.11	0.16	2.21	3.20	2.62

Table 14: Plot 3 (EP4) Little Pine Creek – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.02 - 0.07	1.181	0.431	0.388	0.327	0.313	0.297	0.269	0.180	0.182
0.07 - 0.12	1.243	0.402	0.373	0.289	0.270	0.254	0.230	0.180	0.182
0.35 - 0.40	1.503	0.330	0.326	0.241	0.232	0.227	0.209	0.193	0.178
0.85 - 0.90	1.574	0.225	0.253	0.245	0.239	0.223	0.149	0.200	0.288
1.20 - 1.25	1.543	0.263	0.266	0.255	0.247	0.229	0.169	0.211	0.223

Table 15: Plot 3 (EP4) Little Pine Creek – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.02 - 0.07	5.9	
0.02 - 0.07	4.0	
0.02 - 0.07	8.3	
0.02 - 0.07	5.8	**6.0**
0.07 - 0.12	2.6	
0.07 - 0.12	2.9	
0.07 - 0.12	3.4	**3.0**
0.35 - 0.40	2.3	**2.3**
1.21 - 1.25	6.5	
1.21 - 1.25	2.9	**4.7**

Table 16: Plot 3 (EP4) Little Pine Creek – soil particle size data for samples collected from four positions in soil pits adjacent to the plot on granitic soil.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Position 1				
0.00 - 0.05	47	12	11	30
0.05 - 0.10	45	12	12	31
0.10 - 0.15	41	11	13	35
0.15 - 0.20	40	11	13	36
0.20 - 0.30	38	11	14	37
0.30 - 0.60	35	10	18	37
0.60 - 0.90	32	7	27	34
0.90 - 1.20	29	9	29	33
1.20 - 1.50	36	9	23	32
1.50 - 1.80	33	6	28	33
1.80 - 2.10	29	5	35	31
2.10 - 2.40	31	6	40	23
2.40 - 2.70	31	5	41	23
Position 2				
0.0 - 0.05	42	16	11	31
0.05 - 0.10	43	16	11	30
0.10 - 0.20	43	16	11	30
0.20 - 0.30	40	16	13	31
0.30 - 0.60	38	16	13	33
0.60 - 0.90	38	13	17	32
0.90 - 1.20	28	11	27	34
1.20 - 1.50	27	10	32	31
1.50 - 1.80	29	11	36	24
1.80 - 2.10	35	13	31	21
2.10 - 2.40	32	12	39	17
2.40 - 2.70	31	12	39	18
Position 3				
0.0 - 0.05	37	19	11	33
0.05 - 0.10	45	18	9	28
0.10 - 0.20	43	20	9	28
0.20 - 0.30	42	20	9	29
0.30 - 0.60	47	18	9	26
0.60 - 0.90	40	19	12	29
0.90 - 1.20	35	15	15	35
1.20 - 1.50	29	8	22	41
1.50 - 1.80	31	6	32	31
1.80 - 2.10	31	7	36	26
2.10 - 2.40	30	8	37	25
2.40 - 2.70	29	10	36	25
2.70 - 3.00	32	11	34	23

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Position 4				
0.0 - 0.05	48	12	11	29
0.05 - 0.10	46	12	12	30
0.10 - 0.20	44	12	7	37
0.20 - 0.30	38	13	14	35
0.30 - 0.60	31	14	17	38
0.60 - 0.90	22	18	23	37
0.90 - 1.20	17	25	29	29
Position 4 variant – red colour to the bottom of the profile				
1.20 - 1.50	28	9	38	25
1.50 - 1.80	30	10	38	22
1.80 - 2.10	22	14	42	22
2.10 - 2.40	22	15	42	21
2.40 - 2.70	28	15	38	19
2.70 - 3.00	32	10	40	18
Position 4 variant – yellow colour to the bottom of the profile				
1.20 - 1.50	22	33	25	31
1.50 - 1.80	25	31	22	22
1.80 - 2.10	27	34	21	18
2.10 - 2.40	22	27	30	21
2.40 - 2.70	17	33	31	19
2.70 - 3.00	21	43	23	13

Table 17: Plot 3 (EP4) Little Pine Creek – soil particle density data for samples collected from a soil pit adjacent to the plot on granitic soil.

Profile depth (m)	Sample depth (m)	Particle density (kg m^{-3})
Position 1		
0.10 – 0.15	7-12	2.55
0.30 – 0.60	35-40	2.58
0.60 – 0.90	85-90	2.62
Position 2		
0.10 – 0.20	7-12	2.55
0.30 – 0.60	35-40	2.58
0.60 – 0.90	85-90	2.62

Table 18: Plot 4 (EP9) Robson Logging Area – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.10	Strong brown (7.5YR5/8); silty clay loam; moderate 10-20mm subangular blocky; moist; 2-10% 20-60mm, subangular, dispersed, quartz gravel; abundant roots; clear smooth change to -
0.10 to 0.20	Strong brown (7.5YR5/8); silty clay loam; moderate 10-20mm subangular blocky; moist; 2-10% 20-60mm, subangular, dispersed, quartz gravel; many roots; clear smooth change to -
0.20 to 0.40	Yellowish red (5YR5/8); silty clay loam; weak 20-50mm angular blocky; moist; 2-10% 20-60mm, subangular, dispersed, quartz gravel; common roots; gradual smooth change to -
0.40 to 0.90	Reddish yellow (5YR6/8); 2-10% 5-15mm distinct strong brown (7.5YR5/6) mottles; light medium clay; weak 20-50mm angular blocky; moist; 2-10% 20-60mm, subangular, dispersed, quartz gravel; common roots; gradual smooth change to -
0.90 to 1.20	Reddish yellow (5YR6/8); 2-10% 5-15mm distinct strong brown (7.5YR5/6) mottles; light medium clay; weak 20-50mm angular blocky; moist; 2-10% 20-60mm, subangular, dispersed, quartz gravel; few roots; diffuse smooth change to -
1.20 to 1.80	Reddish yellow (5YR6/8); 2-10% 5-15mm distinct strong brown (7.5YR5/6) mottles; light medium clay; moderate 10-20mm subangular blocky; moist; <2% 20-60mm, subangular, dispersed, quartz gravel; few roots.

Table 19: Plot 4 (EP9) Robson Logging Area – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0 00– 0.10	-	-	-	-	2.91	-	0.13	0.18	0.24	0.11	1.89	0.35	0.00	1.70	2.90
0.10 - 0.20	1.10	4.4	3.8	3.8	2.52	-	0.06	0.13	0.22	0.09	1.54	0.70	2.24	1.30	2.74
0.20 - 0.30	-	4.3	4.0	4.0	1.29	-	0.03	0.10	0.19	0.10	1.26	0.50	2.24	1.00	2.18
0.30 - 0.60	1.20	4.4	4.2	4.0	0.77	-	0.03	0.07	0.35	0.99	1.30	0.41	1.76	1.00	3.15
0.60 - 0.90	1.40	4.4	4.2	4.0	0.30	-	0.03	0.08	0.23	0.09	1.36	0.30	1.71	0.90	2.09
0.90 - 1.20	1.60	4.6	4.2	4.0	0.30	-	0.01	0.15	0.12	0.09	1.84	0.60	1.66	2.10	2.81
0.20 - 1.80	1.50	4.7	4.2	3.9	0.03	-	0.01	0.29	0.10	0.09	3.48	1.08	2.44	2.70	5.05
1.80 - 2.10	-	4.5	4.1	3.8	0.06	-	0.03	0.08	0.18	0.08	1.02	0.31	4.56	1.08	1.70
2.10 - 2.40	-	4.6	4.2	4.1	0.06	-	0.03	0.07	0.12	0.07	1.09	0.25	1.33	-	-

Table 20: Plot 4 (EP9) Robson Logging Area – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.10 - 0.15	1.067	0.508	0.428	0.378	0.352	0.320	0.274	-	0.166
0.30 - 0.35	1.219	0.417	0.391	0.322	0.294	0.256	0.233	-	0.148
0.60 - 0.65	1.446	0.296	0.288	0.251	0.229	0.203	0.183	-	0.152
1.00 - 1.05	1.619	0.234	0.226	0.219	0.207	0.199	0.185	-	0.171
1.50 - 1.55	1.495	0.311	0.312	0.307	0.302	0.292	0.286	-	0.304

Table 21: Plot 4 (EP9) Robson Logging Area – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.10 - 0.15	15.2	
0.10 - 0.15	15.2	
0.10 - 0.15	18.8	
0.10 - 0.15	17.2	**16.6**
0.30 - 0.35	14.6	
0.30 - 0.35	17.5	
0.30 - 0.35	11.9	
0.30 - 0.35	12.4	**14.1**
0.60 - 0.65	1.1	**1.1**
1.00 - 1.05	2.1	**2.1**

Table 22: Plot 4 (EP9) Robson Logging Area – soil particle size mean data for samples collected in the original soil survey (data from file notes).

Depth (m)	Sand %	Silt %	Clay %
0.00 - 0.30	70	10.3	19.7

Table 23: Plot 5 (EP18) Mount Lewis – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark brown (10YR3/3); loamy sand; weak 10-20mm subangular blocky; earthy fabric; <5mm cracks; moist; very weak; non-sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, abundant roots; abrupt smooth change to -
0.05 to 0.10	Dark brown (10YR4/3); loamy sand; weak 10-20mm subangular blocky; earthy fabric; <5mm cracks; moist; very weak; non-sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, abundant roots; clear smooth change to -
0.10 to 0.30	Dark yellowish brown (10YR4/4); coarse sandy loam; weak 10-20mm subangular blocky; earthy fabric; <5mm cracks; moist; moderately weak; non-sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, many roots; gradual wavy change to -
0.30 to 0.60	Strong brown (7.5YR5/6); coarse sandy clay loam; weak 10-20mm subangular blocky; earthy fabric; <5mm cracks; moist; moderately weak; non-sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, common roots; diffuse irregular change to -
0.60 to 0.90	Strong brown (7.5YR5/6); clay loam; weak 10-20mm subangular blocky; earthy fabric; <5mm cracks; moist; moderately firm; slightly sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, few roots; diffuse irregular change to -
0.90 to 1.20	Clay loam; moderate; smooth-ped fabric; moist; moderately firm; slightly sticky; normal plasticity; 10-20% 2-6mm, subangular, undisturbed, quartz gravel, <10% of ped faces or walls coated with cutans; 2-10% 20-60mm ferruginous soft segregations; few roots; diffuse irregular change to -
1.20 to 1.50	Clay loam; moderate; smooth-ped fabric; moist; very strong; 20-50% 6-20mm, angular, undisturbed, granite gravel, <10% of ped faces or walls coated with cutans; discontinuous; few roots.

Table 24: Plot 5 (EP18) Mount Lewis – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0 00 - 0.05	-	4.0	3.8	3.8	8.43	-	1.07	1.17	0.59	0.32	5.15	3.30	8.45	4.00	11.6
0.05 - 0.10	1.10	4.4	4.1	4.2	4.23	-	0.17	0.24	0.28	0.16	4.47	2.08	6.55	1.90	7.40
0.10 - 0.20	-	4.4	4.2	-	3.84	-	0.10	0.15	0.16	0.12	1.36	0.12	1.48	1.90	2.01
0.20 - 0.30	1.30	4.6	4.2	-	2.86	-	0.07	0.11	0.17	0.12	1.04	0.00	1.04	1.50	1.51
0.30 - 0.60	-	4.5	4.4	-	1.64	-	0.07	0.05	0.11	0.09	0.22	0.11	0.33	0.70	0.65
0.60 - 0.90	-	4.4	4.3	-	1.13	-	0.03	0.05	0.11	0.09	0.53	0.13	0.66	0.40	0.94
0.90 - 1.20	-	4.4	4.4	-	0.82	-	0.05	0.05	0.17	0.08	0.40	0.08	0.48	-	0.83
1.20 - 1.50	-	4.4	4.4	-	0.72	-	0.03	0.05	0.17	0.09	0.32	0.11	0.43	-	0.77

Table 25: Plot 5 (EP18) Mount Lewis – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.05 – 0.10	1.072	0.491	0.444	0.383	0.361	0.306	0.275	0.221	0.166
0.20 – 0.25	1.337	0.343	0.328	0.273	0.252	0.229	0.207	0.130	0.127

Table 26: Plot 5 (EP18) Mount Lewis – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	**Saturated hydraulic conductivity K_S (mm $minute^{-1}$)**	**Mean K_S for depth interval (mm $minute^{-1}$)**
0.05 - 0.10	33.2	
0.05 - 0.10	26.6	
0.05 - 0.10	29.3	
0.05 - 0.10	31.3	**30.1**
0.20 - 0.25	4.4	
0.20 - 0.25	31.9	
0.20 - 0.25	18.1	
0.20 - 0.25	27.9	**20.6**

Table 27: Plot 6 (EP19) Garrawalt – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Very dark greyish brown (10YR3/2); clay loam; moderate 2-5mm angular blocky; rough-ped fabric; moist; moderately weak; non sticky; abundant roots; abrupt smooth change to -
0.05 to 0.20	Dark greyish brown (10YR4/2); clay loam; moderate 2-5mm angular blocky; rough-ped fabric; moist; moderately weak; slightly sticky; many roots; abrupt wavy change to -
0.20 to 0.30	Brown (7.5YR5/4) 10-20% 5-15mm distinct very greyish brown (10YR3/2) mottles; sandy clay loam; moderate 5-10mm subangular blocky; rough-ped fabric; moist; moderately weak; slightly sticky; common roots clear wavy change to -
0.30 to 0.40	Brown (7.5YR5/4) 2-10% <5mm distinct very greyish brown (10YR3/2) mottles; sandy clay loam; moderate 10-20mm subangular blocky; rough-ped fabric; moist; moderately weak; slightly sticky; common roots clear wavy change to -
0.40 to 0.60	Reddish yellow (7.5YR6/6); 2-10% <5mm faint pinkish grey (7.5YR7/3) mottles; sandy clay loam; moderate 10-20mm angular blocky; rough-ped fabric; moist; moderately firm; slightly sticky; <10% of ped faces or walls coated with cutans; few roots; gradual irregular change to -
0.60 to 0.90	Reddish yellow (7.5YR6/6); 10-20% 5-15mm distinct pinkish grey (7.5YR7/2) mottles; sandy clay loam; moderate 20-50mm angular blocky; rough-ped fabric; moist; moderately firm; <10% of ped faces or walls coated with cutans; few roots.

Table 28: Plot 6 (EP19) Garrawalt – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0 00 - 0.05	-	4.2	3.9	-	11.5	0.790	2.34	1.94	0.40	0.18	4.79	0.00	-	8.80	9.65
0.05 - 0.10	-	4.4	4.0	-	7.98	0.588	0.71	0.62	0.24	0.13	4.53	0.00	-	6.20	6.23
0.10 - 0.20	0.89	4.4	4.0	-	5.89	0.404	0.31	0.31	0.19	0.11	4.34	0.00	-	5.00	5.26
0.20 - 0.30	1.03	4.4	4.0	-	3.16	0.223	0.21	0.19	0.12	0.08	4.42	0.00	4.42	4.10	5.02
0.30 - 0.60	1.21	4.4	4.0	-	0.70	0.088	0.09	0.12	0.09	0.06	7.60	0.55	8.24	5.90	8.60
0.60 - 0.90	1.36	4.5	3.9	-	0.22	0.033	0.07	0.16	0.07	0.08	10.80	0.65	11.50	-	11.83
0.90 - 1.20	-	4.6	3.8	-	0.15	0.026	0.07	0.20	0.07	0.08	10.50	0.87	11.40	7.80	11.79
1.20 - 1.50	-	4.4	3.8	-	0.13	0.012	0.07	0.22	0.08	0.08	8.95	0.69	9.64	7.30	10.09
1.50 - 1.80	-	4.4	3.8	-	0.10	0.015	0.07	0.27	0.09	0.06	7.92	0.87	8.79	7.20	9.28
1.80 - 2.10	-	4.5	3.8	-	0.06	0.003	0.07	0.27	0.09	0.06	7.00	0.34	7.34	6.40	7.83

Table 29: Plot 6 (EP19) Garrawalt – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.10 – 0.15	0.846	0.739	0.651	0.541	0.522	0.467	0.427	0.301	0.262
0.22 – 0.27	1.055	0.506	0.484	0.391	0.382	0.340	0.323	0.280	0.240
0.32 – 0.37	1.208	0.407	0.394	0.352	0.336	0.315	0.305	0.272	0.239
0.50 – 0.55	1.362	0.348	0.336	0.318	0.309	0.298	0.287	0.275	0.221

Table 30: Plot 6 (EP19) Garrawalt – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.22 - 0.27	8.6	
0.22 - 0.27	10.1	
0.22 - 0.27	8.0	
0.22 - 0.27	11.9	**9.7**
0.32 - 0.37	1.3	
0.32 - 0.37	0.2	
0.32 - 0.37	1.3	**0.9**
0.50 - 0.55	12.9	
0.50 - 0.55	1.3	
0.50 - 0.55	2.4	
0.50 - 0.55	11.1	**6.9**

Table 31: Plot 6 (EP19) Garrawalt – soil particle size data for samples collected from two positions in a soil pit adjacent to the plot.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Position 1				
0 00 - 0.05	16	10	28	46
0.05 - 0.10	21	10	28	41
0.10 - 0.20	19	12	23	46
0.20 - 0.30	24	11	29	36
0.30 - 0.60	20	10	26	44
0.60 - 0.90	20	14	24	42
0.90 - 1.20	23	16	25	36
1.20 - 1.50	23	16	25	36
1.50 - 1.80	25	14	27	34
1.80 - 2.10	34	11	25	30
Position 2				
0 00 - 0.05	19	9	29	43
0.05 - 0.10	20	10	29	41
0.10 - 0.20	27	9	27	37
0.20 - 0.30	25	9	31	35
0.30 - 0.60	22	10	27	41
0.60 - 0.90	18	8	27	47
0.90 - 1.20	21	11	27	41
1.20 - 1.50	24	12	28	36
1.50 - 1.80	21	12	30	37

Table 32: Plot 7 (EP29) Mount Fisher – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark yellowish brown (10YR3/4); sandy loam.
0.05 to 0.10	Dark yellowish brown (10YR4/6); sandy clay loam.
0.10 to 0.20	Yellowish brown (10YR5/6); clay loam; fine sand.
0.20 to 0.30	Brownish yellow (10YR6/8); silty medium clay.
0.30 to 0.60	Yellowish brown (10YR5/8); silty medium clay.

Table 33: Plot 7 (EP29) Mount Fisher – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0.00 - 0.05	0.86	4.0	3.6	3.8	6.30	-	0.65	0.55	0.22	0.10	3.08	0.39	3.47	-	4.99
0.05 - 0.10	0.86	4.1	3.7	4.0	4.67	-	0.37	0.32	0.16	0.09	2.76	0.72	3.48	-	4.42
0.10 - 0.20	1.15	4.1	3.8	4.3	2.71	-	0.22	0.18	0.11	0.06	1.53	0.20	1.73	-	2.30
0.20 - 0.30	1.15	4.3	4.0	4.5	1.84	-	0.17	0.12	0.09	0.05	0.85	0.09	0.94	-	1.37
0.30 - 0.60	1.28	4.4	4.1	4.6	1.14	-	0.13	0.09	0.08	0.05	0.61	0.61	1.22	-	1.57
0.60 - 0.90	1.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 34: Plot 7 (EP29) Mount Fisher – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.02 – 0.07	0.863	0.741	0.654	0.58	0.555	0.522	0.493		0.163
0.20 – 0.25	1.154	0.448	0.444	0.419	0.400	0.380	0.352		0.116
0.40 – 0.45	0.276	0.382	0.378	0.342	0.328	0.31	0.275		0.122

Table 35: Plot 7 (EP29) Mount Fisher – soil particle size mean data for samples collected in the original soil survey (data from file notes).

Depth (m)	Sand %	Silt %	Clay %
0.00 - 0.30	54.8	32.0	13.2

Table 36: Plot 8 (EP30) Agapetes Logging Area – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Brown (7.5YR4/4); sandy light clay; moderate 5-10mm angular blocky; rough-ped fabric; moist; moderately weak; 20-50% 2-6mm, angular, dispersed, quartz gravel; many roots; sharp smooth change to -
0.05 to 0.10	Strong brown (7.5YR4/6); light clay; moderate 5-10mm angular blocky; rough-ped fabric; moist; moderately weak; 10-20% 2-6mm, angular, dispersed, quartz gravel; many roots; abrupt smooth change to -
0.10 to 0.20	Yellowish red (5YR4/6);light medium clay; moderate 5-10mm angular blocky parting to moderate subangular blocky; smooth-ped fabric; moist; moderately firm; 2-10% 2-6mm, angular, dispersed, quartz gravel; common roots; clear wavy change to -
0.20 to 0.30	Red (2.5YR4/6); light medium clay; moderate 5-10mm angular blocky parting to moderate subangular blocky; smooth-ped fabric; moist; moderately firm; 2-10% 2-6mm, angular, dispersed, quartz gravel; common roots; gradual wavy change to -
0.30 to 0.60	Red (2.5YR4/6); medium clay; moderate 5-10mm angular blocky parting to moderate subangular blocky; smooth-ped fabric; moist; very firm; 2-10% 2-6mm, angular, dispersed, quartz gravel; <10% of ped faces or walls coated with cutans; few roots; diffuse wavy change to -
0.60 to 0.90	Red (2.5YR4/6); sandy medium clay; moderate 5-10mm angular blocky parting to moderate subangular blocky; smooth-ped fabric; moist; very firm; 2-10% 2-6mm, angular, dispersed, quartz gravel; <10% of ped faces or walls coated with cutans; few roots;
0.90 to 1.20	Red (2.5YR4/6); sandy medium clay; moderate 10-20mm angular blocky; smooth-ped fabric; moist; very firm; 10-20% 2-6mm, angular, dispersed, quartz gravel;
1.20 to 1.50	Red (10R4/6); sandy medium clay; smooth-ped fabric; moist; very firm; 10-20% 2-6mm, angular, dispersed, quartz gravel; <2% 6-20mm ferruginous soft segregations;
1.50 to 1.80	Red (10R4/6); sandy medium clay; smooth-ped fabric; moist; very firm; 10-20% 2-6mm, angular, dispersed, quartz gravel.

Table 37: Plot 8 (EP30) Agapetes Logging Area – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	0.94	4.4	4.0	-	6.06	-	1.30	1.67	0.34	0.14	-	-	-	3.30	3.45
0.05 - 0.10	-	4.4	4.2	-	3.42	-	0.22	0.63	0.24	0.11	1.39	1.84	3.23	3.50	4.43
0.10 - 0.20	-	4.6	4.2	-	3.91	-	0.22	0.78	0.26	0.11	1.54	1.47	3.01	3.00	4.38
0.20 - 0.30	1.20	4.6	4.2		2.27	-	0.10	0.48	0.15	0.09	1.12	0.24	1.36	2.90	2.18
0.30 - 0.60	1.40	4.6	4.2	-	1.33	-	0.08	1.08	0.10	0.05	0.72	0.16	0.88	2.70	2.19
0.60 - 0.90	-	4.8	4.2	-	0.48	-	0.05	1.52	0.17	0.05	0.24	0.09	0.33	2.70	2.12
0.90 - 1.20	1.40	4.7	4.2		-	-	0.07	0.64	0.16	0.05	0.89	0.24	1.13	2.20	2.05
1.20 - 1.50	-	-	-	-	-	-	0.05	0.35	0.11	0.04	1.13	0.19	1.32	-	1.87
1.50 - 1.80	-	-	-	-	-	-	0.08	0.35	0.11	0.04	1.27	0.32	1.59	-	2.17

Table 38: Plot 8 (EP30) Agapetes Logging Area – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.00 – 0.05	0.937	0.547	0.479	0.423	0.407	0.379	0.341	0.212	0.193
0.20 – 0.25	1.263	0.383	0.349	0.325	0.302	0.277	0.259	0.215	0.204
0.40 – 0.45	1.350	0.365	0.350	0.287	0.277	0.273	0.257	0.212	0.211
1.00 – 1.05	1.385	0.319	0.293	0.268	0.259	0.253	0.240	0.209	0.209

Table 39: Plot 8 (EP30) Agapetes Logging Area – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	**Saturated hydraulic conductivity K_S (mm $minute^{-1}$)**	**Mean K_S for depth interval (mm $minute^{-1}$)**
0.0 - 0.05	7.7	
0.0 - 0.05	25.9	
0.0 - 0.05	40.7	
0.0 - 0.05	13.0	**21.8**
0.20 - 0.25	7.2	
0.20 - 0.25	6.4	
0.20 - 0.25	8.0	
0.20 - 0.25	18.1	
0.20 - 0.25	24.8	**12.9**
0.40 - 0.45	6.9	
0.40 - 0.45	2.3	
0.40 -0.45	6.5	**5.2**
1.0 - 1.05	7.9	
1.0 - 1.05	7.4	**7.6**

Table 40: Plot 9 (EP31) Woopen Creek – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	**Description**
0 to 0.05	Dark yellowish brown (10YR4/4); sandy clay loam; non-sticky; slightly plastic; normal plasticity;
0.05 to 0.10	Dark yellowish brown (10YR4/4); sandy clay loam; non-sticky; slightly plastic; normal plasticity;
0.10 to 0.20	Dark yellowish brown (10YR4/6); sandy clay loam; slightly-sticky; moderately plastic; normal plasticity;
0.20 to 0.30	Dark yellowish brown (10YR4/6); clay loam; slightly sticky; very plastic; normal plasticity;
0.30 to 0.60	Strong brown (7.5YR4/6) light clay; slightly sticky; very plastic; normal plasticity;
0.60 to 0.90	Strong brown (7.5YR4/6) light medium clay; moderately sticky; very plastic; normal plasticity.

Table 41: Plot 9 (EP31) Woopen Creek – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	-	4.3	4.1	4.2	2.17	-	0.43	0.26	0.15	0.08	1.34	0.21	1.55	-	2.47
0.05 - 0.10	-	4.3	4.2	4.3	2.23	-	0.40	0.25	0.15	0.09	1.03	0.00	1.03	-	1.92
0.10 - 0.20	-	4.2	4.2	4.4	1.45	-	0.25	0.16	0.12	0.06	0.73	0.10	0.83	-	1.42
0.20 - 0.30	-	4.2	4.2	4.5	1.17	-	0.22	0.15	0.09	0.05	0.62	0.08	0.80	-	1.21
0.30 - 0.60	-	4.4	4.4	4.6	0.54	-	0.17	0.15	0.09	0.05	0.36	0.21	0.57	-	1.03
0.60 - 0.90	-	4.5	4.4	4.6	0.41	-	0.15	0.18	0.11	0.05	0.48	0.18	0.66	-	1.15

Table 42: Plot 9 (EP31) Woopen Creek – soil particle size mean data for samples collected in the original soil survey (data from file notes).

Depth (m)	Sand %	Silt %	Clay %
0 00 - 0.30	86	6	5.7

Table 43: Plot 10 (EP32) McIlwraith Range – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Very dark greyish brown (10YR3/2); sandy clay loam; moist; friable; moderate 5-10mm subangular blocky; rough ped fabric; macropores; <5mm and 5-10mm cracks; very weak; normal plasticity; abundant roots; abrupt smooth change to -
0.05 to 0.20	Yellowish brown (10YR5/4); many, medium, brown (10YR4/3) mottles; moist; friable; sandy clay loam; moderate 5-20mm subangular blocky; rough ped fabric; macropores; <5mm and 5-10mm cracks; very weak; normal plasticity; many roots; gradual wavy change to -
0.20 to 0.45	Brownish yellow (10YR6/6); common, medium yellowish brown (10YR5/4) mottles; moist; sandy clay loam; <2% 2-6mm rounded, dispersed gravel; slightly hard, friable; moderate 10-20mm subangular blocky; rough ped fabric; macropores; <5mm cracks; moderately weak; normal plasticity; <2% 2-6mm ferruginous nodules; common roots; gradual wavy change to -
0.45 to 0.60	Brownish yellow (10YR6/6); moist; light clay; 2-10% 2-6mm rounded, subangular, dispersed quartz gravel; weak 20-50mm angular blocky; slightly hard to friable; rough ped fabric; macropores; <5mm cracks; moderately weak; normal plasticity; 2-10% 2-6mm ferruginous nodules; common roots; gradual wavy change to -
0.60 to 0.90	Reddish yellow (7.5YR6/8); moist; light clay; 25-50% 6-20mm rounded subangular dispersed quartz gravel; weak 20-50mm angular blocky; rough ped fabric; macropores; <5mm cracks; moderately firm; normal plasticity; 20-50% 6-20mm ferruginous nodules; few roots; gradual irregular change to -
0.90 to 1.20	Reddish yellow (7.5YR6/8); common coarse red (2.5YR5/8) mottles; moist; medium clay 2-10% 6-20mm rounded subangular dispersed quartz gravel; weak 20-50mm angular blocky; rough ped fabric; moderately firm; normal plasticity; slightly sticky; 20-50% 6-60mm ferruginous segregations; few roots; gradual irregular change to -
1.20 to 1.50	Reddish yellow (7.5YR7/8); medium clay; rounded ironstone segregations.

Table 44: Plot 10 (EP32) McIlwraith Range – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	1.08	3.8	-	3.7	4.59	0.298	0.28	0.49	0.15	0.10	1.18	0.27	1.45	3.50	2.47
0.05 - 0.10	-	3.7	-	3.9	2.92	0.214	0.10	0.22	0.11	0.07	1.23	0.17	1.40	2.30	1.90
0.10 - 0.20	1.31	3.7	-	4.1	1.88	0.132	0.05	0.12	0.07	0.04	0.96	0.03	0.99	1.60	1.27
0.20 - 0.30	-	3.5	-	4.2	1.38	0.118	0.03	0.08	0.05	0.04	0.78	0.00	0.76	1.10	0.98
0.30 - 0.45	1.54	3.6	-	4.2	0.96	0.072	0.03	0.07	0.05	0.03	0.70	0.00	0.69	1.00	0.88
0.45 - 0.60	1.54	3.6	-	4.2	0.58	0.056	0.03	0.07	0.04	0.03	0.69	0.00	0.62	1.00	0.86
0.60 - 0.90	-	3.5	-	4.3	0.32	0.038	0.03	0.08	0.02	0.03	0.68	0.00	0.61	1.50	0.84
0.90 - 1.20	1.12	3.6	-	4.3	0.12	0.002	0.03	0.26	0.03	0.03	0.77	0.00	0.68	1.80	1.12
1.20 - 1.50	-	3.6	-	4.3	0.07	0.002	0.03	0.27	0.02	0.04	0.94	0.00	0.87	1.90	1.30
1.50 - 1.80	-	3.4	-	4.2	0.21	0.013	-	-	-	-	0.95	0.00	0.92	-	-
1.80 - 2.10	-	3.4	-	4.2	0.24	0.014	-	-	-	-	1.18	0.00	1.10	-	-
2.10 - 2.40	-	3.5	-	4.0	0.27	0.028	-	-	-	-	1.25	0.13	1.38	-	-

Table 45: Plot 10 (EP32) McIlwraith Range – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.10 – 0.15	1.315	0.339	0.330	0.254	0.214	0.167	0.149	0.096	0.093
0.30 – 0.35	1.495	0.249	0.242	0.180	0.166	0.135	0.114	0.093	0.089
0.50 – 0.55	1.569	0.224	0.210	0.159	0.145	0.102	0.103	0.096	0.089

Table 46: Plot 10 (EP32) McIlwraith Range – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.0 - 0.05	3.4	
0.0 - 0.05	3.4	
0.0 - 0.05	18.6	**8.5**
0.10 - 0.15	2.1	
0.10 - 0.15	4.3	
0.10 - 0.15	2.5	
0.10 - 0.15	3.1	**3.0**
0.30 - 0.35	1.5	
0.30 - 0.35	1.3	
0.30 - 0.35	0.6	
0.30 - 0.35	1.3	**1.2**
0.50 - 0.55	2.0	
0.50 - 0.55	2.8	
0.50 - 0.55	3.4	
0.50 - 0.55	4.3	**3.1**

Table 47: Plot 10 (EP32) McIlwraith Range – soil particle size mean data for samples collected in the original soil survey (data from laboratory sheet, n=8).

Depth (m)	Sand %	Silt %	Clay %
0 00 - 0.30	78.6	7.2	14.2

Table 48: Plot 10 (EP32) McIlwraith Range – soil particle size data for samples collected from two positions in a soil pit adjacent to the plot.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Position 1				
0.0 – 0.5	56	24	3	17
0.5 – 0.10	50	29	3	18
0.10 – 0.20	53	26	3	18
0.20 – 0.30	55	23	3	19
0.30 – 0.45	53	23	5	19
0.45 – 0.60	45	28	5	22
0.60 – 0.90	45	22	8	25
0.90 – 1.20	41	12	19	28
1.20 – 1.50	47	10	20	23
1.50 – 1.80	46	15	20	19
1.80 – 2.10	-	-	-	-
2.10 – 2.40	40	13	28	19
Position 2				
0.0 – 0.5	53	24	4	19
0.5 – 0.10	48	28	4	20
0.10 – 0.20	48	29	3	20
0.20 – 0.30	48	28	3	21
0.30 – 0.45	48	28	3	21
0.45 – 0.60	-	-	-	-
0.60 – 0.90	48	23	7	22
0.90 – 1.20	36	15	20	29
1.20 – 1.50	38	13	22	17

Table 49: Plot 11 (EP33) Curtain Fig – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark reddish brown (5YR2.5/2); silty clay; moderate, medium and fine angular blocky; crumbly; friable; abundant roots; very porous; occasional stones; common gravel
0.05 to 0.10	Dark reddish brown (5YR2.5/2); silty clay loam; angular blocky; less crumbly; friable; common roots
0.10 to 0.20	Dark reddish brown (5YR2.5/2); silty clay; angular blocky; less crumbly; friable; common roots
0.20 to 0.30	Dark reddish brown (5YR3/2); silty clay; moderate, medium subangular blocky; friable; slightly less porous; common stones
0.30 to 0.60	Dark reddish brown (5YR2.5/2 - 3/2); silty clay-clay; moderate, medium subangular blocky; firm; friable; occasional roots
0.60 to 0.90	Dark reddish brown (5YR3/2); clay; incomplete angular blocky; firm; few roots; occasional stones
0.90 to 1.20	Dark reddish brown (5YR3/2); clay; massive; firm; few roots; occasional stones
1.20 to 1.50	Dark reddish brown (5YR3/2); clay; massive; very firm; few roots; few stones
1.50 to 1.80	Dark brown (7.5YR4/2 - 3/2) with grey mottles; silty clay; massive; very firm; rare roots; occasional weathered stones.

Table 50: Plot 11 (EP33) Curtain Fig – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	0.78	6.2	6.3	6.0	7.39	0.726	36.01	7.47	1.09	0.13	0.00	0.10	-	22.90	44.70
0.05 - 0.10	-	6.0	6.1	6.0	5.27	0.60	29.41	5.85	0.78	0.11	0.00	0.09	-	23.60	36.20
0.10 - 0.20	0.85	5.8	6.0	5.7	3.73	0.469	21.91	4.33	0.60	0.09	0.01	0.08	-	17.50	26.40
0.20 - 0.30	-	5.7	6.1	5.8	2.37	0.316	15.43	2.91	0.52	0.09	0.00	0.07	-	14.10	19.00
0.30 - 0.60	1.01	5.6	6.0	5.6	1.02	0.121	8.04	1.70	0.25	0.09	0.01	0.07	-	8.00	10.10
0.60 - 0.90	-	5.4	5.6	5.5	0.66	0.071	5.80	1.96	0.40	0.08	0.00	0.06	-	8.50	8.23
0.90 - 1.20	1.04	4.9	5.4	5.2	0.23	0.034	4.81	2.03	0.57	0.12	0.00	0.05	-	7.70	7.53
1.20 - 1.50	1.03	4.8	5.3	5.0	0.19	0.020	5.41	2.45	0.57	0.23	-	-	-	8.30	-
1.50 - 1.80	-	5.0	5.3	5.1	0.17	0.021	5.69	2.56	0.35	0.29	-	-	-	8.30	-
1.80 - 2.10	-	5.2	5.6	5.3	0.19	0.024	5.88	3.03	0.38	0.59	-	-	-	8.70	-
2.10 - 2.40	-	5.2	5.6	5.1	0.33	0.038	5.38	2.87	0.19	0.83	-	-	-	7.80	-

Table 51: Plot 11 (EP33) Curtain Fig – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.03 - 0.08	0.983	0.633	0.611	0.542	0.521	0.484	0.442	-	0.385
0.12 - 0.17	1.106	0.529	0.443	0.419	0.402	0.382	0.363	-	0.287
0.40 - 0.45	0.213	0.451	0.443	0.419	0.402	0.382	0.363	-	0.287
0.75 - 0.80	0.301	0.404	0.395	0.383	0.368	0.350	0.334	-	0.303
1.20 – 1.25	0.306	0.402	0.397	0.388	0.378	0.364	0.347	-	

Table 52: Plot 11 (EP33) Curtain Fig – soil hydraulic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	**Saturated hydraulic conductivity K_S (mm minute^{-1})**	**Mean K_S for depth interval (mm minute^{-1})**
0.03 - 0.08	1.4	
0.03 - 0.08	2.6	
0.03 - 0.08	1.5	
0.03 - 0.08	1.1	**1.7**
0.12 - 0.17	0.7	**0.7**
0.40 - 0.45	too slow	-

Table 53: Plot 11 (EP33) Curtain Fig – soil particle size data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Sample 1				
0 00 - 0.05	6	8	39	47
0.05 - 0.10	8	22	31	39
0.10 - 0.20	9	8	35	48
0.20 - 0.30	6	5	34	55
0.30 - 0.60	3	4	26	67
0.60 - 0.90	2	5	23	70
0.90 - 1.20	2	4	21	73
1.20 - 1.50	1	5	20	74
1.50 - 1.80	3	8	28	61
1.80 - 2.10	9	11	31	49
2.10 – 2.40	5	9	35	51
Sample 2				
0 00 - 0.05	10	8	62	20
0.05 - 0.10	9	7	46	38
0.10 - 0.20	8	9	46	37
0.20 - 0.30	9	9	41	41
0.30 - 0.60	8	9	37	46
0.60 - 0.90	9	14	30	47
0.90 - 1.20	8	15	23	54
1.20 - 1.50	7	14	38	40
1.50 - 1.80	15	20	25	40
1.80 - 2.10	13	17	25	45
2.10 – 2.40	13	15	30	42
Sample 3				
0 00 - 0.05	17	8	35	40
0.05 - 0.10	3	4	42	51
0.10 - 0.20	6	5	37	52
0.20 - 0.30	2.5	4.5	28	65
0.30 - 0.60	1	4	24	71
0.60 - 0.90	0.5	4.5	25	70
0.90 - 1.20	1	5	22	72
1.20 - 1.50	1.5	5.5	22	71
1.50 - 1.80	4	7	23	66
1.80 - 2.10	5	10	27	58
2.10 - 2.40	27	21	27	25
2.40 - 2.70	16	12	36	36
Sample 4				
0 00 - 0.05	16	13	38	33
0.05 - 0.10	13	12	37	38
0.10 - 0.20	8	5	39	48

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
0.20 - 0.30	2	5	44	49
0.30 - 0.60	1	3	27	69
0.60 - 0.90	1	3	25	71
0.90 - 1.20	0.5	4	21.5	74
1.20 – 1.40	0.5	3.5	21	75
1.40 - 1.50	2	6	25	67
1.50 - 1.80	3	6	22	69
1.80 - 2.10	-	-	-	-
2.10 - 2.40	18	19	36	27

Table 54: Plot 11 (EP33) Curtain Fig – soil particle density data for samples collected from a soil pit adjacent to the plot on granitic soil.

Profile depth (m)	Sample depth (m)	Particle density (kg m^{-3})
Position 3		
0.10 – 0.20	0.12 – 0.17	2.74
0.30 – 0.60	0.40 – 0.45	2.82
0.60 – 0.90	0.75 – 0.80	2.84
Position 4		
0.10 – 0.20	0.12 – 0.17	2.78
0.30 – 0.60	0.40 – 0.45	2.88
0.60 – 0.90	0.75 – 0.80	2.85

Table 55: Plot 12 (EP34) Russell River – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 - 0.05	Dark brown (7.5YR3/4); clayey sand; non-sticky; non-plastic;
0.05 - 0.10	Strong brown (7.5YR4/6); sandy clay loam; slightly sticky; slightly plastic;
0.10 - 0.20	Strong brown (7.5YR4/6); clay loam; slightly sticky; moderately plastic;
0.20 - 0.30	Strong brown (7.5YR4/6); clay loam; slightly sticky; moderately plastic;
0.30 - 0.60	Reddish brown (5YR4/4); clay loam; slightly sticky; very plastic;
0.60 - 0.90	Reddish brown (5YR4/4); clay loam; moderately sticky; very plastic.

Table 56: Plot 12 (EP34) Russell River – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	-	4.5	4.4	4.4	5.87	-	2.20	1.05	0.45	0.09	0.46	0.17	0.63	-	4.42
0.05 - 0.10	-	4.6	4.4	4.5	4.61	-	1.22	0.66	0.27	0.09	0.36	0.25	0.61	-	2.58
0.10 - 0.20		4.4	4.2	4.6	2.97	-	0.62	0.43	0.17	0.08	0.14	0.14	0.28	-	1.58
0.20 - 0.30	-	4.4	4.4	4.8	2.11	-	0.67	0.45	0.12	0.06	0.13	0.13	0.26	-	1.56
0.30 - 0.60	-	4.2	4.3	4.8	1.19	-	0.53	0.61	0.12	0.09	0.11	0.11	0.22	-	1.57
0.60 - 0.90	-	4.2	4.2	4.4	0.75	-	0.40	0.59	0.12	0.10	0.98	0.15	1.13	-	2.34

Table 57: Plot 12 (EP34) Russell River – soil particle size mean data for samples collected in the original soil survey (file data sheet, n=5).

Depth (m)	Sand %	Silt %	Clay %
0 00 - 0.30	91.0	5.2	3.8

Table 58: Plot 13 (EP35) Whyanbeel – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 - 0.10	Brown to dark brown (10YR4/3); light clay; 2-25mm angular to subangular blocky; moderately plastic; normal plasticity; slightly sticky; friable; abundant roots
0.10- 0.20	Strong brown (7.5YR5/6); light medium clay; angular blocky; friable; moderately plastic; normal plasticity; moderately sticky; occasional roots; occasional gravel
0.20 - 0.30	Strong brown (7.5YR5/7); light medium clay; friable; moderately plastic; normal plasticity; moderately sticky; occasional roots; occasional gravel
0.30 - 0.60	Reddish yellow (5YR6/8) common fine mottles; medium heavy clay; firm; moderately plastic; normal plasticity; moderately sticky; rare roots; occasional fine gravel
0.60 - 0.90	Strong brown (7.5YR5/8); few mottles; medium clay; firm; moderately sticky; rare roots; rare gravel.

Table 59: Plot 13 (EP35) Whyanbeel – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	-	3.8	3.5	3.3	3.60	-	0.25	0.43	0.53	0.16	3.84	1.05	-	-	6.26
0.05 - 0.10	-	3.8	3.6	3.4	2.84	-	0.20	0.32	0.25	0.12	3.77	0.85	0.00	5.51	-
0.10 - 0.20	-	3.8	3.7	3.6	1.34	-	0.17	0.21	0.20	0.09	3.37	0.81	0.00	4.85	-
0.20 - 0.30	-	3.6	3.8	3.7	0.70	-	0.13	0.19	0.29	0.08	2.42	0.40	0.00	3.51	-
0.60 - 0.90	-	3.6	3.8	3.8	0.37	-	0.12	0.20	0.35	0.07	2.32	0.11	0.00	3.17	-

Table 60: Plot 13 (EP35) Whyanbeel – soil particle size mean data for samples collected in the original soil survey (file data sheet, n=5).

Depth (m)	Gravel %	Sand %	Silt %	Clay %
0 00 - 0.30	12.6	45.8	20.6	21.0

Table 61: Plot 14 (EP37) Eungella – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.10	Brown (7.5YR4/2) sandy clay loam; moderate 2-5mm subangular blocky; rough-ped fabric; 5-10mm cracks; moderately weak; slightly sticky; normal plasticity; abrupt roots; abrupt smooth change to -
0.10 to 0.20	Dark brown (7.5YR3/4); fine sandy clay loam; moderate 5-10mm subangular blocky; rough-ped fabric; 5-10mm cracks; moderately weak; slightly sticky; normal plasticity; many roots; clear wavy change to -
0.20 to 0.30	Reddish brown (5YR4/4) fine sandy clay loam; moderate 5-10mm subangular blocky; rough-ped fabric; 5-10mm cracks; very weak; slightly sticky; normal plasticity; many roots; clear wavy change to -
0.30 to 0.70	Reddish brown (2.5YR4/4) clay loam; moderate 10-20mm subangular blocky; rough-ped fabric; moderately firm; slightly sticky; normal plasticity; < 2% 200-600mm, subangular, dispersed igneous rock (unidentified) gravel; <10% of ped faces or walls coated with cutans; common roots; clear wavy change to -
0.70 to 0.90	Reddish brown (5YR4/4) light clay; moderate 10-20mm subangular blocky; rough-ped fabric; moderately firm; slightly sticky; normal plasticity; <10% of ped faces or walls coated with cutans; few roots; gradual wavy change to -
0.90 to 1.50	Brown (7.5YR5/4) light medium clay; moderate 20-50mm subangular blocky; rough-ped fabric; very firm; moderately sticky; normal plasticity; <10% of ped faces or walls coated with cutans; few roots; gradual change to -
1.50 to 1.80	Brown (7.5YR5/4) light medium clay to -
1.80 to 2.10	Yellowish brown (10YR5/4) light medium clay.

Table 62: Plot 14 (EP37) Eungella – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0.00 - 0.05	0.72	5.0	4.9	4.6	8.02	0.793	10.5000	3.66	0.67	0.13	0.10	0.00	0.00	12.80	14.90
0.05 - 0.10	-	5.0	4.9	4.6	6.86	0.70	8.02	2.50	0.39	0.12	0.25	0.00	0.00	9.40	11.00
0.10 - 0.20	0.77	4.9	4.9	4.6	4.87	0.803	5.37	1.67	0.20	0.11	0.26	0.00	0.26	8.00	7.61
0.20 - 0.30	0.93	4.7	4.8	4.6	2.81	0.293	2.77	0.97	0.11	0.09	0.16	0.00	0.00	5.10	3.94
0.30 - 0.60	0.87	4.2	4.5	4.4	0.87	0.130	0.86	0.65	0.08	0.06	0.33	0.00	0.33	3.30	1.98
0.60 - 0.70	0.94	4.0	4.2	4.1	0.93	0.080	0.56	0.61	0.09	0.03	0.77	0.04	0.72	3.30	2.10
0.70 - 0.09	1.15	3.8	-	4.0	0.68	0.053	0.43	0.67	0.10	0.03	1.22	0.11	1.33	3.20	2.56
0.09 - 1.20	-	3.7	4.0	3.8	0.52	0.055	0.09	0.45	0.04	0.04	2.11	0.22	2.33	3.10	2.95
1.20 - 1.50	-	3.6	3.9	3.8	0.36	0.023	0.05	0.38	0.02	0.03	2.32	0.28	2.60	2.50	3.08
1.50 - 1.80	-	3.6	3.9	4.0	0.18	0.012	0.07	0.28	0.03	0.03	2.07	0.37	2.44	2.40	2.85
1.80 - 2.10	-	3.6	3.8	4.0	0.15	0.015	0.03	0.23	0.03	0.04	2.53	0.40	2.93	2.50	3.26

Table 63: Plot 14 (EP37) Eungella – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density ($Mg\ m^{-3}$)	Gravimetric moisture content ($kg\ kg^{-1}$) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.02 - 0.07	0.724	0.991	0.851	0.781	0.751	0.685	0.619	0.0359	0.0320
0.10 - 0.15	0.769	0.947	0.804	0.774	0.713	0.664	0.597	0.0337	0.0290
0.20 - 0.25	0.855	0.772	0.658	0.637	0.605	0.547	0.502	0.0472	0.0284
0.50 – 0.55	0.933	0.673	0.653	0.600	0.560	0.515	0.478	0.0327	0.0286
0.80 – 0.85	1.156	0.483	0.466	0.442	0.421	0.398	0.371	0.0343	0.0324

Table 64: Plot 14 (EP37) Eungella – soil hydraulic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	**Saturated hydraulic conductivity K_S (mm $minute^{-1}$)**	**Mean K_S for depth interval (mm $minute^{-1}$)**
0.50-0.55	0.0	
0.50-0.55	9.0	
0.50-0.55	0.3	
0.50-0.55	10.8	**5.0**
0.80-0.85	6.7	
0.80-0.85	15.5	
0.80-0.85	3.1	
0.80-0.85	5.3	**7.7**

Table 65: Plot 14 (EP37) Eungella – soil particle size data for samples collected from a soil pit adjacent to the plot on basaltic soil.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Position A				
0.00-0.05	5	18	37	60
0.05-0.10	6	35	24	35
0.10-0.20	6	45	20	28
0.20-0.30	5	41	19	35
0.30-0.60	2	11	25	62
0.60-0.70	3	6	22	69
0.70-0.90	2	6	23	69
0.90-1.20	2	4	27	67
1.20-1.50	1	4	29	66
1.50-1.80	3	5	34	58
1.80-2.10	2	8	32	58
Position B				
0.00-0.05	4	8	45	43
0.05-0.10	-	-	-	-
0.10-0.20	5	47	25	23
0.20-0.30	6	37	21	36
0.30-0.60	2	10	24	64
0.60-0.70	2	6	23	69
0.70-0.90	2	5	23	70
0.90-1.20	1	4	25	70
1.20-1.50	2	4	28	66

Table 66: Plot 15 (EP38) The Crater – soil chemical analysis data for soil samples collected from contrasting lower and upper slope positions across the 0.5 ha plot. Data represent samples taken during 2000 from bulked soil from three auger holes (within one metre of each other) at both the lower and upper slope positions. Analytical methods are detailed in the main text. (NB. data format for this table varies from other sites.)

Depth (m)	pH 1:5 H_2O	EC dS m^{-1}	Org. C %	Tot. N %	Exchangeable cations				P Bicarb	H + Al	CEC
					Ca	Mg	K	Na			
					(cmol(+) kg^{-1})				mg/kg	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
Upper slope samples (predominantly rhyolitic soil parent material)											
0 00 - 0.10	6.2	0.11	7.80	0.66	20.0	3.90	0.27	0.06	16	0.12	14.0
0.10 - 0.20	6.1	0.08	5.75	0.53	11.0	2.70	0.21	0.08	9	0.11	11.0
0.20 – 0.30	5.9	0.06	4.15	0.38	6.1	1.70	0.12	0.07	8	0.15	5.8
0.30 – 0.45	5.8	0.04	1.95	0.16	1.9	0.67	0.07	0.12	6	0.24	2.6
0.45 – 0.60	6.1	0.02	0.55	0.03	1.1	0.46	0.03	0.07	3	0.19	2.3
0.60 – 0.90	6.1	0.02	0.39	0.01	1.3	1.10	0.04	0.09	1	0.12	2.6
Lower slope samples (valley infill with basaltic influence)											
0.00 - 0.10	6.5	0.21	15.90	1.02	48.00	14.00	0.73	0.21	32	0.17	19.0
0.10 - 0.20	6.5	0.17	12.50	0.89	43.00	9.90	0.45	0.15	19	0.19	19.0
0.20 - 0.30	6.6	0.13	9.45	0.71	39.00	7.40	0.31	0.14	14	0.08	21.0
0.30 - 0.45	6.6	0.09	6.35	0.51	14.00	5.30	0.15	0.12	9	0.09	15.0
0.45 - 0.60	6.7	0.05	3.15	0.25	7.4	3.20	0.06	0.11	8	0.08	8.2
0.60 - 0.90	6.6	0.04	1.75	0.10	4.1	3.20	0.06	0.19	5	0.06	6.0

Table 67: Plot 15 (EP38) The Crater – soil bulk density data for soil samples collected from upper, mid- and lower slope positions across the 0.5 ha plot. Data represent hammer-driven core samples taken during 2002 from small soil pits. (NB. data format for this table varies from that of other sites.)

Depth (m)	Soil bulk density (Mg m^{-3})	Notes
Upper slope (Peg A at northeast corner of plot)		
0.0 – 0.025	0.66	Sandy loam (coarse sand, granitic); black to very dark grey
0.10 – 0.15	0.81	Sandy loam (fine sand only); grey changing to yellow grey at depth
0.25 – 0.50	0.82	
0.50 – 0.55	0.99	
Upper slope (2 m from subplot M corner peg)		
0.0 – 0.05	0.64	
0.10 – 0.15	0.91	One piece of granitic gravel 5 cm diameter and 3 pieces of weathered basalt sampled in profile
0.25 – 0.30	0.98	
0.50 – 0.55	1.38	
Midslope (at mid-plot position, 2 m downslope from J/F/K/G peg)		
0.0 – 0.05	0.57	
0.25 – 0.30	0.87	
0.50 – 0.55	1.05	
Lower slope (5 m downslope from C/D edge peg towards D corner peg)		
0.0 – 0.05	0.37	
0.10 – 0.15	0.71	Gradual transition throughout profile; 1 piece of gravel and 1 piece of basalt
0.25 – 0.30	0.78	Weathered basalt fragment at 30 cm depth
0.50 – 0.55	1.06	Charcoal abundant at 0.50 to 0.55 cm depth
Lower slope (outside the plot adjacent to plot P on the L plot side of the big figtree)		
0.0 – 0.05	0.48	
0.10 – 0.15	0.86	
0.25 – 0.30	0.88	
0.50 – 0.55	1.40	

Table 68: Plot 16 (EP40) Agapetes Scientific Area – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	**Description**
0 to 0.05	Greyish brown (10YR5/2); sandy loam; moderate subangular blocky; moderately strong; non-sticky; non-plastic; normal plasticity; 2-6mm subangular, dispersed, igneous rock (unidentified) gravel
0.05 to 0.10	Light brown (7.5YR6/4); sandy loam; weak granular; moderately strong; non-sticky; slightly plastic; normal plasticity; 2-6mm subangular, dispersed, igneous rock (unidentified) gravel
0.10 to 0.20	Pink (7.5YR7/4); sandy loam; moderately weak; non-sticky; moderately plastic; normal plasticity; 2-6mm subangular, dispersed, igneous rock (unidentified) gravel
0.20 to 0.30	Reddish yellow (7.5YR6/6); loamy sand; weak subangular blocky; moderately weak; non-sticky; moderately plastic; normal plasticity; 2-6mm subangular, dispersed, igneous rock (unidentified) gravel
0.30 to 0.60	Reddish yellow (7.5YR6/6); sandy loam; moderately weak; non-sticky; moderately plastic; normal plasticity; 2-6mm subangular, dispersed, igneous rock (unidentified) gravel
0.60 to 0.90	Pink (7.5YR7/4); sandy loam.

Table 69: Plot 16 (EP40) Agapetes Scientific Area – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	1.07	5.6	5.6	5.2	5.81	-	17.0	2.03	0.51	0.17	0.27	0.20	0.47	10.10	20.18
0.05 - 0.10	1.07	5.4	5.6	4.6	3.15	-	5.67	1.28	0.56	0.18	0.46	0.28	0.74	6.40	8.43
0.10 - 0.20	1.36	5.4	4.9	4.4	2.06	-	3.33	1.17	0.52	0.24	0.74	0.06	0.80	4.50	6.06
0.20 - 0.30	1.36	5.0	4.4	4.3	1.66	-	1.23	0.35	0.54	0.24	1.86	0.03	1.89	3.10	4.25
0.30 - 0.60	-	5.0	4.4	4.4	0.88	-	0.47	0.19	0.38	0.23	1.72	0.00	1.72	2.50	2.99
0.60 - 0.90	-	5.2	4.6	4.3	0.45	-	1.50	0.49	0.34	0.31	1.31	0.15	1.46	3.70	4.10

Table 70: Plot 16 (EP40) Agapetes Scientific Area – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.02 - 0.07	1.084	0.385	0.312	0.235	0.22	0.203	0.195	0.194	0.115
0.15 - 0.20	1.358	0.288	0.267	0.222	0.21	0.200	0.188	0.122	0.098
0.40 - 0.45	1.455	0.300	0.269	0.222	0.20	0.187	0.176	0.124	0.057
0.70 – 0.75	1.418	0.305	0.285	0.222	0.20	0.172	0.155	0.090	0.076

Table 71: Plot 16 (EP40) Agapetes Scientific Area – soil hydraulic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	**Saturated hydraulic conductivity K_S (mm minute^{-1})**	**Mean K_S for depth interval (mm minute^{-1})**
0.02 - 0.07	18.6	**18.6**
0.15 - 0.20	2.6	
0.15 - 0.20	1.0	**1.8**
0.40 - 0.45	1.9	
0.40 - 0.45	5.1	
0.40 - 0.45	5.1	
0.40 - 0.45	1.2	**3.3**

Table 72: Plot 17 (EP41) Oliver Creek – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Very dark greyish brown (10YR3/2); clay loam; abundant surface cobbles and gravel
0.05 to 0.10	Dark yellowish brown (10YR3/4); light clay
0.10 to 0.20	Dark yellowish brown (10YR3/4); light clay
0.20 to 0.30	Dark yellowish brown (10YR3/6); light medium clay
0.30 to 0.55	Dark yellowish brown (10YR3/6); medium clay

Table 73: Plot 17 (EP41) Oliver Creek – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	-	4.6	4.4	4.3	6.01	-	0.53	0.82	0.56	0.18	1.23	0.15	1.38	-	3.47
0.05 - 0.10	-	4.6	4.3	4.4	4.15	-	0.53	0.82	0.53	0.17	1.09	0.22	1.31	-	3.36
0.10 - 0.20	-	4.5	4.2	4.4	2.38	-	0.25	0.43	0.56	0.15	1.13	0.13	1.26	-	2.65
0.20 - 0.30	-	4.6	4.2	4.4	1.77	-	0.22	0.48	0.60	0.15	1.21	0.15	1.36	-	2.81
0.30 - 0.60	-	4.6	4.2	4.4	1.01	-	0.20	0.30	0.33	0.10	0.85	0.04	0.85	-	1.78

Table 74: Plot 17 (EP41) Oliver Creek – soil particle size mean data for samples collected in the original soil survey (data from file notes, n=5).

Depth (m)	Gravel %	Sand %	Silt %	Clay %
0.00 - 0.30	61.8	24.8	8.2	5.4

Table 75: Plot 18 (EP42) Iron Range – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Very dark grey (10YR3/1); fine sandy loam; weak 5-10mm parting to moderate 2-5mm cast; rough-ped fabric; <5mm cracks; very weak; non-sticky; abundant roots; abrupt smooth change to-
0.05 to 0.10	Very dark greyish brown (10YR3/2); fine sandy loam; weak 5-10mm parting to moderate 2-5mm cast; rough-ped fabric; <5mm cracks; very weak; non-sticky; many roots; abrupt smooth change to-
0.10 to 0.30	Dark brown (10YR3/3); fine sandy loam; weak 10-20mm parting to moderate 2-5mm cast; rough-ped fabric; <5mm cracks; very weak; non-sticky; many roots; abrupt smooth change to
0.30 to 0.60	Brown (10YR4/3); 10-20% 5-15mm distinct light yellowish brown (10YR6/4) mottles; fine sandy loam; weak 20-50mm angular blocky; rough-ped fabric; <5mm cracks; moderately weak; non-sticky; common roots; diffuse smooth change to-
0.60 to 1.50	Dark yellowish brown (10YR4/4); 2-10% 5-15mm distinct yellowish brown (10YR6/4) mottles; fine sandy loam; weak 50-100mm angular blocky; rough-ped fabric; <5mm cracks; moderately weak; non-sticky; few roots; diffuse smooth change to-
1.50 to 1.80	Dark yellowish brown (10YR4/6); 2-10% 5-15mm faint dark yellowish brown (10YR4/4) mottles; fine sandy loam; weak 50-100mm angular blocky; rough-ped fabric; <5mm cracks; moderately weak; non-sticky; few roots.

Table 76: Plot 18 (EP42) Iron Range – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0.00 - 0.05	-	5.2	5.0	4.6	2.13	0.169	4.05	2.06	0.25	0.09	0.03	0.06	0.09	5.90	6.54
0.05 - 0.10	-	5.1	4.7	4.4	1.53	0.145	2.49	1.34	0.15	0.07	0.18	0.09	0.27	4.20	4.32
0.10 - 0.20	1.27	4.9	4.5	4.2	1.11	0.110	3.29	1.11	0.19	0.06	0.36	0.10	0.46	3.40	5.11
0.20 - 0.30	-	5.0	4.4	4.0	0.40	0.075	2.29	0.85	0.10	0.05	0.66	0.11	0.77	2.80	4.06
0.30 - 0.60	1.45	5.1	4.6	4.0	0.43	0.043	2.65	1.18	0.18	0.08	0.37	0.12	0.49	3.00	4.58
0.60 - 0.90	-	5.4	4.8	4.2	0.24	0.020	1.41	0.94	0.04	0.06	0.13	0.11	0.24	3.10	2.69
0.09 - 1.20	1.43	-	-	-	0.23	0.015	1.28	1.02	0.14	0.05	0.18	0.16	0.34	-	2.83
1.20 - 1.50	-	-	-	-	0.16	0.014	1.18	1.33	0.09	0.05	0.05	0.18	0.23	3.20	2.88
1.50 - 1.80	-	-	-	-	0.15	0.015	0.99	1.48	0.06	0.05	0.04	0.17	0.21	3.10	2.79

Table 77: Plot 18 (EP42) Iron Range – soil particle size data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Course sand %	Fine sand %	Silt %	Clay %
0 00 - 0.05	6	73	7	14
0.05 - 0.10	6	73	7	16
0.10 - 0.20	6	72	7	15
0.20 - 0.30	4	73	8	15
0.30 - 0.60	3	70	10	17
0.60 - 0.90	2	71	9	18
0.90 - 1.20	3	69	9	19
1.20 - 1.50	2	70	9	19
1.50 - 1.80	2	71	9	18

Table 78: Plot 19 (EP43) Mount Baldy – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.05	Dark brown (7.5YR3/2); 5-15mm very dark grey (7.5YR3/1) mottles; light clay; moderate 5-10mm subangular blocky; rough-ped fabric; moist; very weak; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; abundant roots; abrupt smooth change to-
0.05 to 0.10	Brown (7.5YR4/2); 10-20% 5-15mm dark brown (7.5YR3/2) mottles; light clay; moderate 5-10mm subangular blocky; rough-ped fabric; moist; very weak; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; abundant roots; clear wavy change to-
0.10 to 0.20	Brown (7.5YR5/4); 10-20% 5-15mm faint brown (7.5YR4/2) mottles; light clay; moderate 5-10mm subangular blocky; rough-ped fabric; moist; very weak; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; many roots; gradual irregular change to-
0.20 to 0.48	Strong brown (7.5YR5/5); 2-10% 5-15mm faint brown (7.5YR4/4) mottles; light clay; moderate 5-10mm subangular blocky; rough-ped fabric; moist; very weak; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; common roots; diffuse irregular change to-
0.48 to 0.75	Brown (7.5YR4/4); 20-50% 5-15mm faint brown (7.5YR4/2) mottles; medium clay; weak 5-10mm subangular blocky; rough-ped fabric; moist; very firm; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; <10% of ped faces or walls coated with cutans; few roots; diffuse irregular change to-
0.75to 1.10	Strong brown (7.5YR5/5); 2-10% <5mm weak red (2.5YR4/2) mottles; heavy clay; massive 5-10mm subangular blocky; moist; very firm; 2-10% 6-20mm subrounded, dispersed, igneous rock (unidentified) gravel; <10% of ped faces or walls coated with cutans; few roots; diffuse irregular change to-
1.10 to 1.50	Reddish yellow (7.5YR6/6); 20-50% <5mm weak red (2.5YR4/2) mottles; massive 5-10mm subangular blocky; moist; very firm; <10% of ped-faces or walls coated with cutans; few roots
1.50 to 2.00	Reddish yellow (7.5YR6/5); 20-50% <5mm weak red (2.5YR4/2) mottles.

Table 79: Plot 19 (EP43) Mount Baldy – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations (cmol(+) kg^{-1})				Acid H (cmol(+) kg^{-1})		Exch. acid. (cmol(+) kg^{-1})	Comp. CEC (cmol(+) kg^{-1})	Sum. CEC (cmol(+) kg^{-1})
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H			
0.00 - 0.05	0.80	4.8	4.4	-	5.75	-	1.63	1.27	0.55	0.91	1.40	0.46	1.86	-	6.22
0.05 - 0.10	-	4.8	4.3	-	3.81	-	0.43	0.53	0.35	0.06	1.90	0.49	2.39	-	3.76
0.10 - 0.20	-	4.7	4.2	-	2.42	-	0.13	0.28	0.25	0.06	1.74	0.73	2.47	-	3.19
0.20 - 0.30	1.20	4.8	4.3	-	1.42	-	0.13	0.24	0.15	0.05	1.69	0.47	2.16	-	2.73
0.30 - 0.60	-	4.6	4.3	-	0.82	-	0.08	0.16	0.11	0.04	1.44	0.38	1.82	-	2.21
0.60 - 0.90	1.30	4.6	4.2	-	0.60	-	0.08	0.20	0.08	0.04	2.26	0.58	2.84	-	3.24
0.09 - 1.20	1.50	4.6	4.1	-	0.34	-	0.07	0.15	0.09	0.04	2.52	0.48	3.00	-	3.35
1.20 - 1.50	-	4.6	4.0	-	0.18	-	0.07	0.08	0.11	0.04	3.12	0.66	3.78	-	4.08
1.50 - 2.00	1.50	4.5	4.0	-	0.15	-	0.10	0.07	0.12	0.04	3.43	0.96	4.39	-	4.72

Table 80: Plot 19 (EP43) Mount Baldy – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures					
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa*	100 kPa*
0.02 - 0.07	0.800	0.778	0.663	0.557	0.525	0.485	0.440
0.25 - 0.30	0.933	0.404	0.396	0.359	0.341	0.326	0.312
0.60 - 0 65	1.323	0.331	0.326	0.283	0.265	0.253	0.225
0.90 – 0.95	1.098	0.286	0.278	0.252	0.240	0.231	0.220

* An entry in the laboratory records indicates that determinations for 33kPa and 100 kPa were undertaken using the lower cylinder only.

Table 81: Plot 19 (EP43) Mount Baldy – soil hydraulic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.02 - 0.07	8.76	
0.02 - 0.07	12.06	
0.02 - 0.07	23.22	
0.02 - 0.07	20.04	**16.02**
0.25 - 0.30	0.78	
0.25 - 0.30	1.14	**0.96**
0.25 - 0.30	too slow	
0.60 - 0.65	6.54	
0.60 - 0.65	2.16	
0.60 - 0.65	3.18	**3.96**
0.60 - 0.65	too slow	
090 - 0.95	too slow	
090 - 0.95	too slow	
090 - 0.95	too slow	
1.50 - 1.55	too slow	
1.50 - 1.55	too slow	
1.50 - 1.55	too slow	

Table 82: Plot 19 (EP43) Mount Baldy – soil particle size data for samples collected from four locations within the plot.

Depth (m)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Total %
Sample 1 (at tree E3)					
0 00 - 0.05	16.5	11.2	33.3	29.3	90.4
0.05 - 0.10	18.0	10.5	27.8	34.2	90.4
0.10 - 0.20	14.5	11.4	37.2	31.4	94.4
0.20 - 0.30	15.5	12.5	37.2	31.4	96.5
0.30 - 0.60	14.5	14.2	38.4	31.0	98.2
0.60 - 0.90	13.5	13.9	33.3	39.5	100.1
Sample 2 (at tree C19)					
0 00 - 0.05	15.8	15.2	32.5	28.0	91.5
0.05 - 0.10	15.4	16.2	33.5	29.4	94.5
0.10 - 0.20	16.1	15.6	33.9	30.5	96.1
0.20 - 0.30	15.9	16.0	34.8	30.3	97.0
0.30 - 0.60	15.3	17.9	34.3	30.6	98.1
0.60 - 0.90	11.6	16.7	30.3	40.1	98.8
Sample 3 (at tree P23)					
0 00 - 0.05	19.5	15.6	29.6	23.5	88.1
0.05 - 0.10	17.8	16.3	31.4	25.0	90.6
0.10 - 0.20	15.9	17.6	32.5	25.8	91.7
0.20 - 0.30	15.3	18.0	33.3	26.5	93.2
0.30 - 0.60	16.6	19.1	33.1	27.0	95.6
0.60 - 0.90	19.2	21.7	32.4	24.3	97.6
Sample 4 (at tree I22)					
0 00 - 0.05	25.6	7.7	29.0	27.6	89.9
0.05 - 0.10	23.5	7.9	30.2	29.6	91.1
0.10 - 0.20	19.7	8.3	38.5	25.4	91.8
0.20 - 0.30	18.0	9.0	33.9	32.3	93.3
0.30 - 0.60	19.1	9.7	35.0	32.1	95.9
0.60 - 0.90	22.0	13.3	33.0	28.8	97.0

Table 83: Plot 20 (EP44) Fantail Logging Area – a soil profile description based on a soil pit adjacent to the plot.

Horizon depth (m)	Description
0 to 0.03	Brown (7.5YR4/4); sandy clay loam; single grain; very weak; 20-50% 2-6mm angular, dispersed, quartz gravel; abundant roots; sharp smooth change to-
0.03 to 0.05	Strong brown (7.5YR4/6); clay loam; fine sandy; moderate 5-10mm subangular blocky; rough-ped fabric; moderately weak; 10-20% 2-6mm angular, dispersed, quartz gravel; many roots; abrupt smooth change to-
0.05 to 0.10	Yellowish red (5YR4/6); clay loam; fine sandy; moderate 5-10mm subangular blocky; rough-ped fabric; moderately weak; 10-20% 2-6mm angular, dispersed, quartz gravel; common roots; smooth change to-
0.10 to 0.30	Red (2.5YR4/6); sandy clay loam; weak 5-10mm subangular blocky; earthy fabric; moderately weak; 2-10% 2-6mm angular, dispersed, quartz gravel; common roots; clear smooth change to-
0.30 to 0.60	Red (2.5YR4/6); light medium clay; weak 10-20mm angular blocky; moderately firm; normal plasticity; 10-20% 2-6mm angular, dispersed, quartz gravel; few roots; gradual smooth change to-
0.60to 0.90	Red (2.5YR4/6); light medium clay; weak 20-50mm angular blocky; rough-ped fabric; very firm; 10-20% 2-6mm angular, dispersed, quartz gravel; few roots; diffuse smooth change to-
0.90 to 1.80	Red (2.5YR4/6); light medium clay; weak 20-50mm angular blocky; rough-ped fabric; very firm; 10-20% 2-6mm angular, dispersed, quartz gravel; gradual smooth change to-
1.80 to 2.40	Red (2.5YR4/8); light medium clay; weak 20-50mm angular blocky; 10-20% 2-6mm angular, dispersed, quartz gravel.

Table 84: Plot 20 (EP44) Fantail Logging Area – soil chemical analysis data for soil samples collected from five random positions across the 0.5 ha plot. Analytical methods are detailed in the main text.

Depth (m)	Bulk density (Mg m^{-3})	pH 1:5			Org. C %	Tot. N %	Exchangeable cations				Acid H		Exch.	Comp.	Sum.
		H_2O	$CaCl_2$	KCl			Ca	Mg	K	Na	Al	H	acid.	CEC	CEC
							(cmol(+) kg^{-1})				(cmol(+) kg^{-1})		(cmol(+) kg^{-1})	(cmol(+) kg^{-1})	(cmol(+) kg^{-1})
0.00 - 0.05	1.10	4.4	4.0	4.0	10.4	-	1.50	2.42	0.51	0.24	0.78	0.82	1.60	4.90	6.27
0.05 - 0.10	1.10	4.4	4.2	4.2	5.37	-	0.27	0.80	0.26	0.14	0.58	0.41	0.99	3.80	2.46
0.10 - 0.20	1.21	4.6	4.3	4.3	3.86	-	0.10	0.57	0.16	0.12	0.52	0.34	0.86	2.80	1.81
0.20 - 0.30	1.21	4.2	4.1	4.5	2.31	-	0.10	0.24	0.06	0.05	0.38	0.17	0.55	2.50	1.00
0.30 - 0.60	1.34	4.5	4.2	4.5	1.37	-	0.08	0.17	0.04	0.05	0.72	0.00	0.72	2.30	1.06
0.60 - 0.90	1.43	4.6	4.2	4.4	1.03	-	0.07	0.15	0.04	0.06	0.77	0.05	0.82	1.70	1.14
0.09 - 1.20	1.43	4.5	4.2	-	0.91	-	0.07	0.22	0.04	0.06	0.60	0.06	0.66	-	1.05
1.20 - 1.50	-	4.6	4.2	-	0.70	-	0.07	0.43	0.03	0.04	0.40	0.04	0.44	-	1.01
1.50 - 1.80	-	4.6	4.2	-	0.55	-	0.07	0.55	0.05	0.04	0.34	0.06	0.40	-	1.11
1.80 - 2.10	-	4.6	4.3	-	0.36	-	0.07	0.57	0.05	0.04	0.22	0.00	0.22	-	0.95

Table 85: Plot 20 (EP44) Fantail Logging Area – soil bulk density and moisture characteristic data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Soil bulk density (Mg m^{-3})	Gravimetric moisture content (kg kg^{-1}) at various suction pressures							
		0 kPa	1 kPa	5 kPa	10 kPa	33 kPa	100 kPa	300 kPa	1500 kPa
0.05 - 0.10	1.103	0.484	0.472	0.426	0.404	0.364	0.337	0.204	0.211
0.18 - 0.23	1.204	0.405	0.396	0.340	0.318	0.292	0.275	0.214	0.212
0.45 - 0.50	1.342	0.325	0.314	0.285	0.269	0.284	0.243	0.202	0.187
0.80 - 0.85	1.445	0.274	0.266	0.239	0.225	0.211	0.201	0.197	0.193

Table 86: Plot 20 (EP44) Fantail Logging Area – soil hydraulic conductivity data for samples collected from a soil pit adjacent to the plot.

Depth (m)	Saturated hydraulic conductivity K_S (mm minute^{-1})	Mean K_S for depth interval (mm minute^{-1})
0.05 - 0.10	6.3	
0.05 - 0.10	0.7	
0.05 - 0.10	17.8	
0.05 - 0.10	21.8	**11.7**
0.18 - 0.23	1.4	
0.18 - 0.23	11.3	
0.18 - 0.23	6.6	
0.18 - 0.23	15.5	**8.7**
0.80 - 0.85	1.1	
0.80 - 0.85	19.3	**10.2**

Table 87: Plot 20 (EP44) Fantail Logging Area – soil particle size data for samples collected within the plot during the original soil survey bulked from 0.0 to 0.3 m depth (data from file records).

Sample location (Subplot corners)	Soil Register Number	pH	Sand %	Clay %	Silt %
ABEF	1179	4.7	57.71	33.8	3.45
CDGH	1180	4.9	71.89	22.48	5.62
KLOP	1181	4.6	57.91	35.54	6.55
GHJK	1182	4.6	62.44	30.04	7.51
IJMN	1183	4.5	60.64	33.73	5.62
Means		**4.7**	**62.1**	**31.1**	**5.8**

Table 88: Plot 20 (EP44) Fantail Logging Area – soil particle density data for samples collected from unknown locations at the plot.

Profile depth (m)	Sample depth (m)	Particle density (kg m^{-3})
Position 1		
0.20 – 0.30	0.18 – 0.23	2.54
0.30 – 0.60	0.45 – 0.50	2.56
0.60 – 0.90	0.90 – 0.85	2.47
Position 2		
0.20 – 0.30	0.18 – 0.23	2.59
0.60 – 0.90	0.90 – 0.85	2.48

CNS-2000 MULTI FUNCTIONAL ANALYSER

A. Beech

In brief, the CNS-2000 is a multi-functional analyser, which combines three inter-dependant modules. The Determinator unit houses the ballast tank, C, N and S detectors and a computer that is accessed by a touch sensitive screen. The Furnace unit combusts the samples in a sealed, temperature controlled combustion tube and the Autoloader can hold and process a maximum of 49 samples/standards for analysis at any one time.

The sample to be analysed is weighed into a ceramic boat and loaded into the purge block of the combustion furnace, which is then sealed and purged of all atmospheric gases. The boat containing the sample is then pushed into the 'hot spot' (1200°C for plant material or 1350°C for soils) of the horizontal tube furnace and combusted in an atmosphere of oxygen (UHP - 99.99%), which converts elemental carbon, nitrogen and sulphur into CO_2, N_2, NO_X and SO_2. The combustion gases are collected into a ballast tank and equilibrated. An aliquot of the gas mixture is taken for nitrogen analysis. Using Helium as a carrier gas, it passes through a catalyst heater (Cu), which converts NO_X to N_2, before flowing through the TC (thermal conductivity) cell to determine N_2. The remaining gas in the ballast tank is passed through two IR (infrared) cells to determine the carbon and sulphur content. The resulting values are calculated, using the weight of the sample, to give an answer in percentage (%) for each of the elements analysed.

LABORATORY PROCEDURES FOR SOIL-WATER STUDIES

Notes by Ian S. Webb, dated 1983

Objectives

The laboratory procedures described below are for measuring soil physical properties of importance in assessing the transmission and retention of water by soil and in identifying soil layers likely to form barriers to water movement and root growth.

The procedures given are for determining:

1. Saturated hydraulic conductivity of undisturbed cores, K sat;
2. The desorption soil moisture characteristic, the $\Psi_{(\theta)}$ function; and
3. The bulk density of undisturbed soil cores.

These properties and functions are of fundamental importance in soil-water and soil-water-plant relationships. They are required for the routine prediction of profile available water holding capacity, estimation of the pore size distribution in soils, computation of the $K_{(\theta)}$ function (the change in hydraulic conductivity, K, with volumetric water content, θ) and in soil water balance studies.

These laboratory determinations will be made on soil samples from the principal horizons of profile pits at the QRS tropical rainforest permanent plots.

Samples

Two or three types of soil sample will be used in these procedures, namely vertical cores (50 mm high by 74 mm diameter), undisturbed fragments from the cores and air-dried, sieved (<2 mm) “fine earth”. Four replicate cores are collected from each horizon in the field as soil heterogeneity is usually large. The methods for collection, transport, storage and handling of the core samples aim to minimise the disturbance of the natural soil by compaction, distortion, smearing, premature drying, biological activity and collection etc.

Procedures for procuring undisturbed cores in the field using a gun-driven (“Ramset”) samples are given by McIntyre (1974). The gun-driven corer has been found to cause less disturbance to moist, soft-medium consistent soils than hammer-driven corers (McIntyre and Barrow 1971).

The methods given below apply to moist, stable soils. Other procedures are required for unstable or expansive soils. Cores with large channels (several millimetres in diameter) are unsuited to the laboratory determination of saturated hydraulic conductivity (K sat).

Equipment Required for Hydraulic Conductivity / Moisture Retention Tests

- Plastic cover for low-tension plate. (c. 280 mm diameter by 150 mm high).
- Contact material, 5-50 µm.
- Containers (with lids) for weighing core samples when wet.
- Sealant for edges of cores.
- Waterproof tape for joining brass cylinders.
- Cloth to go under cores for K_S test.
- 4 strips 1” x 1/8” x 10½” (i.e.25 x 3 x 267 mm) to support rack.

Laboratory Measurement of Saturated Hydraulic Conductivity (K sat)

For non-expanding soils estimation may be made in the laboratory of the saturated hydraulic conductivity of soil cores. The results obtained in the laboratory frequently do not correlate very closely with field measurements of hydraulic conductivity. However the field methods are not suited to routine measurements. The laboratory procedure is suitable for obtaining approximate values for K_S. High precision in the measurement is not normally justified.

Precautions should be taken to minimise disturbance to soil cores whilst sampling and transporting cores to the laboratory. In particular check for large pores artificially created at the wall of the cores. These can be sealed off with relatively impermeable material. Cores with large channels or holes where roots or stones have been pulled out in sampling should be rejected.

Sample Preparation and Wetting

Trim the cores at each end until level with the brass cylinder. If the surface has been smeared, pick it lightly with a sharp pointed instrument (the indentations on the lower surface will later be filled by contact material in the drainage tests). Attach a second cylinder to the (upper) non-bevelled edge with waterproof tape or wide elastic band. Place a 70 mm filter paper on the upper surface of the core. Place the core assembly on a 10 mm filter paper on a blotting-paper suction plate (Loveday 1974, A2-11, A2-12) and commence capillary wetting with the base of the core >50 mm (probably 100 mm, value missing from notes) above the free water surface. After 2 days reduce the suction to 50 mm for 2 days, then to 0 mm until flooded. The water used should be freshly distilled or de-aired (Loveday, 1974, 4-57).

Measurement of Hydraulic Conductivity

Allow water to pass up through core for several hours, removing water from the upper cylinder by suction (tube) as required, then measure the quantity of water passing through the core in a known period of time. No more than about 6 mm of water should be allowed to accumulate in the upper cylinder or the hydraulic head will be reduced too much. At suitable intervals remove the water from the upper ring into a measuring cylinder by suction and record the total volume of water collected, Q, in time, t. The hydraulic conductivity, K sat. by this arrangement is given by:

$K\ sat. = Q * l / t * \pi * R^2 * \Delta Ø$, from Darcy's Law,

Where l is the length of the test sample,
R is the radius of the core,
And $\Delta Ø$ is the mean hydraulic head difference ($Ø^2 - Ø1$) (see Appendix 1 Figure 1).

(In this case, l, the length of the core, is a standard 50 mm, being length of the brass cylinders, R, the radius of the soil core, is a standard of 37 mm, and $\Delta Ø$, the average head difference, is a near-constant value of 37.5 mm in this apparatus.)

Moisture Retention by Soils (Undisturbed Cores) at Low Matric Potentials ($\theta_{\text{-1 to -10 kPa}}$)

The following method is used to determine the quantity of water retained by soils at matric potentials in the range -1 to -15 kPa (0.01 - 0.15 bar). Soil water in this range of low matric potentials is held in the larger pores, hence the need to use soil samples that are as far as possible undisturbed. For a well-drained soil, the water held at "field capacity", that is " the percentage of water remaining in the soil 2 or 3 days after having been saturated and after free drainage has practically ceased" (Rich, 1971), is commonly found to be in equilibrium with a matric potential of -5 to -10 kPa (0.05-0.10 bar).

The laboratory determination of moisture retention by soil in this low matric potential range uses undisturbed soil cores and the ceramic-epoxy suction plate with a hanging water column. Measurements will be made at matric potentials of -1.0, -5.0 and -10.0 kPa (water column suctions of 102, 510 and 1020 mm respectively). Some details of the equipment and procedures are given in Loveday (1974) and reference to the relevant paragraphs is given for each of the steps listed below.

Step		Equipment	Procedure
1.	Sample preparation.		4-14
2.	Wetting to saturation.	A2-11	4-6, A2-12, Note 1, 4-11, 4-13
3.	Weigh the (nearly) saturated core.		(4-60), Note 2
4.	Position the wetted core on the ceramic-epoxy plate connected to the hanging water column wetted contact material (4-55).	A2-5, A2-6	4-7, 4-22, Note 3
5.	Establish equilibrium with water columns of 102, 510 and 1020 mm successively.	A2-15, A2-20, Figure A2-5	4-22, 4-61, 4-62, (6-30)
6.	Weigh the wet soil and cylinder in a container (remove contact material first) after each equilibrium.		6-30 (3) (4) (6) (7)
7.	Continue moisture retention measurements on the cores on the "1-bar ceramic" plate for matric potentials in the range -15 to -100 kPa OR		See methods sheets for intermediate range of matric potentials.
8.	Remove suitable soil fragments for the measurements at -33 and -100 kPa, and then determine the oven-dry weight of the soil. Subsequently the oven-dry weight of the fragments will be added this weight for the calculation required.		
9.	Calculate the gravimetric and volumetric water content of the soil at each matric potential.		6-30 (10), Note 4

Note 1

For those samples for which laboratory hydraulic conductivity (Ksat) is to be measured, the wetting process will precede the conductivity measurements. After weighing for water content at (near) saturation the cores can be transferred directly to the ceramic-epoxy plate, retaining the saturated filter paper as contact material.

Note 2

Wipe excess water from the cylinder and immediately place in a container for weighing, with the minimum loss of water by drainage.

Note 3

Filter paper may be used as the contact material for the 102 mm suction but the silt-sized particulate material should be used at 510 mm and 1020 mm suctions.

Note 4

The measurements required are:

M_1 (M_5, M_{10}) = wet mass of soil of matric potential of -1 kPa (-5 kPa, -10 kPa).

V_B = bulk volume at -10 kPa, for non-expensive soils this will be very close to the volume of the cylinder (= 0.215 l).

M_S = mass of oven-dry soil (final measurement on core)

Moisture Retention by Soils (Undisturbed Fragments or Cores) at Intermediate Matric Potentials ($\theta_{-10\ \mathrm{to}\ -100\ \mathrm{kPa}}$)

The following methods are used to determine the quantity of water retained by soils at matric potentials in the range -15 to -100 kPa (0.15-1.0 bar). In general, soil water held between -10 and -100 kPa matric potential (0.1-1.0 bar) is considered to be readily available to plant roots in humid regions. Soil cores can be used for the intermediate range, but equilibrium times are rather long due to the height of the samples. Although more difficult to handle, quicker results should be obtained using relatively undisturbed fragments of soils.

The method given below for the use of core samples. Measurements will be made at -33 and -100 kPa pressure on the "1-bar ceramic" plate in the pressure chamber. Some details of the necessary equipment and procedures are given in Loveday (1974) and reference is made to the relevant paragraphs for the steps listed below:

Step		Equipment	Procedure
1.	Wetting.		Note 1, 4 – 24
2.	Positioning of the wetted sample on the "1 bar ceramic" plate.	4-21, A2-5, A2-6, A2-24 to A2-27, A2-30	4-24
3.	Establishment of equilibrium with gas pressures of 33 and 100 kPa (4.8 and 14.5 psi).	4-21(2)	4-24, Note 2
4.	Weighing of the equilibrated cores.		6-30 (3) (4) (6) (7)
5.	Determination of the oven-dry weight of soil.	4-25	4-26, 6-30 (9)
6.	Calculation of the soil bulk density and volumetric water contents at matric potentials of -33 and -100 kPa.		6-30 (10), Note 3

Note 1

For stable soils handled carefully the same set of cores used in the measurements at low suctions can be equilibrated on the "1-bar ceramic" plate, adding fresh wet contact material on the base of the core after each weighing (Loveday 1974, para. 6-30(6) and (7)). In this case no further wetting is required as measurements are made at successively higher matric potentials.

Alternatively wet the cores or fragments by capillary wetting (see Loveday, 1974, sections 4-6, 4-9, 4-11, 4-13, 4-14, 4-57, 4-58).

Note 2

Equilibrium time on pressure plates will vary markedly with pressure and height of sample. Cores and fragments with reasonable structure may take up to 7 days. The temperature of the equipment should be held reasonably constant.

Note 3

The measurements required are:

M_{33} = wet mass of soil at matric potential of -33 kPa (= gross mass of wet soil, brass cylinder, weighing container etc less mass of brass cylinder, weighing container, etc.).

M_{100} = wet mass of soil at matric potential of -100 kPa.

V_B = bulk volume at -10 kPa: for non-expansive soils this will be very close to the volume of the cylinder (= 0 215 l).

M_S = mass of oven-dried soil (mass of solids)

Moisture Retention by Soil (Fine Earth) at High Matric Potentials ($\theta_{-1500\ kPa}$)

The following method is used to determine the quality of water retained by soils at matric potentials in the range -200 to -1500 kPa (2-15 bar). Soil water in this range is held by very fine pores and is little affected by changes in structure. In order to keep equilibrium times for drainage tolerably short it is convenient to use "fine earth" (air dried soil less than 2 mm) or small fragments (less than 5 mm high). Numerous studies have shown that moisture held at matric potentials in excess of 1500 kPa is unavailable to most plants. The permanent wilting percentage of many soils is closely matched by the moisture retained by soil samples equilibrated in a pressure chamber with an applied pressure of 1500 kPa (15 bar).

Measurements will be made at matric potentials of -300 and -1500 kPa (3 and 15 bar) on a "15-bar ceramic" plate in the pressure chamber. Fresh samples of "fine earth" are used at each pressure. The procedure (following Loveday 1974) is as follows:

Step		Procedure
1.	Wetting directly on pressure plate.	4-47, 6-32, 6-22, A2-24, A2-26, 4-52, 4-63, A2-28, A2-29, 4-52, A2-30, Note 1
2.	Draining.	4-52, 4-63, A2-28, A2-29
3.	Establish equilibrium.	4-52, A2-30, Note 1
4.	Release pressure, weigh moist soil.	6-32 (5)
5.	Oven-dry soil and re-weigh when cool.	6-32(5)
6.	Calculation the gravimetric and volumetric water content of the soil at each matric potential.	6-22(7), Note 2

Note 1

If air dried fine earth 2 cm deep is used at 300 kPa and 7-10mm air-dried fine earth at 1500 kPa, equilibrium times will generally be in the range 4-7 days.

Note 2

The measurements required are:

M_{300} (M_{1500}) = wet mass of soil at matric potential of -300 kPa (-1500 kPa).

M_S = mass of oven-dried soil.

D_B = bulk density (at -10 kPa).

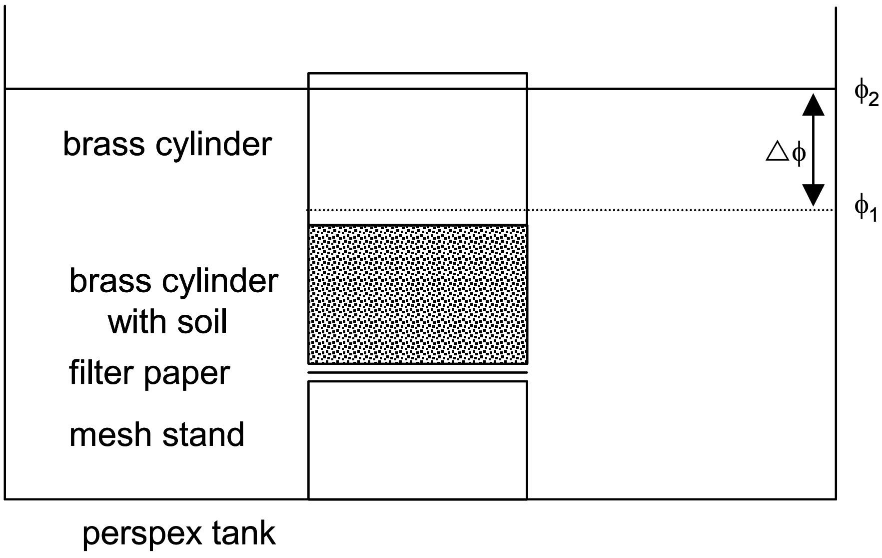

Figure 1: A diagrammatic representation of the apparatus used in Saturated Hydraulic Conductivity K_S determinations in the laboratory at Atherton for soils of the CSIRO Permanent Plots.

APPENDIX 2: FLORISTICS

FLORISTIC IDENTIFICATIONS AND LISTS

B. P. M. Hyland, K. D. Sanderson, R. K. Hewett, M. G. Bradford and A. J. Ford

On each of the 20 plots, all enumerated trees ≥10 cm dbh were identified. For each recognised species within each plot, reference voucher specimens were prepared and formally determined and a list of enumerated trees was prepared. In addition, the floristic composition of each subplot was recorded at establishment for all plants >0.25 m high but <10 cm dbh (see main text for details). Reference voucher specimens of those understorey species not already encountered as trees were collected and determined. Other life forms such as epiphytic trees, vines, herbs, ferns and epiphytes present within the plot were recorded on a supplementary species list and reference voucher specimens collected when feasible.

A master reference list was prepared for tree and shrub species found within the 20 plots. Over time the nomenclature was updated (e.g. following Hyland and Whiffin 1993). For this report all nomenclature follows Queensland Herbarium (2002).

All voucher specimens from the 20 plots are stored in the Queensland Regional Station (QRS) Herbarium at the CSIRO Tropical Forest Research Centre, Atherton. This research herbarium is a branch of the Australian National Herbarium and is maintained by staff of CSIRO Plant Industry.

Table 1: Plot 1 (EP2) Downfall Creek – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1971.

Trees

Acacia celsa
Acronychia acronychioides
Acronychia laevis
Agathis robusta
Aleurites rockinghamensis
Alstonia muelleriana
Aphananthe philippinensis
Archidendron hendersonii
Argyrodendron polyandrum
Arytera divaricata
Austromyrtus hillii
Austromyrtus minutiflora
Austromyrtus sp. (Danbulla LSS 10123)
Blepharocarya involucrigera
Brachychiton acerifolius
Buckinghamia celsissima
Canthium lamprophyllum
Casearia dallachii
Elaeodendron melanocarpum
Castanospermum australe
Cerbera inflata
Clausena brevistyla
Cleistanthus semiopacus
Croton insularis
Croton triacros
Cryptocarya clarksoniana
Cupaniopsis foveolata
Decaspermum humile
Dinosperma erythrococcum
Diospyros cupulosa
Diospyros pentamera
Euroschinus falcatus var. *falcatus*
Ficus watkinsiana
Flindersia schottiana
Glochidion sessiliflorum var. *pedicellatum*
Gmelina fasciculiflora
Guioa acutifolia
Helicia australasica
Homalium circumpinnatum
Mallotus philippensis
Mallotus polyadenos
Mischocarpus lachnocarpus
Mischocarpus pyriformis ssp. *pyriformis*
Mischocarpus stipitatus
Phaleria chermsideana
Polyalthia nitidissima
Polyscias australiana
Pouteria xerocarpa
Pseudoweinmannia lachnocarpa
Atractocarpus fitzalanii ssp. *fitzalanii*
Rhodamnia sessiliflora
Rhodamnia spongiosa
Rhodomyrtus macrocarpa
Sarcomelicope simplicifolia ssp. *simplicifolia*
Scolopia braunii
Symplocos cochinchinensis var. *pilosiuscula*
Syzygium oleosum
Tetrasynandra pubescens

Shrubs

Alyxia oblongata
Callicarpa pedunculata
Dendrocnide moroides
Desmodium nemorosum
Pittosporum revolutum
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Wikstroemia indica

Vines

Austrosteenisia blackii *var.* blackii
Calamus caryotoides
Caelospermum paniculatum var. *paniculatum*
Embelia australiana
Hippocratea barbata
Jasminum didymum ssp. *didymum*
Maclura cochinchinensis
Melodinus bacellianus
Melodorum leichhardtii
Parsonsia straminea
Smilax australis
Solanum seaforthianum

Scamblers

Lantana camara var. *camara*

Herbs

Alpinia caerulea
Coveniella poecilophlebia
Dianella caerulea
Lastreopsis tenera

Epiphytes and hemi-epiphytes

Arthropteris tenella
Asplenium nidus
Dendrobium tetragonum sens.lat.
Dockrillia nugentii
Dockrillia racemosa
Drynaria rigidula
Platycerium superbum

Grasses and sedges

Gahnia aspera
Panicum lachnophyllum

Table 2: Plot 2 (EP3) Mt Haig – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1971.

Trees

- *Aceratium doggrellii*
- *Agathis atropurpurea*
- *Alloxylon wickhamii*
- *Alphitonia whitei*
- *Antidesma erostre*
- *Antirhea* sp. (Mt Lewis BG 5733)
- *Apodytes brachystylis*
- *Archidendron grandiflorum*
- *Archirhodomyrtus beckleri*
- *Austromyrtus* sp. (Gillies BG 1484)
- *Austromyrtus* sp. (Windsor Tableland BG 412)
- *Balanops australiana*
- *Beilschmiedia bancroftii*
- *Beilschmiedia collina*
- *Beilschmiedia tooram*
- *Bobea myrtoides*
- *Brackenridgea australiana*
- *Canarium australasicum*
- *Canthium* sp. (Kuranda GS 680)
- *Cardwellia sublimis*
- *Carnarvonia araliifolia* var. *montana*
- *Casearia costulata*
- *Ceratopetalum succirubrum*
- *Chionanthus axillaris*
- *Cinnamomum laubatii*
- *Cryptocarya angulata*
- *Cryptocarya bellendenkerana*
- *Cryptocarya corrugata*
- *Cryptocarya densiflora*
- *Cryptocarya leucophylla*
- *Cryptocarya lividula*
- *Cryptocarya onoprienkoana*
- *Cryptocarya putida*
- *Cryptocarya smaragdina*
- *Cupaniopsis foveolata*
- *Darlingia darlingiana*
- *Elaeocarpus elliffii*
- *Elaeocarpus foveolatus*
- *Elaeocarpus largiflorens* ssp. *largiflorens*
- *Elaeocarpus sericopetalus*
- *Elaeocarpus* sp. (Mt Bellenden Ker LJB 18336)
- *Endiandra bessaphila*
- *Endiandra dielsiana*
- *Endiandra monothyra* ssp. *monothyra*
- *Endiandra palmerstonii*
- *Fagraea fagraeacea*
- *Flindersia bourjotiana*
- *Flindersia brayleyana*
- *Flindersia pimenteliana*
- *Franciscodendron laurifolium*
- *Garcinia* sp. (Davies Creek JGT 14745)
- *Gevuina bleasdalei*
- *Gillbeea adenopetala*
- *Glochidion harveyanum* var. *harveyanum*
- *Guioa acutifolia*
- *Halfordia kendack*
- *Harpullia pendula*
- *Hedycarya loxocarya*
- *Helicia nortoniana*
- *Hypsophila dielsiana*
- *Ilex* sp. (Gadgarra BH 2011RFK)
- *Jagera pseudorhus* var. *integerrima*
- *Lethedon setosa*
- *Levieria acuminata*
- *Litsea leefeana*
- *Lomatia fraxinifolia*
- *Melicope broadbentiana*
- *Mischarytera lautereriana*
- *Musgravea stenostachya*
- *Neolitsea dealbata*
- *Opisthiolepis heterophylla*
- *Perrottetia arborescens*
- *Pitaviaster haplophyllus*
- *Pittosporum trilobum*
- *Auranticarpa papyracea*
- *Placospermum coriaceum*
- *Polyosma alangiacea*
- *Polyosma rhytophloia*
- *Polyscias australiana*
- *Pouteria euphlebia*
- *Pouteria papyracea*
- *Pullea stutzeri*
- *Atractocarpus fitzalanii* ssp. *tenuipes*
- *Rapanea achradiifolia*
- *Rapanea porosa*
- *Rhodamnia blairiana*
- *Rhodamnia spongiosa*
- *Rhodomyrtus pervagata*
- *Sarcotoechia cuneata*
- *Sarcotoechia* sp. (Mt Carbine GJM 995)
- *Sloanea langii*
- *Sloanea macbrydei*
- *Sphenostemon lobosporus*
- *Streblus glaber* var. *australianus*
- *Symplocus cochinchinensis* var. *gittinsii*
- *Synima cordierorum*
- *Synoum glandulosum* ssp. *paniculosum*
- *Syzygium apodophyllum*
- *Syzygium canicortex*
- *Syzygium cormiflorum*
- *Syzygium endophloium*
- *Syzygium johnsonii*
- *Syzygium luehmannii*
- *Syzygium wesa*
- *Syzygium wilsonii* ssp. *cryptophlebium*
- *Tasmannia membranea*
- *Waterhousea unipunctata*
- *Wilkiea angustifolia*
- *Wilkiea wardellii*
- *Xanthophyllum octandrum*

Palm tree

- *Oraniopsis appendiculata*

Tree fern

- *Cyathea rebeccae*

Shrubs

- *Acronychia parviflora*
- *Alyxia ilicifolia*
- *Austromatthaea elegans*
- *Harpullia rhyticarpa*
- *Lepiderema ixiocarpa*
- *Mackinlaya confusa*
- *Psychotria* sp. (Danbulla STB 15262)
- *Rapanea* sp. (Atherton KJW AQ91778)
- *Rapanea subsessilis* ssp. (Gordonvale STB 9734)

Vines

- *Caelospermum paniculatum* ssp. *paniculatum*
- *Calamus australis*
- *Cissus penninervis*
- *Hypserpa laurina*
- *Lygodium reticulatum*
- *Melodinus* sp. (EP3)
- *Neosepicaea jucunda*
- *Palmeria* sp. (EP3)
- *Quintinia fawkneri*
- Rubiaceae (EP3)
- *Smilax australis*

Herb

- *Blechnum cartilagineum*

Epiphytes and hemi-epiphytes

- *Asplenium australasicum*
- *Bulbophyllum newportii* ?
- *Bulbophyllum evasum*
- *Bulbophyllum gadgarrense*
- *Bulbophyllum johnsonii*
- *Crypsinus simplicissimus*
- *Dendrobium fleckeri*
- *Drynaria rigidula*
- *Freycinetia excelsa*
- *Platycerium bifurcatum*

Sedge

- *Exocarya scleroides*

Table 3: Plot 3 (EP4) Little Pine Creek – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1972.

Trees
Acacia hylonoma
Acacia celsa
Aceratium concinnum
Acmena hemilampra ssp. *hemilampra*
Acronychia acronychioides
Acronychia vestita
Aglaia meridionalis
Alphitonia whitei
Alstonia muelleriana
Alstonia scholaris
Antidesma erostre
Antirhea tenuiflora
Ardisia pachyrrhachis
Austromyrtus minutiflora
Beilschmiedia bancroftii
Blepharocarya involucrigera
Brachychiton acerifolius
Calophyllum sil
Canarium muelleri
Carallia brachiata
Cardwellia sublimis
Carnarvonia araliifolia var. *araliifolia*
Celtis paniculata
Citronella smythii
Claoxylon tenerifolium
Clerodendrum tracyanum
Commersonia bartramia
Cryptocarya cunninghamii
Cryptocarya grandis
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cryptocarya oblata
Cryptocarya pleurosperma
Cryptocarya vulgaris
Cupaniopsis flagelliformis var. *flagelliformis*
Cupaniopsis foveolata
Darlingia darlingiana
Davidsonia pruriens
Decaspermum humile
Diospyros hebecarpa
Dysoxylum alliaceum
Dysoxylum oppositifolium
Dysoxylum papuanum
Elaeocarpus grandis
Elaeocarpus bancroftii
Elaeocarpus eumundi
Elaeocarpus foveolatus
Emmenosperma cunninghamii
Endiandra acuminata
Endiandra cowleyana
Endiandra impressicosta
Endiandra leptodendron
Endiandra palmerstonii
Endiandra wolfei
Ficus leptoclada
Flindersia acuminata
Flindersia bourjotiana
Flindersia pimenteliana
Franciscodendron laurifolium
Gillbeea adenopetala
Glochidion harveyanum var. *harveyanum*
Glochidion sumatranum
Gmelina fasciculiflora
Gomphandra australiana
Grevillea baileyana
Guioa acutifolia
Guioa lasioneura
Hedraianthera porphyropetala
Hedycarya loxocarya
Homalium circumpinnatum
Ilex arnhemensis ssp. *ferdinandi*
Linociera sp. (Little Pine LA BH 2520RFK)
Litsea bindoniana
Litsea leefeana
Macaranga subdentata
Mallotus polyadenos
Medicosma fareana
Melicope vitiflora
Mischarytera lautereriana
Neolitsea dealbata
Niemeyera prunifera
Ormosia ormondii
Pittosporum trilobum
Podocarpus grayae
Polyalthia sp. (Wyvuri BH 2632RFK)
Polyosma hirsuta
Polyosma rhytophloia
Polyscias australiana
Polyscias elegans
Pouteria chartacea
Pouteria obovata
Pouteria xerocarpa
Prunus turneriana
*Pseuduvaria froggattii**
Atractocarpus fitzalanii ssp. *fitzalanii*
Rapanea porosa
Rhodamnia spongiosa
Sarcopteryx martyana
Sarcopteryx reticulata
Scolopia braunii
Sloanea langii
Stenocarpus reticulatus
Symplocos cochinchinensis var. *pilosiuscula*
Synima cordierorum
Syzygium cormiflorum
Syzygium johnsonii
Syzygium luehmannii
Tabernaemontana orientalis
Ternstroemia cherryi
Tetrasynandra pubescens
Toechima erythrocarpum
Vavaea amicorum
Xanthophyllum octandrum
Xanthostemon whitei
Xylopia maccreae
Zanthoxylum veneficum

Palm tree
Licuala ramsayi

Tree pandan
Pandanus monticola

Tree cycad
Lepidozamia hopei

Shrubs
Austromatthaea elegans
Harpullia rhyticarpa
Mackinlaya confusa
Psychotria dallachiana
Atractocarpus hirtus
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Solanum dallachii

Palm shrub
Hydriastele wendlandiana

Vines
Caelospermum paniculatum var. *paniculatum*
Calamus australis
Calamus motii
Cissus penninervis
Connarus conchocarpus ssp. *conchocarpus*
Erycibe coccinea
Eustrephus latifolius
Flagellaria indica
Hibbertia scandens
Hypserpa decumbens
Hypserpa laurina
Lygodium reticulatum
Maesa dependens var. *dependens*
Melodinus sp. (EP4)
Mitrephora sp. (EP4)* possibly *Melodorum uhrii*
Neosepicaea jucunda
Palmeria scandens
Pandorea pandorana
Parsonsia latifolia
Strychnos minor
Tetracera daemeliana
Tetracera nordtiana

Herbs
Blechnum cartilagineum
Bowenia spectabilis
Cordyline cannifolia
Dianella caerulea
Gymnostachys anceps

Epiphytes and hemi-epiphytes
Asplenium australasicum
Cymbidium madidum
Freycinetia excelsa
Platycerium bifurcatum
Platycerium hillii
Pothos longipes

Parasite
Amylotheca sp. (EP4)

* Entry recognised as being a wrong identification

Table 4: Plot 4 (EP9) Robson Logging Area – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1972.

Trees

Abrophyllum ornans
Acronychia acidula
Acronychia acronychioides
Agathis microstachya
Aglaia tomentosa
Alangium villosum ssp. *polyosmoides*
Alloxylon wickhamii
Alphitonia petriei
Alphitonia whitei
Antidesma erostre
Antirhea tenuiflora
Apodytes brachystylis
Archidendron vaillantii
Archirhodomyrtus beckleri
Argyrodendron trifoliolatum
Austromyrtus dallachiana
Austromyrtus sp. (Windsor Tableland BG 412)
Balanops australiana
Beilschmiedia bancroftii
Beilschmiedia collina
Beilschmiedia recurva
Beilschmiedia tooram
Bobea myrtoides
Brackenridgea australiana
Bubbia semecarpoides
Canarium australasicum
Canarium muelleri
Canthium lamprophyllum
Cardwellia sublimis
Carnarvonia araliifolia var. *montana*
Casearia costulata
Ceratopetalum succirubrum
Cerbera inflata
Chionanthus axillaris
Cinnamomum laubatii
Citronella smythii
Cnesmocarpon dasyantha
Croton insularis
Cryptocarya angulata
Cryptocarya corrugata
Cryptocarya densiflora
Cryptocarya lividula
Cryptocarya mackinnoniana
Cryptocarya melanocarpa
Cryptocarya murrayi
Cryptocarya putida
Cupaniopsis flagelliformis var. *flagelliformis*
Daphnandra repandula
Darlingia darlingiana
Davidsonia pruriens
Delarbrea michieana
Diploglottis smithii
Doryphora aromatica
Elaeocarpus carolinae
Elaeocarpus foveolatus
Elaeocarpus largiflorens ssp. *largiflorens*
Elaeocarpus sericopetalus
Endiandra bessaphila
Endiandra cowleyana
Endiandra dielsiana
Endiandra monothyra ssp. *monothyra*
Endiandra palmerstonii
Endiandra sankeyana
Endiandra wolfei
Fagraea fagraeacea
Ficus destruens
Flindersia bourjotiana
Flindersia laevicarpa var. *laevicarpa*
Flindersia pimenteliana
Franciscodendron laurifolium
Galbulimima baccata
Garcinia sp. (Davies Creek JGT 14745)
Gardenia ovularis
Gevuina bleasdalei
Gillbeea adenopetala
Guioa lasioneura
Halfordia kendack
Hedycarya loxocarya
Helicia lamingtoniana
Hypsophila dielsiana
Irvingbaileya australis
Lethedon setosa
Levieria acuminata
Litsea bindoniana
Litsea connorsii
Litsea leefeana
Lomatia fraxinifolia
Macaranga subdentata
Medicosma fareana
Melicope broadbentiana
Melicope elleryana
Mischarytera lautereriana
Mischocarpus exangulatus
Myristica globosa ssp. *muelleri*
Neisosperma poweri
Neolitsea dealbata
Niemeyera prunifera
Opisthiolepis heterophylla
Perrottetia arborescens
Pilidiostigma tropicum
Pittosporum wingii
Placospermum coriaceum
Polyosma alangiacea
Polyosma hirsuta
Polyosma rhytophloia
Polyscias australiana
Polyscias elegans
Polyscias murrayi
Pouteria brownlessiana
Prunus turneriana
Pullea stutzeri
Rapanea achradiifolia
Rhodamnia blairiana
Rhodomyrtus pervagata
Rockinghamia angustifolia
Sarcotoechia lanceolata
Scheffera actinophylla
Siphonodon membranaceus
Sloanea australis subsp. *parviflora*
Sloanea langii
Sloanea macbrydei
Sphenostemon lobosporus
Steganthera macooraia
Stenocarpus reticulatus
Streblus glaber var. *australianus*
Symplocos cochinchinensis var. *glaberrima*
Symplocos paucistaminea
Synima cordierorum
Synoum glandulosum ssp. *paniculosum*
Syzygium canicortex
Syzygium endophloium
Syzygium johnsonii
Syzygium kuranda
Syzygium luehmannii
Syzygium papyraceum
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tasmannia membranea
Tetrasynandra laxiflora
Toechima erythrocarpum
Wilkiea angustifolia
Xanthophyllum octandrum

Tree fern

Cyathea rebeccae

Tree pandan

Pandanus monticola

Shrubs

Alyxia ilicifolia
Ardisia brevipedata
Austromatthaea elegans
Clerodendrum grayi
Harpullia rhyticarpa
Mackinlaya confusa
Pilidiostigma tetramerum
Pittosporum rubiginosum
Psychotria sp. (Utchee Creek H. Flecker NQNC 5313)
Atractocarpus hirtus
Randia tuberculosa
Symplocos hayesii
Syzygium wilsonii ssp. *wilsonii*

Vines

Austrosteenisia blackii
Caesalpinia robusta
Calamus australis
Calamus motii
Cissus penninervis
Cissus repens
Desmos goezeanus
Flagellaria indica
Hypserpa laurina
Lygodium reticulatum
Melodinus australis
Melodorum uhrii
Piper caninum
Smilax australis
Tetracera daemeliana

Herbs

Blechnum cartilagineum
Cordyline cannifolia
Gymnostachys anceps
Lastreopsis rufescens

Epiphytes and hemi-epiphytes

Asplenium australasicum
Asplenium simplicifrons
Colysis ampla
Cymbidium madidum
Davallia denticulata var. *denticulata*
Dendrobium monophyllum
Drynaria rigidula
Freycinetia excelsa
Platycerium bifurcatum
Platycerium superbum
Pothos longipes
Rhaphidophora australasica

Sedge

Exocarya scleroides

Table 5: Plot 5 (EP18) Mt Lewis – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1973.

Trees

Acmena resa
Aglaia brassi
Aglaia meridionalis
Alphitonia whitei
Antirhea sp. (Mt Lewis BG 5733)
Apodytes brachystylis
Archidendron grandiflorum
Archidendron vaillantii
Ardisia pachyrrhachis
Argyrodendron sp. (Mt Haig LSS 14307)
Athertonia diversifolia
Austrobuxus megacarpus
Austromyrtus dallachiana
Austromyrtus minutiflora
Austromyrtus sp. (Gillies BG 1484)
Austromyrtus sp. (Mt Lewis BG 831)
Balanops australiana
Beilschmiedia bancroftii
Beilschmiedia collina
Bubbia queenslandiana ssp. queenslandiana
Buckinghamia celsissima
Cardwellia sublimis
Carnarvonia araliifolia var. montana
Casearia costulata
Catalepidia heyana
Ceratopetalum succirubrum
Chionanthus axillaris
Niemeyera sp. (Mt Lewis AKI 1402)
Cinnamomum laubatii
Cnesmocarpon dasyantha
Corynocarpus cribbianus
Cryptocarya angulata
Cryptocarya cocosoides
Cryptocarya corrugata
Cryptocarya densiflora
Cryptocarya grandis
Cryptocarya leucophylla
Cryptocarya lividula
Cryptocarya oblata
Cupaniopsis flagelliformis var. flagelliformis
Darlingia darlingiana
Delarbrea michieana
Denhamia viridissima
Diospyros sp. (Mt Lewis LSS 10107)
Doryphora aromatica
Dryadodaphne sp. (Mt Lewis BH 1496RFK)
Elaeocarpus carolinae
Elaeocarpus elliffii
Elaeocarpus largiflorens ssp. retinervis
Elaeocarpus sericopetalus
Elaeocarpus sp. (Mt Bellenden Ker LJB 18336)
Elaeocarpus sp. (Windsor Tableland BH 5541)
Endiandra acuminata
Endiandra dielsiana
Endiandra leptodendron
Endiandra montana
Endiandra phaeocarpa
Endiandra sankeyana
Endiandra wolfei
Eupomatia laurina
Fagraea fagraeacea
Ficus crassipes
Flindersia acuminata
Flindersia bourjotiana
Flindersia brayleyana
Flindersia pimenteliana
Franciscodendron laurifolium
Garcinia sp. (Davies Creek JGT 14745)
Garcinia warrenii
Goniothalamus australis
Guioa acutifolia
Halfordia kendack
Hedraianthera porphyropetala
Helicia grayi
Helicia lewisensis
Hylandia dockrillii
Hypsophila dielsiana
Ixora orophila
Ixora sp. (North Mary LA BH 8618)
Litsea connorsii
Medicosma fareana
Mischarytera lautereriana
Mischocarpus exangulatus vel aff.
Mischocarpus macrocarpus
Mischocarpus pyriformis ssp. pyriformis
Neolitsea dealbata
Oreodendron biflorum
Pitaviaster haplophyllus
Pittosporum trilobum
Placospermum coriaceum
Planchonella macrocarpa
Podocarpus smithii
Polyosma hirsuta
Polyosma rigidiuscula
Polyscias australiana
Polyscias elegans
Polyscias murrayi
Pouteria euphlebia
Pouteria sp. (Mt Lewis BH 579)
Prumnopitys ladei
Atractocarpus fitzalanii ssp. tenuipes
Rapanea achradiifolia
Rapanea porosa
Rhodamnia blairiana
Rhysotoechia mortoniana
Sarcopteryx montana
Sarcotoechia cuneata
Sarcotoechia sp. (Mt Carbine GJM 995)
Sloanea australis ssp. parviflora
Sloanea langii
Sloanea macbrydei
Sphalmium racemosum
Steganthera macooraia
Stenocarpus davallioides
Streblus glaber var. australianus
Synima cordierorum
Synoum glandulosum ssp. paniculosum
Syzygium cormiflorum
Syzygium endophloium
Syzygium johnsonii
Syzygium luehmannii
Syzygium wesa
Syzygium wilsonii ssp. cryptophlebium
Tetrasynandra sp. (Mt Lewis BH 1053RFK)
Toechima monticola
Wilkiea angustifolia
Xanthophyllum octandrum

Palm tree

Oraniopsis appendiculata

Shrubs

Ardisia sp. (South Mary LA BH 8778)
Atractocarpus merikin
Harpullia rhyticarpa
Mackinlaya confusa
Pilidiostigma tetramerum
Meiogyne sp. (Mt Lewis LWJ 554)
Psychotria sp. (Mt Lewis VKM 2445)
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Symplocos graniticola
Symplocos sp. (North Mary BG 2543)

Palm shrub

Linospadix microcarya

Vines

Alyxia grandis
Austrobaileya scandens
Calamus australis
Cephalaralia cephalobotrys
Cissus penninervis
Flagellaria indica
Hypserpa smilacifolia
Jasminum didymum ssp. didymum
Jasminum kajewskii
Melodinus bacellianus
Morinda sp. (Mt Finnigan LJW 12114)
Motherwellia haplosciadea
Pararistolochia sparusifolia
Parsonsia latifolia
Piper caninum
Ripogonum album
Sarcopetalum harveyanum
Smilax glyciphylla

Herbs

Cordyline cannifolia
Gymnostachys anceps
Nephrolepis auriculata

Epiphytes and hemi-epiphytes

Asplenium australasicum
Asplenium laserpitiifolium*
Asplenium simplicifrons
Bulbophyllum johnsonii
Bulbophyllum lageniforme
Crypsinus simplicissimus
Cymbidium madidum
Cymbidium suave
Davallia denticulata var. denticulata
Dendrobium adae
Dendrobium carrii
Dendrobium gracilicaule
Dendrobium jonesii var. magnificum
Dictymia brownii
Drynaria rigidula
Freycinetia excelsa
Liparis nugentiae
Mobilabium hamatum
Phreatia crassiuscula
Platycerium bifurcatum
Plectorrhiza tridentata
Sarcochilus serrulatus

Parasite

Dendrophthoe glabrescens?

* Entry recognised as being a wrong identification

Table 6: Plot 6 (EP19) Garrawalt – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1975.

Trees

Acacia celsa
Aceratium concinnum
Acronychia acronychioides
Acronychia vestita
Alphitonia whitei
Alstonia muelleriana
Antidesma erostre
Antirhea tenuiflora
Apodytes brachystylis
Archidendron vaillantii
Austromyrtus minutiflora
Austromyrtus sp. (Windsor Tableland BG 412)
Balanops australiana
Beilschmiedia collina
Beilschmiedia recurva
Bobea myrtoides
Brachychiton acerifolius
Brackenridgea australiana
Brombya platynema
Bubbia semecarpoides
Caldcluvia australiensis
Canarium australasicum
Canarium muelleri
Canthium sp. (Kuranda GS 680)
Cardwellia sublimis
Carnarvonia araliifolia var. *araliifolia*
Cinnamomum laubatii
Citronella smythii
Cnesmocarpon dasyantha
Croton triacros
Cryptocarya angulata
Cryptocarya corrugata
Cryptocarya grandis
Cryptocarya mackinnoniana
Cryptocarya putida
Cryptocarya saccharata
Cryptocarya vulgaris
Darlingia darlingiana
Decaspermum humile
Diospyros cupulosa
Dysoxylum oppositifolium
Elaeocarpus grandis
Elaeocarpus largiflorens ssp. *largiflorens*
Elaeocarpus ruminatus
Elaeocarpus sp. (Mt Bellenden Ker LJB 18336)
Endiandra bessaphila
Endiandra cowleyana
Endiandra dielsiana
Endiandra hypotephra
Endiandra leptodendron
Endiandra wolfei
Eupomatia laurina
Fagraea fagraeacea
Ficus leptoclada
Flindersia bourjotiana
Flindersia brayleyana
Gevuina bleasdalei
Glochidion sessiliflorum var. *pedicellatum*
Guioa lasioneura
Halfordia kendack
Hedycarya loxocarya
Helicia nortoniana
Litsea bindoniana
Litsea connorsii
Litsea leefeana
Mallotus polyadenos
Medicosma fareana
Melicope broadbentiana
Melicope vitiflora
Mischocarpus grandissimus
Mischocarpus lachnocarpus
Myristica muelleri ssp. *globosa*
Neolitsea dealbata
Opisthiolepis heterophylla
Perrottetia arborescens
Pilidiostigma tropicum
Auranticarpa papyracea
Podocarpus grayae
Polyosma alangiacea
Polyosma hirsuta
Polyscias australiana
Polyscias elegans
Pouteria papyracea
Pouteria xerocarpa
Sundacarpus amarus
Prunus turneriana
Pullea stutzeri
Atractocarpus fitzalanii ssp. *fitzalanii*
Rhodamnia sessiliflora
Rockinghamia angustifolia
Sarcotoechia cuneata
Sloanea australis ssp. *parviflora*
Sloanea langii
Sloanea macbrydei
Streblus glaber var. *australianus*
Symplocos cochinchinensis var. *pilosiuscula*
Symplocos paucistaminea
Synoum glandulosum ssp. *paniculosum*
Syzygium canicortex
Syzygium cormiflorum
Syzygium endophloium
Syzygium johnsonii
Syzygium leuhmannii
Syzygium sayeri
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tasmannia membranea
Tetrasynandra laxiflora
Tetrasynandra pubescens
Toechima erythrocarpum
Xanthophyllum octandrum
Xylopia maccreae

Tree fern

*Cyathea robertsiana**

Tree pandan

Pandanus monticola

Shrubs

Ardisia brevipedata
Ophiorrhiza australiana ssp. *australiana*
Pilidiostigma tetramerum
Psychotria sp. (Utchee Creek H. Flecker NQNC 5313)
Rapanea subsessilis ssp. (Gordonvale STB 9734)

Vines

Alyxia grandis
Austrosteenisia blackii var. *blackii*
Calamus australis
Hypserpa decumbens
Lygodium reticulatum
Melodinus australis
Morinda sp. (Mt Finnigan LJW 12114)
Neosepicaea jucunda
Palmeria scandens
Pandorea pandorana
Parsonsia latifolia
Piper caninum
Piper sp. (EP19)
Ripogonum album
Rourea brachyandra
Tetracera nordtiana
Trophis scandens ssp. *scandens*

Herbs

Adiantum silvaticum
Alpinia arctiflora
Blechnum cartilagineum
Cordyline cannifolia

Epiphytes and hemi-epiphytes

Asplenium australasicum
Asplenium polyodon
Cymbidium suave
Drynaria rigidula
Freycinetia excelsa
Pothos longipes
Rhaphidophora australasica
Goniophlebium subauriculatum
Vittaria elongata

Filmy fern

Cephalomanes obscurum

* Record based on plot notes only

Table 7: Plot 7 (EP29) Mt Fisher – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1975.

Trees

Aceratium doggrellii
Acmena resa
Alphitonia petriei
Alphitonia whitei
Apodytes brachystylis
Archidendron vaillantii
Austromyrtus lasioclada
Balanops australiana
Beilschmiedia bancroftii
Beilschmiedia collina
Beilschmiedia obtusifolia
Beilschmiedia tooram
Bobea myrtoides
Bubbia semecarpoides
Cardwellia sublimis
Casearia costulata
Chionanthus axillaris
Cinnamomum laubatii
Citronella smythii
Cryptocarya angulata
Cryptocarya corrugata
Cryptocarya densiflora
Cryptocarya leucophylla
Cryptocarya lividula
Cupaniopsis flagelliformis var. *flagelliformis*
Darlingia ferruginea
Diospyros sp. (Mt Lewis LSS 10107)
Doryphora aromatica
Dysoxylum klanderi
Elaeocarpus carolinae
Elaeocarpus ferruginiflorus
Elaeocarpus foveolatus
Elaeocarpus largiflorens ssp. *largiflorens*
Elaeocarpus sericopetalus
Endiandra bessaphila
Endiandra dichrophylla
Fagraea fagraeacea
Flindersia bourjotiana
Flindersia pimenteliana
Franciscodendron laurifolium
Gevuina bleasdalei
Gillbeea adenopetala
Glochidion hylandii vel aff.
Guioa lasioneura
Guioa montana
Halfordia kendack
Helicia lamingtoniana
Irvingbaileya australis
Litsea bennetii
Lomatia fraxinifolia
Medicosma fareana
Melicope broadbentiana
Melicope vitiflora
Mischarytera lautereriana
Neolitsea dealbata
Perrottetia arborescens
Pitaviaster haplophyllus
Auranticarpa papyracea
Polyosma alangiacea
Polyosma hirsuta
Polyosma rhytophloia
Pouteria brownlessiana
Pullea stutzeri
Atractocarpus fitzalanii ssp. *tenuipes*
Rapanea achradiifolia
Rapanea porosa
Rhodamnia blairiana
Rhodomyrtus pervagata
Rhysotoechia mortoniana
Rockinghamia angustifolia
Sarcotoechia lanceolata
Sloanea macbrydei
Sphenostemon lobosporus
Steganthera macooraia
Streblus glaber var. *australianus*
Symplocos cochinchinensis var. *gittinsii*
Symplocos paucistaminea
Synoum glandulosum ssp. *paniculosum*
Syzygium endophloium
Syzygium johnsonii
Syzygium luehmannii
Syzygium papyraceum
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tasmannia membranea
Toechima monticola
Wilkiea angustifolia
Xanthophyllum octandrum

Tree fern

Cyathea robertsiana

Shrubs

Acronychia parviflora
Alyxia ilicifolia
Ardisia brevipedata
Harpullia rhyticarpa
Mackinlaya confusa
Pilidiostigma tetramerum
Psychotria sp. (Danbulla STB 15262)
Symplocos hayesii
Tapeinosperma sp. (Cedar Bay JGT 14780)
Wilkiea sp. (EP29, KS 841)

Palm shrub

Laccospadix australasica

Vines

Alyxia grandis
Calamus australis
Cissus repens
Cissus sterculiifolia
Elaeagnus triflora
Hibbertia scandens
Hypserpa smilacifolia
Melodinus australis
Morinda sp. (Mt Finnigan LJW 12114)
Morinda umbellata vel aff.
Palmeria scandens
Pararistolochia deltantha
Sageretia hamosa
Smilax australis

Herbs

Blechnum cartilagineum
Cordyline cannifolia
Helmholtzia acorifolia
Lastreopsis wurunuran
Pteridoblechnum neglectum
Solidago altissma

Epiphytes and hemi-epiphytes

Asplenium australasicum
Bulbophyllum wadsworthii
Microsorum scandens

Table 8: Plot 8 (EP30) Agapetes Logging Area, Windsor Tableland – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1976.

Trees

Acacia celsa
Acronychia acronychioides
Agathis robusta
Alphitonia petriei
Alphitonia whitei
Antidesma erostre
Antirhea sp. (Mt Lewis BG 5733)
Archidendron grandiflorum
Archirhodomyrtus beckleri
Ardisia pachyrrhachis
Austromyrtus sp. (Gillies BG 1484)
Austromyrtus sp. (Mt Lewis BG 831)
Austromyrtus sp. (Windsor Tableland BG 412)
Balanops australiana
Baloghia parviflora
Beilschmiedia bancroftii
Beilschmiedia collina
Brackenridgea australiana
Brombya platynema
Bubbia semecarpoides
Buckinghamia celsissima
Canarium australasicum
Canthium costatum
Canthium lamprophyllum
Cardwellia sublimis
Carnarvonia araliifolia var. *montana*
Casearia costulata
Ceratopetalum succirubrum
Cinnamomum laubatii
Cryptocarya lividula
Cryptocarya mackinnoniana
Cryptocarya onoprienkoana
Cryptocarya saccharata
Darlingia darlingiana
Davidsonia pruriens
Diospyros pentamera
Dysoxylum oppositifolium
Elaeocarpus bancroftii
Elaeocarpus eumundi
Elaeocarpus ruminatus
Elaeocarpus sericopetalus
Elaeocarpus sp. (Windsor Tableland BH 5541)
Endiandra leptodendron
Endiandra wolfei
Melicope jonesii
Eupomatia laurina
Fagraea fagraeacea
Ficus triradiata
Flindersia acuminata
Flindersia bourjotiana
Flindersia brayleyana
Flindersia ifflaiana
Flindersia pimenteliana
Franciscodendron laurifolium
Glochidion sessiliflorum var. *pedicellatum*
Guioa acutifolia
Halfordia kendack
Harpullia pendula
Hedycarya loxocarya
Helicia australasica
Ixora sp. (North Mary LA BH 8618)
Litsea connorsii
Lomatia fraxinifolia
Melicope vitiflora
Mischarytera lautereriana
Mischocarpus lachnocarpus
Mischocarpus pyriformis ssp. *pyriformis*
Musgravea heterophylla
Neolitsea dealbata
Neorites kevediana
Niemeyera prunifera
Pittosporum wingii
Placospermum coriaceum
Polyosma alangiacea
Polyscias australiana
Polyscias elegans
Pouteria euphlebia
Pouteria xerocarpa
Rapanea achradiifolia
Rhodamnia costata
Rhodamnia spongiosa
Rhodomyrtus pervagata
Sarcopteryx martyana vel aff.
Sarcotoechia cuneata
Sarcotoechia sp. (Mt Carbine GJM 995)
Scolopia braunii
Sloanea australis ssp. *parviflora*
Sloanea langii
Steganthera macooraia
Streblus glaber var. *australianus*
Symplocos cochinchinensis var. *gittonsii*
Symplocos cochinchinensis var. *pilosiuscula*
Synima cordierorum
Synoum glandulosum ssp. *paniculosum*
Syzygium apodophyllum
Syzygium canicortex
Syzygium dansiei
Syzygium endophloium
Syzygium johnsonii
Syzygium kuranda
Syzygium oleosum
Syzygium papyraceum
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tasmannia membranea
Tetrasynandra laxiflora
Tetrasynandra pubescens
Wilkiea angustifolia
Wilkiea wardellii
Zanthoxylum veneficum

Tree fern

*Cyathea rebeccae**

Shrubs

Ardisia sp. (South Mary LA BH 8778)
Harpullia rhyticarpa
Mackinlaya confusa
Pilidiostigma tetramerum
Psychotria dallachiana
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Solanum macoorai

Vines

Calamus australis
Embelia australiana
Flagellaria indica
Jasminum kajewskii
Lygodium reticulatum
Melodinus acutiflorus
Melodinus australis
Melodorum leichhardtii
Morinda sp. (Mt Finnigan LJW 12114)
Neosepicaea jucunda
Palmeria scandens
Parsonsia straminea
Piper sp. (Leo Creek BH 6367)
Ripogonum album
Smilax glyciphylla
Tetracera nordtiana

Herbs

Adiantum silvaticum
Blechnum cartilagineum

Epiphytes and hemi-epiphytes

Arthropteris tenella
Asplenium australasicum
Asplenium polyodon
Asplenium simplicifrons
Dendrobium jonesii var. *magnificum*
Drynaria rigidula
Platycerium bifurcatum
Goniophlebium subauriculatum

Sedge

Exocarya scleroides

Parasite

Amyema whitei

* Record based on plot notes only

Table 9: Plot 9 (EP31) Wooper Creek – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1976.

Trees

Aceratium megalospermum
Acmena divaricata
Acronychia vestita
Adenanthera pavonina
Aglaia australiensis
Aglaia tomentosa
Alangium villosum ssp. *polyosmoides*
Alstonia scholaris
Antidesma erostre
Antirhea tenuiflora
Archidendron whitei
Argyrodendron trifoliolatum
Arytera pauciflora
Austromyrtus dallachiana
Backhousia bancroftii
Barongia lophandra
Barringtonia calyptrata
Beilschmiedia bancroftii
Beilschmiedia tooram
Canthium sp. (Kuranda GS 680)
Canthium lamprophyllum
Cardwellia sublimis
Casearia sp. (EP 31, not collected)
Castanospermum australe
Chionanthus sleumeri
Clerodendrum costatum
Clerodendrum tracyanum
Corynocarpus cribbianus
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cryptocarya pleurosperma
Davidsonia pruriens
Delarbrea michieana
Dendrocnide photinophylla
Diploglottis bernieana
Dysoxylum arborescens
Dysoxylum oppositifolium
Dysoxylum papuanum
Dysoxylum pettigrewianum
Elaeocarpus grandis
Elaeocarpus largiflorens ssp. *largiflorens*
Elaeocarpus stellaris
Endiandra compressa
Endiandra cowleyana
Endiandra globosa
Endiandra insigins
Endiandra montana
Endiandra sankeyana
Erythroxylon ecarinatum
Fagraea cambagei
Ficus copiosa
Ficus leptoclada
Ficus variegate
Ficus septica
Franciscodendron laurifolium
Glochidion harveyanum var. *harveyanum*
Guioa lasioneura vel aff.
Haplostichanthus johnsonii
Haplostichanthus sp. (Johnstone River LWJ 471)
Harpullia pendula
Helicia nortoniana
Irvingbaileya australis
Lepiderema largiflorens
Litsea leefeana
Macadamia whelanii
Medicosma fareana
Mischocarpus grandissimus
Mischocarpus lachnocarpus
Myristica muelleri ssp. *globosa*
Neolitsea dealbata
Niemeyera prunifera
Pilidiostigma tropicum
Pisonia umbelliflora
Pitaviaster haplophyllus
Podocarpus dispermus
Polyalthia michaelii
Polyosma hirsuta
Polyscias australiana
Polyscias elegans
Polyscias mollis
Pouteria obovoidea
Pouteria sp. (Barong MT 22)
Prunus turneriana
Rhysotoechia robertsonii
Ristantia pachysperma
Rockinghamia angustifolia
Sarcotoechia lanceolata
Schefflera actinophylla
Siphonodon membranaceus
Symplocos cochinchinensis var. *pilosiuscula*
Synima macrophylla
Syzygium cormiflorum
Syzygium erythrocalyx
Syzygium kuranda
Syzygium sayeri
Syzygium wilsonii ssp. *cryptophlebium*
Ternstroemia cherryi
Tetrasynandra laxiflora
Toechima erythrocarpum
Wilkiea angustifolia
Xanthophyllum octandrum

Palm tree

Licuala ramsayi

Shrubs

Ardisia brevipedata
Austromyrtus sp. (EP 31, not collected)
Breynia sp. (EP 31, DF 129)
Dendrocnide moroides
Diospyros sp. (Millaa Millaa LWJ 515)
Diploglottis pedleyi
Atractocarpus merikin
Harpullia frutescens
Harpullia rhyticarpa
Lasianthus strigosus
Leea indica
Mackinlaya confusa
Pittosporum rubiginosum
Psychotria sp. (Danbulla STB 15262)
Psychotria submontana
Quassia sp. (Barong BG 742)
Atractocarpus hirtus
Randia tuberculosa
Tapeinosperma sp. (Cedar Bay JGT 14780)

Palm shrub

Linospadix microcarya

Vines

Bambusa moreheadiana
Calamus australis
Calamus moti*
*Calamus radicalis**
Carronia protensa
Connarus conchocarpus ssp. *conchocarpus*
Desmos goezeanus
Flagellaria indica
Hypserpa laurina
Melodinus australis
Melodorum uhrii
Salacia disepala
Tetracera nordtiana
Tetrastigma nitens

Herbs

Alpinia arctiflora
Alpinia modesta
Arthropteris palisotii
Bowenia spectabilis
Cordyline cannifolia
Diplazium dilatatum
Gymnostachys anceps
Microlepia speluncae
Molineria capitulata
Selaginella longipinna
Tapeinochilos ananassae

Epiphytes and hemi-epiphytes

Asplenium cuneatum
Colysis ampla
Dendrobium lichenastrum
Epipremnum pinnatum
Eria eriaeoides
Pothos longipes
Rhaphidophora australasica
Stenochlaena palustris

* Record based on plot notes only

Table 10: Plot 10 (EP32) McIlwraith Range – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1975.

Trees

Acacia midgleyi
Acmena hemilampra ssp. *hemilampra*
Acronychia acronychioides
Alphitonia whitei
Antidesma erostre
Antirhea tenuiflora
Archidendron grandiflorum
Austromyrtus sp. (Leo Creek BG 5244)
Austromyrtus sp. (McIlwraith Range BH 11148)
Beilschmiedia peninsularis
Blepharocarya involucrigera
Bubbia semecarpoides
Calophyllum sil
Canarium australasicum
Canthium sp. (Mt Rose ARB 1978)
Canthium lamprophyllum
Casearia dallachii
Chionanthus axillaris
Choriceras tricorne
Cinnamomum baileyanum
Cinnamomum oliveri
Citronella smythii
Cleistanthus hylandii
Corynocarpus cribbianus
Cryptocarya cunninghamii
Cryptocarya densiflora
Cryptocarya mackinnoniana
Cryptocarya vulgaris
Decaspermum humile
Diospyros cupulosa
Diospyros hebecarpa
Diploglottis diphyllostegia
Elaeocarpus eumundi
Elaeocarpus sp. (Windsor Tableland BH 5541)
Endiandra collinsii
Endiandra dielsiana
Endiandra glauca
Garcinia warrenii
Glochidion sessiliflorum var. *sessiliflorum*
Grevillea baileyana
Halfordia kendack
Helicia australasica
Horsfieldia australiana
Litsea breviumbellata
Mischocarpus exangulatus
Myristica muelleri ssp. *globosa*
Neolitsea dealbata
Pittosporum sp.#
Pittosporum wingii
Planchonella queenslandica
Podocarpus grayae
Polyscias australiana
Pouteria chartacea
Prunus brachystachya
Atractocarpus sessilis
Rapanea porosa
Rhodamnia sp. (McIlwraith Range LJW 9527)
Rhodomyrtus trineura ssp. *capensis*
Sarcopteryx sp. (McIlwraith Range BH 3261RFK)
Scheffera actinophylla
Sloanea macbrydei
Symplocos cochinchinensis var. *pilosiuscula*
Syzygium apodophyllum
Syzygium cormiflorum
Syzygium fibrosum
Syzygium forte ssp. *forte*
Syzygium johnsonii
Syzygium wilsonii ssp. *cryptophlebium*
Ternstroemia cherryi
Xanthophyllum octandrum
Xanthostemon chrysanthus

Palm tree

Licuala ramsayi

Tree Pandan

Pandanus gemmifer

Tree fern

*Cyathea felina**

Shrubs

Actephila sp. (Lockerbie WWC 817)
Croton brachypus
Lasianthus cyanocarpus
Mackinlaya confusa
Melastoma affine
Monimiaceae sp. (McIlwraith Range BH 10894)
Pilidiostigma recurvum

Palm shrubs

Hydriastele wendlandiana
Linospadix minor

Vines

Alyxia spicata
Calamus australis
Cissus penninervis
Flagellaria indica
Hibbertia scandens
Hoya macgillivrayi
Hugonia jenkinsii
Hypserpa decumbens
Lygodium reticulatum
Melodinus australis
Melodorum leichhardtii
Morinda sp. (Mt Finnigan LJW 12114)*
Palmeria scandens
Smilax glyciphylla
Tetracera nordtiana

Herbs

Blechnum cartilagineum
Cordyline cannifolia
Dianella bambusifolia
Lindsaea brachypoda
Schelhammera multiflora

Epiphytes and hemi-epiphytes

Bulbophyllum baileyi
Cymbidium madidum
Dendrobium malbrownii
Humata repens
Huperzia phlegmaria
Platycerium hillii
Psilotum complanatum
Goniophlebium subauriculatum
Vittaria elongata

* Entry recognised as being a wrong identification

\# Further identification required

Table 11: Plot 11 (EP33) Curtain Fig – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1976.

Trees

Acmenosperma claviflorum
Acronychia acidula
Aglaia sapindina
Aglaia tomentosa
Aleurites rockinghamensis
Alloxylon flammeum
Alstonia scholaris
Anthocarapa nitidula
Argyrodendron sp. (Boonjee BH 2139RFK)
Arytera divaricata
Austromyrtus dallachiana
Austromyrtus minutiflora
Beilschmiedia obtusifolia
Brachychiton acerifolius
Canthium sp. (Kuranda GS 680)
Castanospermum australe
Castanospora alphandii
Clausena brevistyla
Cryptocarya hypospodia
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cupaniopsis flagelliformis var. *flagelliformis*
Daphnandra repandula
Delarbrea michieana
Dendrocnide photinophylla
Diospyros cupulosa
Diploglottis diphyllostegia
Doryphora aromatica
Dysoxylum pettigrewianum
Endiandra cowleyana
Endiandra insigins
Endiandra monothyra ssp. *monothyra*
Endiandra sankeyana
Erythroxylon ecarinatum
Eupomatia laurina
Euroschinus falcatus var. *falcatus*
Ficus fraseri
Ficus rubiginosa
Ficus septica
Ficus watkinsiana
Firmiana papuana
Flindersia brayleyana
Flindersia schottiana
Glochidion harveyanum var. *harveyanum*
Gmelina fasciculflora
Litsea leefeana
Macaranga inamoena
Mallotus polyadenos
Melicope bonwickii
Myristica muelleri ssp. *globosa*
Neisosperma poweri
Neolitsea dealbata
Pararchidendron pruinosum
Pennantia cunninghamii
Pilidiostigma tropicum
Pitaviaster haplophyllus
Pouteria obovoidea
Pouteria xerocarpa
Rhodomyrtus macrocarpa
Rhysotoechia robertsonii
Siphonodon membranaceus
Sloanea australis ssp. *parviflora*
Sloanea macbrydei
Stenocarpus sinuatus
Synima macrophylla
Syzygium cormiflorum
Syzygium gustavioides
Syzygium johnsonii
Syzygium sayeri
Ternstroemia cherryi
Tetrasynandra laxiflora
Toona ciliata
Viticipremna queenslandica
Wilkiea angustifolia
Zanthoxylum veneficum

Shrubs

Ardisia brevipedata
Codiaeum variegatum var. *moluccanum*
Atractocarpus merikin
Haplostichanthus sp. (Topaz LWJ 520)
Harpullia frutescens
Hodgkinsonia frutescens
Pavetta australiensis
Phaleria octandra
Psychotria sp. (Danbulla STB 15262)
Sauropus macranthus
Solanum dallachii
Tapeinosperma sp. (Cedar Bay JGT 14780)

Vines

Austrosteenisia blackii
Caesalpinia robusta
Calamus caryotoides
Calamus radicalis
Carronia protensa
Cayratia acris
Cissus repens
Desmos goezeanus
Embelia australiana
Glossocarya hemiderma
Melodinus australis
Parsonsia latifolia
Parsonsia rotata
Ripogonum album
Sageretia hamosa
Ventilago ecorollata

Herbs

Adiantum hispidulum
Blechnum cartilagineum
Calanthe triplicata
Cordyline cannifolia
Coveniella poecilophlebia
Lastreopsis rufescens

Epiphytes and hemi-epiphytes

Asplenium australasicum
*Dischidia nummularia**
Drynaria rigidula
Platycerium bifurcatum
Platycerium superbum
Pothos longipes
Pyrrosia confluens var. *dielsii*

* Entry recognised as being a wrong identification

Table 12: Plot 12 (EP34) Russell River – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1976.

Trees

Acmena divaricata
Acronychia vestita
Aglaia australiensis
Aglaia tomentosa
Alangium villosum ssp. *polyosmoides*
Alphitonia whitei
Alstonia scholaris
Antirhea tenuiflora
Apodytes brachystylis
Archidendron whitei
Argyrodendron peralatum
Argyrodendron trifoliolatum
Austromyrtus sp. (Danbulla LSS 10123)*
Beilschmiedia bancroftii
Beilschmiedia tooram
Beilschmiedia volckii
Breynia stipitata
Bubbia semecarpoides
Cardwellia sublimis
Castanospermum australe
Castanospora alphandii
Cinnamomum laubatii
Citronella smythii
Cnesmocarpon dasyantha
Corynocarpus cribbianus
Cryptocarya angulata
Cryptocarya grandis
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cryptocarya pleurosperma
Cryptocarya saccharata
Daphnandra repandula
Delarbrea michieana
Diploglottis bracteata
Doryphora aromatica
Dysoxylum oppositifolium
Dysoxylum parasiticum
Dysoxylum sp. (Gosschalk LA BG 786)
Elaeocarpus grandis
Elaeocarpus foveolatus
Elaeocarpus largiflorens ssp. *largiflorens*
Endiandra bessaphila
Endiandra insigins
Endiandra monothyra ssp. *monothyra*
Endiandra sankeyana
Erythroxylon ecarinatum
Euodia xanthoxyloides
Ficus pleurocarpa
Garcinia gibbsiae
Geissois biagiana
Gillbeea adenopetala
Gmelina fasciculiflora
Guioa acutifolia
Guioa montana
Haplostichanthus johnsonii
Haplostichanthus sp. (Johnstone River LWJ 471)
Hedraianthera porphyropetala
Helicia nortoniana
Hollandaea sayeriana
Hylandia dockrillii
Irvingbaileya australis
Levieria acuminata
Litsea leefeana
Macaranga inamoena
Mammea touriga
Medicosma fareana
Melicope vitiflora
Myristica muelleri ssp. *globosa*
Neolitsea dealbata
Niemeyera prunifera
Opisthiolepis heterophylla
Pilidiostigma tropicum
Pitaviaster haplophyllus
Pittosporum trilobum
Polyalthia michaelii
Polyosma hirsuta
Polyscias elegans
Polyscias mollis
Polyscias murrayi
Pouteria castanosperma
Prunus turneriana
Rockinghamia angustifolia
Sarcotoechia protracta vel aff.
Schistocarpaea johnsonii
Siphonodon membranaceus
Sloanea australis ssp. *parviflora*
Sloanea macbrydei
Symplocos cochinchinensis var. *pilosiuscula*
Symplocos paucistaminea
Synima cordierorum
Syzygium cormiflorum
Syzygium gustavioides
Syzygium sayeri
Syzygium trachyphloium
Tetrasynandra laxiflora
Toechima erythrocarpum
Triunia erythrocarpa
Viticipremna queenslandica
Xanthophyllum octandrum

Shrubs

Ardisia bifaria
Ardisia brevipedata
Cyrtandra baileyi
Diospyros sp. (Millaa Millaa LWJ 515)
Eupomatia sp. (Noahs Head LJW 10269)
Harpullia frutescens
Harpullia rhyticarpa
Ixora baileyana
Lasianthus strigosus
Psychotria sp. (Utchee Creek H. Flecker NQNC 5313)
Psychotria submontana vel aff.
Atractocarpus hirtus
Randia tuberculosa
Symplocos hayesii
Tabernaemontana pandacaqui

Palm shrub

Linospadix microcarya

Vines

Austrobaileya scandens
Carronia protensa
Celastrus subspicata vel aff.
Connarus conchocarpus ssp. *conchocarpus*
Desmos goezeanus
Dichapetalum papuanum
Faradaya splendida
Flagellaria indica
Hoya australis ssp. *australis*
Melodinus australis
Melodorum uhrii
Gen.(AQ124851) sp. (Boonjie LJW 6837A)
Morinda jasminoides
Parsonsia velutina
Salacia disepala
Smilax calophylla
Tetracera nordtiana

Herbs

Alpinia modesta
Blechnum cartilagineum
Bowenia spectabilis
Cordyline cannifolia
Diplazium dilatatum
Marattia oreades
Pollia macrophylla
Tectaria confluens

Epiphytes and hemi-epiphytes

Bulbophyllum radicans
Colysis ampla
Eria queenslandica
Freycinetia scandens
Huperzia phlegmaria
Liparis bracteata
Mobilabium hamatum
Piper novae-hollandiae vel aff.
Pothos longipes
Pyrrosia confluens var. *dielsii*
Pyrrosia rupestris
Rhaphidophora australasica
Goniophlebium subauriculatum
Vittaria elongata

* Entry recognised as being a wrong identification

Table 13: Plot 13 (EP35) Whyanbeel – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1977.

Trees

Acacia celsa
Aceratium concinnum
Acmena divaricata
Acronychia acronychioides
Aglaia meridionalis
Alphitonia whitei
Alstonia muelleriana
Antidesma erostre
Antirhea tenuiflora
Archidendron kanisii
Argyrodendron sp. (Whyanbeel BH 1106RFK)
Backhousia hughesii
Beilschmiedia bancroftii
Brackenridgea australiana
Brombya platynema
Bubbia semecarpoides
Calophyllum sil
Canarium australasicum
Canthium sp.[#]
Cardwellia sublimis
Chionanthus axillaris
Citronella smythii
Cleistanthus discolor
Cryptocarya angulata
Cryptocarya corrugata
Cryptocarya densiflora
Cryptocarya lividula
Cryptocarya mackinnoniana
Cryptocarya murrayi
Darlingia darlingiana
Davidsonia pruriens
Diospyros hebecarpa
Dysoxylum arborescens
Dysoxylum klanderi
Elaeocarpus bancroftii
Elaeocarpus elliffii
Elaeocarpus foveolatus
Elaeocarpus sp. (Windsor Tableland BH 5541)
Endiandra dielsiana
Endiandra hypotephra
Endiandra leptodendron
Endiandra wolfei
Fagraea cambagei
Flindersia bourjotiana
Flindersia laevicarpa var. *laevicarpa*
Flindersia pimenteliana
Franciscodendron laurifolium
Garcinia sp. (Davies Creek JGT 14745)
Garcinia warrenii
Gardenia ovularis
Glochidion sessiliflorum var. *pedicellatum*
Helicia nortoniana
Hernandia albiflora
Hypsophila dielsiana
Ixora sp. (North Mary LA BH 8618)
Lethedon setosa
Litsea bindoniana
Litsea leefeana
Macaranga subdentata
Melicope broadbentiana
Mischocarpus exangulatus
Musgravea stenostachya
Neorites kevediana
Niemeyera prunifera
Ormosia ormondii
Pittosporum wingii
Placospermum coriaceum
Planchonella macrocarpa
Podocarpus grayae
Polyosma hirsuta
Polyscias australiana
Pouteria castanosperma
Pouteria chartacea
Atractocarpus fitzalanii ssp. *fitzalanii*
Sarcopteryx reticulata
Sarcotoechia villosa
Sloanea langii
Symplocos paucistaminea
Syzygium apodophyllum
Syzygium erythrocalyx vel aff.
Syzygium gustavioides
Syzygium johnsonii
Syzygium kuranda
Syzygium wesa
Ternstroemia cherryi
Toechima erythrocarpum
Waterhousea unipunctata
Xanthophyllum octandrum
Xylopia maccreae

Palm trees

Licuala ramsayi
Normanbya normanbyi

Tree fern

*Cyathea rebeccae**

Tree pandan

Pandanus monticola

Tree cycad

Lepidozamia hopei

Shrubs

Ardisia brevipedata
Austromatthaea elegans
Harpullia frutescens
Mackinlaya confusa
Pilidiostigma recurvum
Psychotria sp. (EP35, KS 1184)
Rapanea urceolata
Rhodomyrtus effusa
Symplocos cyanocarpa
Tabernaemontana pandacaqui
Wilkea sp. (EP35, KS 1200)

Palm shrub

Linospadix minor

Vines

Calamus australis
Connarus conchocarpus ssp. *conchocarpus*
Palmeria scandens
Passiflora sp. (Kuranda BH 12896)
Salacia sp. (EP35)

Herb

Bowenia spectabilis

Epiphytes and hemi-epiphytes

Asplenium australasicum
Bulbophyllum baileyi
Cymbidium madidum
Dendrobium jonesii ssp. *jonesii*
Drynaria rigidula
Freycinetia excelsa
Platycerium hillii
Pyrrosia sp.
Rhaphidophora australasica

* Record based on plot notes only

\# Further identification required

Table 14: Plot 14 (EP37) Eungella – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1977.

Trees

Acmena resa
Acronychia acidula
Alangium villosum ssp. *polyosmoides*
Alphitonia petriei
Alstonia scholaris
Antidesma erostre
Argyrodendron actinophyllum ssp. *diversiflorum*
Canarium australasicum
Cinnamomum laubatii
Cinnamomum oliveri
Citronella moorei
Cryptocarya angulata
Cryptocarya corrugata
Cryptocarya grandis
Cryptocarya hypospodia
Cryptocarya macdonaldii
Dendrocnide photinophylla
Diospyros australis
Diospyros pentamera
Dysoxylum mollissimum ssp. *molle*
Elaeocarpus grandis
Elaeocarpus foveolatus
Endiandra cowleyana
Endiandra muelleri ssp. *bracteata*
Ficus destruens
Ficus leptoclada
Glochidion ferdinandi vel aff.
Gmelina leichhardtii
Guioa semiglauca
Helicia glabriflora
Litsea leefeana
Melicope vitiflora
Mischarytera lautereriana
Mischocarpus macrocarpus
Neolitsea dealbata
Niemeyera prunifera
Polyosma rhytophloia
Polyscias australiana
Sarcotoechia heterophylla
Sloanea macbrydei
Symplocos cochinchinensis var. *pilosiuscula*
Synoum glandulosum ssp. *paniculosum*
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
*Tasmannia membranea**
Tetrasynandra laxiflora
Toona ciliata
Zanthoxylum brachyacanthum

Palm tree

Archontophoenix cunninghamiana

Shrubs

Psychotria loniceroides
Rubiaceae Gen. Nov. sp. (Shute Harbour DAH Q811)
Tapeniosperma pseudojambosa
Wilkiea macrophylla

Vines

Elaeagnus triflora
Jasminum domatiigerum ssp. *australe*
Melodinus australis
Morinda jasminoides
Palmeria scandens
Parsonsia ventricosa
Ripogonum album
Tetrastigma nitens
VINE (Unknown EP 37, not sampled)

Herbs

Adiantum hispidulum
Alpinia caerulea
Blechnum cartilagineum
Calanthe triplicata
Lastreopsis microsora
Pollia macrophylla

Epiphytes and hemi-epiphytes

Arthropteris tenella
Asplenium polyodon
Bulbophyllum newportii
Bulbophyllum radicans
Davallia denticulata var. *denticulata*
Dendrobium speciosum ssp. *curvicaule*
Dictymia brownii
Dockrilla teretifolia
Freycinetia excelsa
Liparis bracteata
Microsorum scandens
Peperomia tetraphylla
Piper caninum
Platycerium bifurcatum
Pothos longipes
Teratophyllum brightiae

* Entry recognised as being a wrong identification

Table 15: Plot 15 (EP38) The Crater – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1977.

Trees

Acmena resa
Acronychia acidula
Aglaia tomentosa
Alangium villosum ssp. *polyosmoides*
Aleurites rockinghamensis
Alloxylon flammeum
Alphitonia whitei
Anthocarapa nitidula
Antidesma erostre
Apodytes brachystylis
Ardisia pachyrrhachis
Beilschmiedia bancroftii
Beilschmiedia tooram
Brachychiton acerifolius
Bubbia semecarpoides
Carnarvonia araliifolia var. *montana*
Casearia dallachii
Castanospora alphandii
Ceratopetalum succirubrum
Cinnamomum laubatii
Claoxylon tenerifolium
Cryptocarya corrugata
Cryptocarya grandis
Cryptocarya hypospodia
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cryptocarya onoprienkoana
Cryptocarya triplinervis var. *riparia*
Cupaniopsis flagelliformis var. *flagelliformis*
Daphnandra repandula
Dendrocnide photinophylla
Diospyros sp. (Mt Lewis LSS 10107)
Doryphora aromatica
Drypetes acuminata
Dysoxylum klanderi
Dysoxylum parasiticum
Dysoxylum rufum
Elaeocarpus ruminatus
Elaeocarpus sp. (Mt Bellenden Ker LJB 18336)
Endiandra cowleyana
Endiandra insigins
Endiandra monothyra ssp. *monothyra*
Endiandra sankeyana
Eupomatia laurina
Fagraea fagraeacea
Ficus leptoclada
Ficus obliqua
Ficus pleurocarpa
Flindersia brayleyana
Fontainea picrosperma
Franciscodendron laurifolium
Galbulimima baccata
Geijera salicifolia
Geissois biagiana
Glochidion harveyanum var. *harveyanum*
Guioa acutifolia
Halfordia kendack
Helicia nortoniana
Hymenosporum flavum
Irvingbaileya australis
Ixora sp. (North Mary LA BH 8618)
Litsea leefeana
Lomatia fraxinifolia
Mallotus philippensis
Melicope broadbentiana
Mischarytera lautereriana
Mischocarpus macrocarpus
Myristica muelleri ssp. *globosa*
Neisosperma poweri
Neolitsea dealbata
Opisthiolepis heterophylla
Pararchidendron pruinosum
Perrottetia arborescens
Polyosma hirsuta
Pouteria brownlessiana
Sundacarpus amarus
Prunus turneriana
Pullea stutzeri
Rhodamnia sessiliflora
Sarcopteryx martyana
Scolopia braunii
Sloanea australis ssp. *parviflora*
Solanum viridifolium
Sphenostemon lobosporus
Stenocarpus sinuatus
Synoum glandulosum ssp. *paniculosum*
Syzygium cormiflorum
Syzygium johnsonii
Syzygium kuranda
Syzygium trachyphloium
Tetrasynandra laxiflora
Toechima erythrocarpum
Toona ciliata
Wilkiea angustifolia
Zanthoxylum veneficum

Shrubs

Acronychia parviflora
Atractocarpus merikin
Haplostichanthus sp. (Topaz LWJ 520)
Harpullia frutescens
Harpullia rhyticarpa
Pittosporum rubiginosum
Psychotria sp. (Danbulla STB 15262)
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Sambucus australasica
Solanum macoorai
Tapeinosperma sp. (Cedar Bay JGT 14780)

Vines

Calamus caryotoides
Cayratia acris
Cephalaralia cephalobotrys
Cissus antarctica
Desmos goezeanus
Dichapetalum papuanum
Elaeagnus triflora
Legnephora moorei
Melodinus bacellianus
Melodorum leichhardtii
Gen.(AQ124851) sp. (Boonjie LJW 6837A)
Morinda sp. (Mt Finnigan LJW 12114)
Neosepicaea jucunda
Palmeria scandens
Pandorea pandorana
Pararistolochia deltantha
Ripogonum discolor
Sageretia hamosa
Smilax calophylla
Tournefortia sarmentosa
Trophis scandens ssp. *scandens*

Scrambler

Rubus moluccanus vel aff.

Herbs

Alpinia modesta
Blechnum cartilagineum
Calanthe triplicata
Cordyline cannifolia
Lastreopsis tenera
Pollia macrophylla
Pteris pacifica
Pteris umbrosa
Tectaria confluens

Epiphytes and hemi-epiphytes

Arthropteris submarginalis
Piper novae-hollandiae vel aff.
Platycerium bifurcatum
Pothos longipes

Table 16: Plot 16 (EP40) Agapetes Scientific Area, Windsor Tableland – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1978.

Trees

Acacia celsa
Acronychia acronychioides
Acronychia laevis
Agathis robusta
Alectryon tomentosus
Alphitonia whitei
Alstonia muelleriana
Antidesma bunius
Archidendron grandiflorum
Archidendron hendersonii
Argyrodendron polyandrum
Austromyrtus hillii
Austromyrtus minutiflora
Austromyrtus sp. (Danbulla LSS 10123)
Backhousia hughesii
Blepharocarya involucrigera
Brachychiton acerifolius
Buckinghamia celsissima
Canthium sp.#
Canthium lamprophyllum
Casearia dallachii
Casearia sp. (Mission Beach BH 773RFK)
Elaeodendron australe var. *(Windsor Tableland BH 5574)*
Celtis paniculata
Cryptocarya clarksoniana
Cryptocarya hypospodia
Cryptocarya vulgaris
Cupaniopsis foveolata
Decaspermum humile
Denhamia celastroides
Diospyros pentamera
Diospyros sp. (Mt Lewis LSS 10107)
Dysoxylum oppositifolium
Elaeocarpus bancroftii
Elaeocarpus coorangooloo
Elaeocarpus elliffii
Elattostachys microcarpa
Endiandra acuminata
Euroschinus falcatus var. *falcatus*
Ficus fraseri
Ficus watkinsiana
Flindersia ifflaiana
Glochidion harveyanum var. *harveyanum*
Guioa lasioneura
Helicia australasica
Ixora sp. (North Mary LA BH 8618)
Jagera pseudorhus var. *pseudorhus*
Annonaceae (EP 40, KS 1696)#
Lepiderema sericolignis
Litsea fawcettiana
Macaranga subdentata
Mallotus philippensis
Mallotus polyadenos
Maytenus disperma
Mischocarpus lachnocarpus
Mischocarpus pyriformis ssp. *pyriformis*
Mischocarpus stipitatus
Neolitsea brassii
Olea paniculata
Pitaviaster haplophyllus
Podocarpus grayae
Polyalthia nitidissima
Polyscias australiana
Polyscias elegans
Pouteria chartacea
Pouteria myrsinoides
Pouteria xerocarpa
Pseudoweinmannia lachnocarpa
Atractocarpus fitzalanii ssp. *tenuipes*
Rapanea variabilis
Rhodamnia costata
Rhodamnia sessiliflora
Rhodamnia spongiosa
Rhodomyrtus macrocarpa
Sarcomelicope simplicifolia ssp. *simplicifolia*
Scolopia braunii
Streblus brunonianus
Symplocos cochinchinensis var. *pilosiuscula*
Syzygium cormiflorum
Syzygium luehmannii
Syzygium oleosum
Tetrasynandra laxiflora
Tetrasynandra pubescens
Xylopia maccreae
Zanthoxylum ovalifolium
Zanthoxylum veneficum

Shrubs

Alyxia oblongata
Codiaeum variegatum var. *moluccanum*
Croton acronychiodes
Dendrocnide moroides
Pittosporum rubiginosum
Meiogyne sp. (Mt Lewis LWJ 554)
Psychotria dallachiana
Psychotria loniceroides
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Melicope affinis
Tabernaemontana pandacaqui

Vines

Caelospermum paniculatum var. *syncarpum*
Cissus repens
Geitonoplesium cymosum
Marsdenia micradenia
Melodinus sp. (EP40)
Melodorum leichhardtii
Pandorea pandorana
Parsonsia latifolia
Passiflora sp. (Kuranda BH 12896)
Smilax calophylla
Tetrastigma nitens
Tylophora sp. (EP40)

Herbs

Alpinia hylandii
Coveniella poecilophlebia
Dianella sp. (EP40)
Lastreopsis rufescens

Epiphytes and hemi-epiphytes

Arthropteris tenella
Dendrobium cacatua
Dockrillia teretifolia
Pomatocalpa macphersonii

Sedge

Carex sp. (EP40)

Further identification required

Table 17: Plot 17 (EP41) Oliver Creek – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1977.

Trees

Acmena graveolens
Aglaia meridionalis
Aglaia tomentosa
Aleurites rockinghamensis
Alstonia scholaris
Antidesma erostre
Antirhea tenuiflora
Archidendron ramiflorum
Argyrodendron peralatum
Austromuellera trinervia
Beilschmiedia bancroftii
Beilschmiedia obtusifolia
Beilschmiedia tooram
Brackenridgea australiana
Brombya platynema
Castanospermum australe
Chionanthus sleumeri
Citronella smythii
Claoxylon tenerifolium
Cleistanthus myrianthus
Commersonia bartramia
Cryptocarya angulata
Cryptocarya clarksoniana
Cryptocarya grandis
Cryptocarya mackinnoniana
Cryptocarya murrayi
Cryptocarya pleurosperma
Cupaniopsis flagelliformis var. *flagelliformis*
Davidsonia pruriens
Doryphora aromatica
Dysoxylum alliaceum
Dysoxylum arborescens
Dysoxylum oppositifolium
Dysoxylum papuanum
Dysoxylum parasiticum
Dysoxylum pettigrewianum
Elaeocarpus bancroftii
Elaeocarpus sp. (Mt Bellenden Ker LJB 18336)
Endiandra microneura
Endiandra monothyra ssp. *monothyra*
Endiandra sankeyana
Euodia hylandii
Eupomatia laurina
Ficus variegata
Garcinia warrenii
Gardenia ovularis
Gillbeea whypallana
Glochidion sumatranum
Gomphandra australiana
Hedraianthera porphyropetala
Helicia nortoniana
Hernandia albiflora
Hypsophila dielsiana
Idiospermum australiense
Lepiderema hirsuta
Lindsayomyrtus racemoides
Litsea leefeana
Macaranga subdentata
Medicosma fareana
Medicosma sessiliflora
Melicope broadbentiana
Melicope vitiflora
Myristica muelleri ssp. *globosa*
Niemeyera prunifera
Pouteria brownlessiana
Pouteria castanosperma
Pouteria obovoidea
Prunus turneriana
Pseuduvaria froggattii
Quassia baileyana
Ristantia pachysperma
Ryparosa javanica
Mischarytera sp. (Oliver Creek LJW 10903)
Siphonodon membranaceus
Sloanea macbrydei
Storckiella australiensis
Symplocos paucistaminea
Synima cordierorum
Syzygium sp. (Noah Creek KH 2038)
Syzygium sharoniae
Terminalia sericocarpa
Tetrasynandra laxiflora
Toechima erythrocarpum
Xanthophyllum octandrum

Palm tree

Normanbya normanbyi

Shrubs

Ardisia brevipedata
Euodia pubifolia
Eupomatia sp. (Noahs Head LJW 10269)
Gardenia antinocarpa
Haplostichanthus sp. (Cooper Creek BG 2433)
Harpullia rhyticarpa
Ixora biflora
Lasianthus strigosus
Ophiorrhiza australiana ssp. *australiana*
Pittosporum rubiginosum
Atractocarpus hirtus
Symplocos cyanocarpa
Tabernaemontana pandacaqui

Palm shrub

Linospadix minor

Vines

Austrosteenisia stipularis
Caesalpinia traceyi
Carronia protensa
Cissus repens
Connarus conchocarpus ssp. *conchocarpus*
Dichapetalum papuanum
Erycibe coccinea
Flagellaria indica
Marsdenia hemiptera
Melodinus australis
Neosepicaea jucunda
Pandorea pandorana
Pachygone longifolia
Uncaria lanosa var. *appendiculata*

Herb

Cordyline cannifolia

Epiphytes and hemi-epiphytes

Colysis ampla
Epipremnum pinnatum
Piper caninum
Pothos longipes
Rhaphidophora australasica
Rhaphidophora hayi

Table 18: Plot 18 (EP42) Iron Range – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1977.

Trees

Acacia crassicarpa vel aff.
Acmenosperma claviflorum
Aglaia argentea
Aglaia sapindina
Aglaia spectabilis
Ailanthus integrifolia ssp. *intregrifolia*
Alangium sp. (Claudie River BH 2682RFK)
Alchornea rugosa
Alstonia scholaris
Neolamarckia cadamba
Antiaris toxicaria var. *macrophylla*
Antidesma hylandii
Aphananthe philippinensis
Argyrodendron polyandrum
Arytera divaricata
Barringtonia calyptrata
Beilschmiedia obtusifolia
Berrya javanica
Breynia cernua
Cananga odorata
Casearia grewiaefolia var. *gelonioides*
Castanospermum australe
Chrysophyllum roxburghii
Cleidion spiciflorum
Cleistanthus apodus
Cleistanthus hylandii
Cordia dichotoma
Cryptocarya burckiana
Cryptocarya endiandrifolia
Cryptocarya glaucocarpa
Cryptocarya hypospodia
Cryptocarya triplinervis var. *riparia*
Dendrocnide corallodesme
Diospyros hebecarpa
Dissiliaria laxinervis
Dysoxylum arborescens
Dysoxylum gaudichaudianum
Dysoxylum setosum
Endiandra impressicosta
Endiandra longipedicellata
Ficus copiosa
Ficus hispida var. *hispida*
Ganophyllum falcatum
Garcinia sp. (Claudie River LJB 19658)
Garcinia warrenii
Garuga floribunda
Glochidion sumatranum
Gomphandra australiana
Harpullia ramiflora
Homalium circumpinnatum
Lepidopetalum fructoglabrum
Lindera queenslandica
Linociera sp. (Little Pine LA BH 2520RFK)
Mallotus philippensis
Mallotus polyadenos
Maniltoa lenticellata
Maranthes corymbosa
Margaritaria indica
Miliusa horsfieldii
Mitrephora diversifolia
Monimiaceae Gen. Nov. sp. (Davies Creek LJW 6430)
Myristica insipida
Nauclea orientalis
Palaquium galactoxylum
Pisonia umbellifera
Polyalthia australis
Pongamia pinnata
Rhodamnia spongiosa
Rinorea bengalensis
Scheffera actinophylla
Semecarpus australiensis
Siphonodon australis
Sterculia shillinglawii
Streblus brunonianus
Syzygium cormiflorum
Syzygium pseudofastigiatum
Syzygium puberulum
Syzygium tierneyanum
Tabernaemontana orientalis
Terminalia complanata
Tetrameles nudiflora
Toechima daemelianum
Toona ciliata
Wrightia laevis ssp. *millgar*

Shrubs

Codiaeum variegatum var. *moluccanum*
Glycosmis trifoliata
Haplostichanthus sp. (Rocky River Scrub PIF 10617)
Lunasia amara
Morinda bracteata var. *celebica*
Pittosporum rubiginosum
Pleomele angustifolia
Rhyticaryum longifolium

Palm shrub

Ptychosperma macarthurii

Vines

Calamus caryotoides
Capparis sp. (EP42)
Carronia protensa
Derris trifoliata
Faradaya splendida
Geophila repens
Hippocratea barbata
Petraeovitex multiflora
Phyllanthus novae-hollandiae
Tetracera nordtiana

Herbs

Alpinia caerulea
Bolbitis quoyana
Tectaria brachiata

Epiphytes and hemi-epiphytes

Arthropteris submarginalis
Corymborkis veratrifolia
Dendrobium bifalce
Epipremnum pinnatum
Freycinetia excelsa

Table 19: Plot 19 (EP43) Mt Baldy – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1978.

Trees

Acmena resa
Acronychia acidula
Acronychia acronychioides
Acronychia crassipetala
Aglaia tomentosa
Alangium villosum ssp. *polyosmoides*
Alphitonia whitei
Antidesma erostre
Antirhea tenuiflora
Apodytes brachystylis
Archidendron vaillantii
Archirhodomyrtus beckleri
Ardisia pachyrrhachis
Arytera divaricata
Austromyrtus lasioclada
Balanops australiana
Beilschmiedia collina
Bobea myrtoides
Brackenridgea australiana
Bubbia semecarpoides
Canarium australasicum
Canthium sp. (Herberton Range SFK 1377)
Cardwellia sublimis
Casearia costulata
Casearia dallachii
Castanospora alphandii
Ceratopetalum succirubrum
Chionanthus axillaris
Cinnamomum laubatii
Citronella smythii
Clerodendrum longiflorum var. *glabrum*
Cryptocarya angulata
Cryptocarya cocosoides
Cryptocarya densiflora
Cryptocarya leucophylla
Cryptocarya mackinnoniana
Cryptocarya putida
Cryptocarya saccharata
Daphnandra repandula
Darlingia darlingiana
Darlingia ferruginea
Delarbrea michieana
Diospyros sp. (Mt Lewis LSS 10107)
Doryphora aromatica
Drypetes acuminata
Elaeocarpus largiflorens ssp. *largiflorens*
Elaeocarpus sericopetalus
Endiandra bessaphila
Endiandra dielsiana
Endiandra leptodendron
Endiandra palmerstonii
Endiandra sankeyana
Endiandra wolfei
Melicope jonesii
Fagraea fagraeacea
Ficus leptoclada
Ficus virens var. *virens* vel aff.
Flindersia bourjotiana
Flindersia brayleyana
Flindersia pimenteliana
Franciscodendron laurifolium
Galbulimima baccata
Gardenia ovularis
Gevuina bleasdalei
Halfordia kendack
Hedycarya loxocarya
Helicia nortoniana
Jagera pseudorhus var. *integerrima*
Levieria acuminata
Litsea leefeana
Lomatia fraxinifolia
Macaranga inamoena
Medicosma fareana
Melicope broadbentiana
Melicope elleryana
Mischarytera lautereriana
Mischocarpus pyriformis ssp. *pyriformis*
Neisosperma poweri
Neolitsea dealbata
Opisthiolepis heterophylla
Pitaviaster haplophyllus
Auranticarpa papyracea
Polyosma alangiacea
Polyosma rhytophloia
Polyscias australiana
Pouteria papyracea
Planchonella pohlmaniana var. *asterocarpon*
Prunus turneriana
Pullea stutzeri
Atractocarpus fitzalanii ssp. *tenuipes*
Rapanea achradiifolia
Rhodamnia blairiana
Rhodamnia spongiosa
Rhodomyrtus pervagata
Rockinghamia angustifolia
Sarcotoechia sp. (Mt Carbine GJM 995)
Sloanea australis ssp. *parviflora*
Sloanea langii
Sloanea macbrydei
Solanum viridifolium
Steganthera macooraia
Stenocarpus reticulatus
Symplocos cochinchinensis var. *pilosiuscula*
ynima cordierorum
Synoum glandulosum ssp. *paniculosum*
Syzygium canicortex
Syzygium cormiflorum
Syzygium endophloium
Syzygium luehmannii
Syzygium papyraceum
Syzygium trachyphloium
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tetrasynandra laxiflora
Toechima erythrocarpum
Wilkiea angustifolia
Xanthophyllum octandrum
Xanthostemon whitei

Shrubs

Ardisia brevipedata
Dendrocnide moroides
Atractocarpus merikin
Harpullia frutescens
Mackinlaya macrosciadea
Pittosporum rubiginosum
Psychotria sp. (Danbulla STB 15262)
Randia tuberculosa
Rapanea subsessilis ssp. (Gordonvale STB 9734)

Vines

Cissus penninervis
Dichapetalum papuanum
Embelia grayi
Hypserpa decumbens
Hypserpa smilacifolia
Jasminum kajewskii
Melodinus acutiflorus
Melodinus australis
Morinda umbellata
Palmeria scandens
Parsonsia straminea
Ripogonum album
Smilax glyciphylla

Herbs

Adiantum silvaticum
Alpinia arctiflora
Blechnum cartilagineum
Cordyline cannifolia
Lastreopsis wurunuran
Triumfetta pilosa

Epiphytes and hemi-epiphytes

Arthropteris palisotii
Asplenium australasicum
Bulbophyllum newportii
Crypsinus simplicissimus
Dendrobium adae
Oleandra neriiformis
Piper caninum
Pothos longipes

Filmy fern

Cephalomanes obscurum

Sedge

Exocarya scleroides

Parasite

Amyema quaternifolium

Table 20: Plot 20 (EP44) Fantail Logging Area, Windsor Tableland – floristic composition for all plants >0.25 m in height recorded within the 0.5 ha plot at the time of establishment in 1980.

Trees

Acronychia acidula
Acronychia acronychioides
Albizia sp. (Windsor Tableland BG 2181)
Alphitonia whitei
Antidesma erostre
Antirhea sp. (Mt Lewis BG 5733)
Archidendron vaillantii
Ardisia pachyrrhachis
Austromyrtus sp. (Mt Lewis BG 831)
Austromyrtus sp. (Windsor Tableland BG 412)
Beilschmiedia bancroftii
Beilschmiedia collina
Brackenridgea australiana
Brombya platynema
Cardwellia sublimis
Carnarvonia araliifolia var. *montana*
Casearia costulata
Ceratopetalum succirubrum
Chionanthus axillaris
Cinnamomum laubatii
Cryptocarya corrugata
Cryptocarya grandis
Cryptocarya mackinnoniana
Cryptocarya oblata
Cryptocarya saccharata
Cupaniopsis flagelliformis
Davidsonia pruriens
Dysoxylum oppositifolium
Elaeocarpus bancroftii
Elaeocarpus elliffii
Elaeocarpus eumundi
Elaeocarpus ruminatus
Elaeocarpus sp. (Mt Bellenden Ker LJB 18336)
Endiandra leptodendron
Endiandra sankeyana
Endiandra wolfei
Melicope jonesii
Eupomatia laurina
Ficus leptoclada
Flindersia bourjotiana
Flindersia brayleyana
Franciscodendron laurifolium
Guioa sarcopterifructa
Hedycarya loxocarya
Helicia australasica
Ixora sp. (North Mary LA BH 8618)
Lethedon setosa
Levieria acuminata
Litsea connorsii
Litsea leefeana
Medicosma fareana
Melicope broadbentiana
Musgravea heterophylla
Neolitsea dealbata
Neorites kevediana
Opisthiolepis heterophylla
Pittosporum wingii
Placospermum coriaceum
Polyosma alangiacea
Polyscias mollis
Polyscias murrayi
Pouteria papyracea
Pullea stutzeri
Rhodamnia blairiana
Rhodomyrtus pervagata
Sarcotoechia sp. (Mt Carbine GJM 995)
Siphonodon membranaceus
Sloanea australis ssp. *parviflora*
Sloanea langii
Steganthera macooraia
Stenocarpus sinuatus
Streblus glaber var. *australianus*
Symplocos ampulliformis
Symplocos cochinchinensis var. *gittinsii*
Synima cordierorum
Synoum glandulosum ssp. *paniculosum*
Syzygium apodophyllum
Syzygium johnsonii
Syzygium kuranda
Syzygium luehmannii
Syzygium trachyphloium
Syzygium wesa
Syzygium wilsonii ssp. *cryptophlebium*
Tarenna dallachiana
Tetrasynandra laxiflora
Wilkiea angustifolia
Zanthoxylum veneficum

Tree fern

*Cyathea rebeccae**

Shrubs

Ardisia sp. (South Mary LA BH 8778)
Harpullia rhyticarpa
Mackinlaya confusa
Pilidiostigma tetramerum
Pittosporum rubiginosum
Meiogyne sp. (Mt Lewis LWJ 554)
Polyscias purpurea
Psychotria dallachiana
Psychotria sp. (EP44, GLU 774)
Rapanea subsessilis ssp. (Gordonvale STB 9734)
Solanum dallachii
Solanum macoorai

Vines

Austrosteenisia stipularis
Calamus motii
Cissus penninervis
Eustrephus latifolius
Hypserpa smilacifolia
Melodinus acutiflorus
Melodinus australis
Morinda sp. (Mt Finnigan LJW 12114)
Neosepicaea jucunda
Pandorea pandorana
Pararistolochia deltantha
Tetracera nordtiana

Herb

Alpinia arctiflora

Epiphytes and hemi-epiphytes

Asplenium australasicum
Asplenium simplicifrons
Colysis ampla
Freycinetia excelsa
*Huperzia phlegmaria**
*Huperzia prolifera**
Pothos longipes
*Rhaphidophora australasica**

* Record based on plot notes only

FLORISTIC ANALYSES

A. W. Graham and J. Kanowski

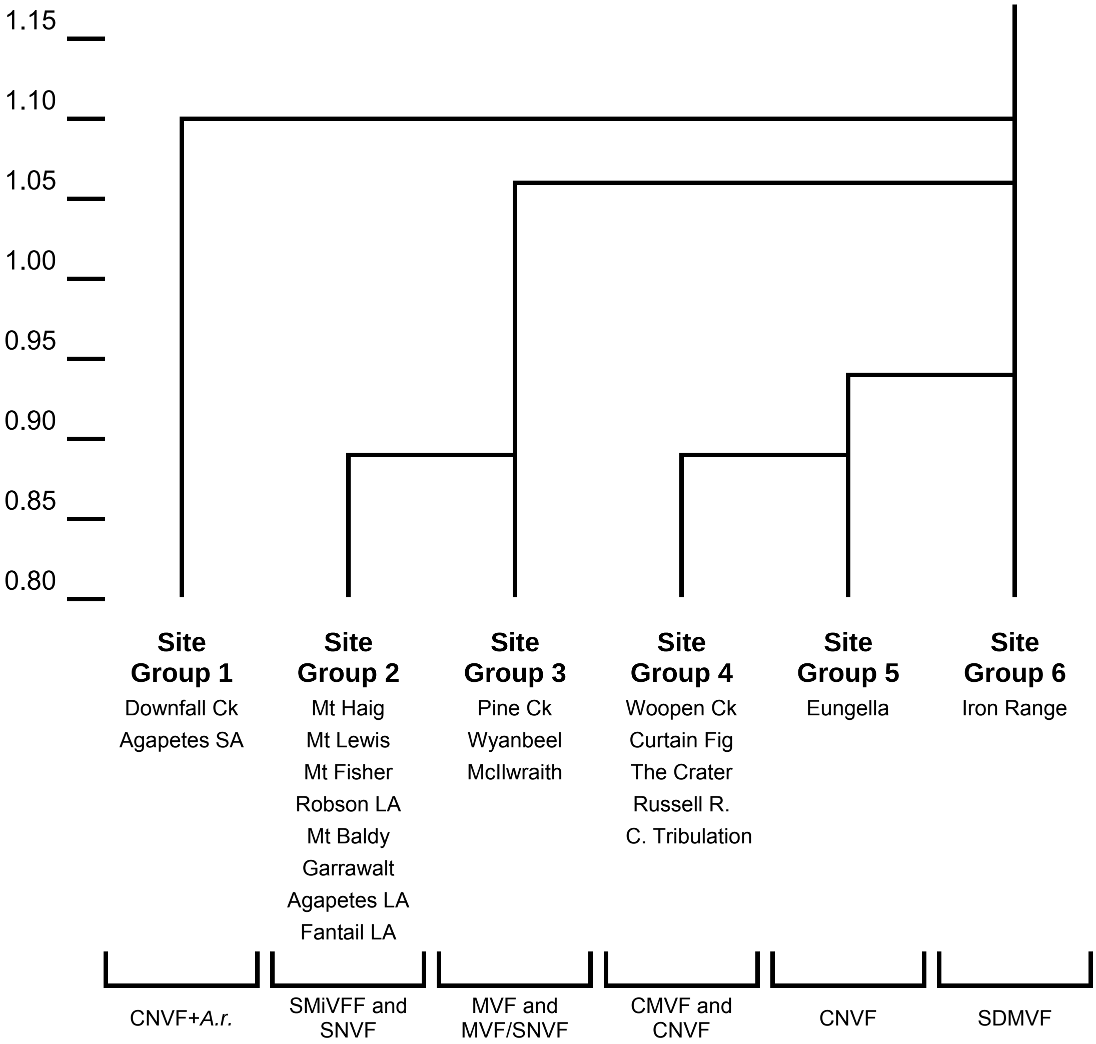

Figure 1: Dendrogram at the six site group level resulting from clustering of the 20 CSIRO plots in primary rainforests in north Queensland using stem abundance data. The agglomerative classification of the log(x+1) transformed data (stems of 236 tree species with stems ≥10 cm diameter at breast height, and present in two or more plots) utilized the Bray-Curtis coefficient of dissimilarity as the association measure and flexible UPGMA sorting. The six site groups are clearly defined in terms of their physiognomic typing (see Text Table 9 for details) and biogeographic setting (see Text Table 1 for locations).

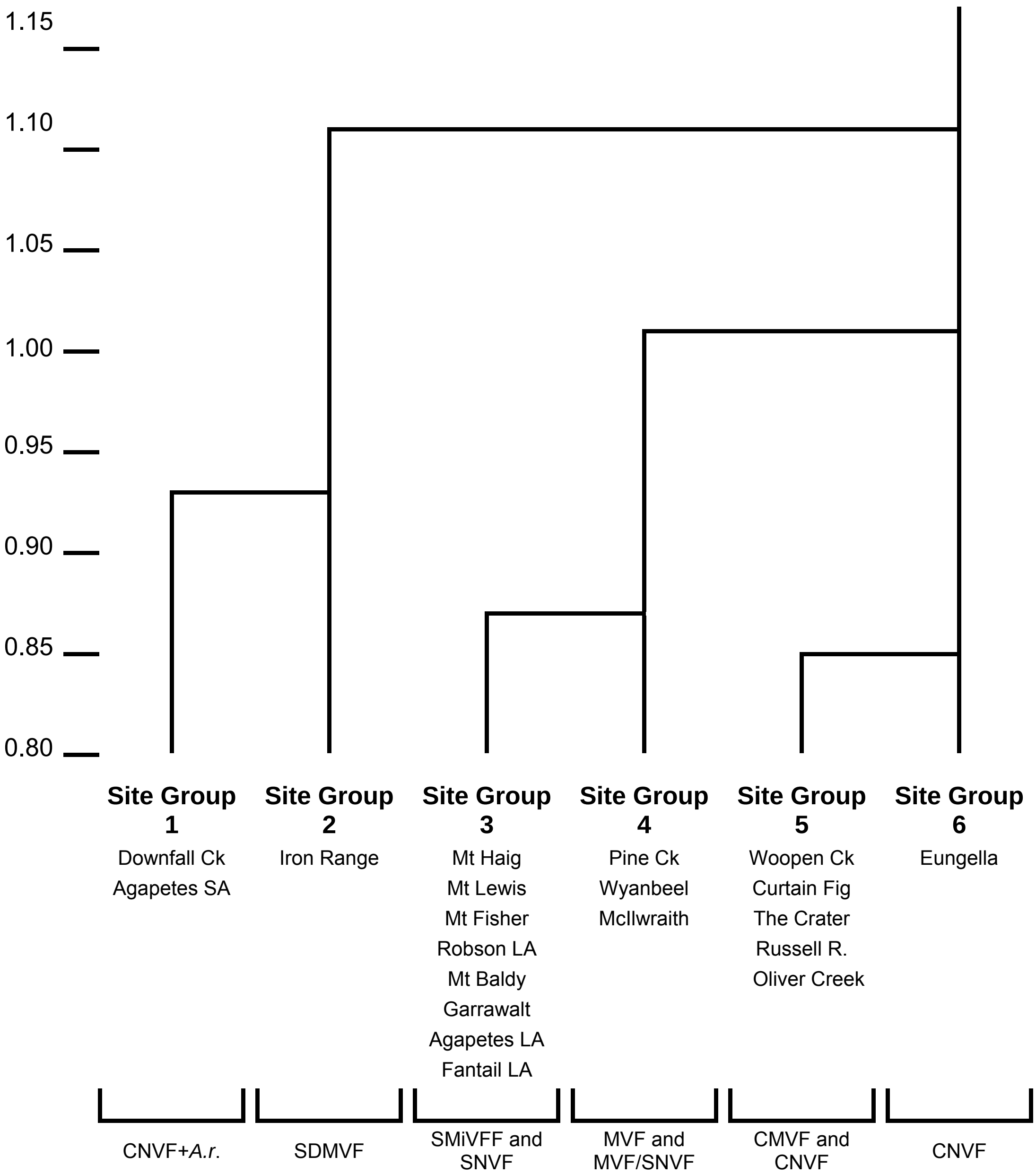

Figure 2: Dendrogram at the six site group level resulting from clustering of the 20 CSIRO plots in primary rainforests in north Queensland using species presence or absence data. The agglomerative classification of the floristic presence / absence data (236 tree species present in two or more plots) utilized the Czekanowski coefficient of dissimilarity as the association measure and flexible UPGMA sorting. The six site groups are clearly defined in terms of their physiognomic typing (see Text Table 9 for details) and biogeographic setting (see Text Table 1 for locations).

APPENDIX 3:
PUBLICATIONS AND RESEARCH ACTIVITIES

A list of publications for research activities carried out on, or immediately adjacent to, the series of 20 CSIRO permanent plots*

Scientific Publications Containing Plot Data

Beadle, N. C. W. (1981) The vegetation of Australia. Cambridge University Press, Cambridge.

(all plots except 18, 19 and 20)

Stocker, G. C. (1983) Aspects of the dynamics of rainforests in north east Australia. PhD Thesis, University of New England.

(all plots except 20; copy held at CSIRO Atherton)

Stocker, G. C. (1988) Tree species diversity in rainforests – establishment and maintenance. *Proceedings of the Ecological Society of Australia* 15: 39-47.

(all plots except 20)

Stocker, G. C. and Unwin, G. L. (1989) *The rain forests of northeastern Australia – their environment, evolutionary history and dynamics*. In: Tropical Rain Forest Ecosystems, Biogeographical and Ecological Studies. (Eds. H. Lieth and M. J. A. Werger) Elsevier, Amsterdam. pp. 241-259.

(all plots except 20)

Stocker, G. C., Thompson, W. A., Irvine, A. K., Fitzsimon, J. D. and Thomas, P. R. (1995) Annual patterns of litterfall in a lowland and tableland rainforest in tropical Australia. *Biotropica* 27(4): 412-420.

(plots 3 and 11)

Stocker, G. C., Unwin G. L. and West, P. W. (1985) Measures of richness, evenness and diversity in tropical rainforest. *Australian Journal of Botany* 33: 131-137.

(all plots except 20)

Unwin, G. L., Applegate, G. B., Stocker, G. C. and Nicholson, D. I. (1988) Initial effects of Tropical Cyclone 'Winifred' on forests in north Queensland. *Proceedings of the Ecological Society of Australia* 15: 283-296.

(plots 9 and 12)

West, P. W., Stocker, G. C. and Unwin, G. L. (1988) Environmental relationships and floristic and structural change in some unlogged tropical rainforest plots of north Queensland. *Proceedings of the Ecological Society of Australia* 15: 49-60.

(all plots except 20)

Other Ecological Publications For Research Sites Within Or Adjacent To Plot Areas*

Armstrong, J. E. and Irvine, A. K. (1989) Floral Biology of *Myristica insipida* (Myristicaceae). A distinctive beetle pollination syndrome. *American Journal of Botany* 76(1): 86-94.
(plots 3 and 11)

Armstrong, J. E. and Irvine, A. K. (1989) Flower, sex ratios, pollen-ovule ratios, fruit set and reproductive effort of a dioecious tree. *Myristica insipida* (Myristicaceae) in two different rainforest communities. *American Journal of Botany* 76(1): 74-85.
(plots 3 and 11)

Armstrong, J. E. and Irvine, A. K. (1990) Functions of Staminodia in a beetle-pollinated flower of *Eupomatia laurina. Biotropica* 22(4): 429-431.
(plots 3 and 11)

Doley, D., Unwin G. L. and Yates D. J. (1988) Spatial and temporal distribution of photosynthesis and transpiration by single leaves in a rainforest tree. *Argyrodendron peralatum. Australian Journal of Plant Physiology* 15(1,2): 317-326.
(plot 11)

Doley, D., Yates D. J. and Unwin G. L. (1987) Photosynthesis in an Australian rainforest tree, *Argyrodendron peralatum* during the rapid development and relief of water deficits in the dry season. *Oecologia* 74: 441-449.
(plot 11)

Grubb, P. J., Metcalfe, D. J., Grubb, E. A. A. and Jones, G. D. (1998) Nitrogen-richness and protection of seeds in Australian tropical rainforest: a test of plant defence theory. *Oikos* 82: 467-482.
(plots 4, 5, 11, 12 and 15)

Herwitz, S. R. (1982) Tropical rainforest influences on rainwater flux. PhD Thesis, Australian National University.
(plot 11)

Herwitz, S. R., Slye, R. E. and Turton, S. M. (1998) Co-registered aerial stereopairs from low-flying aircraft for the analysis of long-term tropical rainforest canopy dynamics. *Photogrammetric Engineering and Remote Sensing* 64(5): 387-406.
(plot 11)

Herwitz, S. R., Slye, R. E. and Turton, S. M. (2000) Long-term survivorship and crown area dynamics of tropical rain forest canopy trees. *Ecology* 81(2): 585-597.
(plot 11)

Hopkins, M. S., Tracey, J. G. and Graham, A. W. (1990) The size and composition of soil seed banks in remnant patches of three structural rainforest types in North Queensland. *Australian Journal of Ecology* 15: 43-50.
(plot 11)

House, S. M. (1989) Pollen movement to flowering canopies of pistillate individuals of three rainforest tree species in tropical Australia. *Australian Journal of Ecology* 14: 77-94.

House, S. M. (1992) Population density and fruit set in three dioecious tree species in Australian tropical rainforest. *Journal of Ecology* 80: 57-69.

House, S. M. (1993) Pollination success in a population of dioecious rainforest trees. *Oecologia* 96(4): 555-561.

Irvine, A. K. and Armstrong, J. E. (1988) Beetle pollination in Australian tropical rainforests. *Proceedings of the Ecological Society of Australia* 15: 107-113.

(plots 3 and 11)

Irvine, A. K. and Armstrong, J. E. (1989) *Beetle pollination and comparisons in some tropical forests of Australia and America*. In: Reproductive Ecology of Tropical Forest Plants (Eds. K. S. Bawa and M. Hadley). Man and the Biosphere, UNESCO.

(plots 3 and 11)

Kershaw, A. P. and Strickland, K. M. (1990) A 10 year pollen trapping record from rainforest in northeastern Queensland, Australia. *Review of Palaeobotany and Palynology* 64: 281-288.

(plot 5)

Lewis, S. L., Phillips, O. L., Sheil, D., Vinceti, B., Baker, T. R., Brown, S., Graham, A. W., Higuchi, N., Hilbert, D. W., Laurance, W. F., Lejoly, J., Malhi, Y., Monteagudo, A., Vargas, P. N., Sonké, B., Nur Supardi M. N., Terborgh, J. W., Martínez, R. V. (2004) Tropical forest tree mortality, recruitment and turnover rates: calculation, interpretation and comparison when census intervals vary. *Journal of Ecology* 92: 929-944

(plots 2 and 5)

Myers, B. J. (1981) Guide to identification of some tropical rainforest species from large – scale aerial photographs. *Australian Forestry* 45(1): 28-41.

(plots 1, 2, 3, 5, 9 and 11)

Myers, B. J. and Benson M. L. (1981) Rainforest Species on large – scale colour photos. *Photogrammetric Engineering and Remote Sensing* 47(4): 503-513.

(plots 1, 2, 3, 5, 9 and 11)

Myers, B. J., Robichaux, R. H., Unwin, G. L. and Craig, L. E. (1987) Leaf water relations and anatomy of a tropical rainforest tree species vary with crown position. *Ecology* 74: 81-85.

(plot 11)

Osunkoya, O. O., Ash, J. E., Hopkins, M. S. & Graham, A. W. (1992) Factors affecting survival of tree seedlings in North Queensland rainforests. *Oecologia* 91: 569-578.

(plot 11)

Osunkoya, O. O., Ash, J. E., Hopkins, M. S. and Graham, A. W. (1993) Growth of tree seedlings in tropical rainforests of North Queensland. *Journal of Tropical Ecology* 9: 1-18.
(plot 11)

Osunkoya, O. O., Ash, J. E., Hopkins, M. S. and Graham, A. W. (1994) Influence of seed size and seedling ecological attributes on shade tolerance of North Queensland rainforest tree species. *Journal of Ecology* 82: 149-163.
(plot 11)

Pfeifer, M. (2002) Spatial distribution pattern of pioneer and non-pioneer tree species in a dry tropical rainforest of Northern Queensland. MSc Thesis, Friedrich Schiller University of Jena, Jena, Germany.
(Plot 11)

Stocker, G. C. and Irvine, A. K. (1983) Seed dispersal by Cassowaries (*Casuarius casuarius*) in Queensland rainforests. *Biotropica* 15(3): 170-176.
(plots 3 and 9)

Unwin, G .L. (1983) Dynamics of the rainforest – eucalypt forest boundary in the Herberton Highland, North Queensland. MSc Thesis, James Cook University, Townsville.
(plots 15 and 19 with CSIRO sclerophyll forest plots EP36 and EP39)

Unwin, G. L. (1989) Structure and composition of the abrupt rainforest boundary in the Herberton Highland. *Australian Journal of Botany* 37(5): 413-442.
(plots 15 and 19 with CSIRO sclerophyll forest plots EP36 and EP39)

Unwin, G. L. and Kriedmann, P. (1990) Drought tolerance and rainforest tree growth on a North Queensland rainfall gradient. *Forest Ecology and Management* 30: 113-123.
(plots 3 and 11)

Unwin, G. L. and Sanderson, K. D. (1983) *The use of experimental fire to study the effects on the rainforest-eucalypt forest boundary, Herberton Highland*. In: North Queensland. Fire Research Workshop, Gympie (Ed. B. R. Roberts) Darling Downs Institute Advanced Education. pp. 95-109.
(plot 15 and CSIRO sclerophyll forest plot EP39)

Yates, D. J., Unwin, G. L. and Doley, D. (1988) Rainforest environment and physiology. *Proceedings of the Ecological Society of Australia* 15: 31-37.
(plot 11)

* A number of rainforest ecophysiological studies were carried out from the now-demolished canopy towers adjacent to plots 3 and 11. This research addressed some of the species found on the adjacent plots and some relevant publications are listed above. Published details of other ecophysiological research may be obtained from the CSIRO Tropical Forest Research Centre library in the centre's list of publications.

PHOTOGRAPHS

Photographs start from page 229.

Photograph 1: Plot 1 (EP2) Downfall Creek. The forest at this site is Complex Notophyll Vine Forest with emergent *Agathis robusta* (Kauri Pine). Bob Hewett (*left*) and Matt Bradford consider the abundance of small stems on this site. (Photograph courtesy of Andrew Graham.)

Photograph 2: Plot 1 (EP2) Downfall Creek. The canopy of the plot ranges between 15 and 18 m in height and is somewhat lower than nearby examples of the same forest type. (Photograph courtesy of Andrew Graham.)

Photograph 3: Plot 1 (EP2) Downfall Creek. On the plot there are examples of basal branching, often indicative of past disturbance. In 2000, recognition of this feature led the plot review team to further research the history of the site. (Photograph courtesy of Andrew Graham.)

Photograph 4: Plot 2 (EP3) Mount Haig. Tree E 23 is a 21 metre high Mountain Kauri (*Agathis atropurpurea*), a characteristic species in Simple Microphyll Vine-Fern Forest. (Photograph courtesy of Andrew Graham.)

Photograph 5: Plot 2 (EP3) Mount Haig. A general view across the western section plot that is not affected by the ancient landslide. (Photograph courtesy of Andrew Graham.)

Photograph 6: Plot 3 (EP4) Little Pine Creek. This dense understorey with fan palms (*Licuala ramsayi*) is characteristic of Mesophyll Vine Forest that has been intermittently disturbed by cyclones. (Photograph courtesy of Andrew Ford.)

Photograph 7: Plot 3 (EP4) Little Pine Creek. Bob Hewett is collecting root biomass and relict soil charcoal samples under a Hope's Cycad or Zamia Palm (*Lepidozamia hopei*). (Photograph courtesy of Andrew Graham.)

Photograph 8: Plot 4 (EP9) Robson Logging Area. In this Simple Notophyll Vine Forest, tree C 20 is a Silver Ash (*Flindersia bourjotiana*) on the upper slope landform element of the plot. (Photograph courtesy of Andrew Ford.)

Photograph 9: Plot 5 (EP18) Mount Lewis. A view of some mid- and larger sized stems in the Simple Microphyll Vine-Fern Forest on the Mount Lewis plot. (Photograph courtesy of Andrew Graham.)

Photograph 10: Plot 5 (EP18) Mount Lewis. The enduring remains of a number of old fallen trees were noted along the western side of the plot at the time of plot establishment. (Photograph courtesy of Andrew Graham.)

Photograph 11: Plot 5 (EP18) Mount Lewis. A seedling of Mount Spurgeon Pine (*Prumnopitys ladei*) in the understorey of the plot. This is one of two charismatic tree species on the plot with very limited distributions in the region. (Photograph courtesy of Andrew Graham.)

Photograph 12: Plot 6 (EP19) Garrawalt. Moderate and large sized tree stems of the Simple Notophyll Vine Forest in the northwestern subplot (M) that has remained free of dieback caused by *Phytophthora cinnamomi* despite a positive record of the *P. cinnamomi* organism from the subplot in 1976. (Photograph courtesy of Andrew Ford.)

Photograph 13: Plot 6 (EP19) Garrawalt. This vigorous regeneration of small stems in the northeastern subplot (P) followed extensive earlier vegetation dieback caused by *Phytophthora cinnamomi*. Positive records of *P. cinnamomi* and *P. heveae* were made from this subplot in 1976. (Photograph courtesy of Dan Metcalfe.)

Photograph 14: Plot 7 (EP29) Mount Fisher. On this exposed high altitude plot, stem suckers and low branching or multi-stem form trees are common. These stems of *Cryptocarya leucophylla* are typical of the phenomenon. (Photograph courtesy of Andrew Graham.)

Photograph 15: Plot 9 (EP31) Woopen Creek. This floristic variant of Complex Mesophyll Vine Forest was disturbed by Cyclone Winifred in 1986. The locally restricted endemic species, Barong Quassia (*Quassia* sp. Barong B. Gray 742), is common in the dense understorey (see right-hand side, elongated leaves). (Photograph courtesy of Andrew Ford.)

Photograph 16: Plot 9 (EP31) Woopen Creek. In 1976, trees of Johnstone River Hardwood (*Backhousia bancroftii*) made up one third of the measured stems and constituted two-thirds of the basal area on the plot. This tree has characteristic star buttresses and patterned coarse flaky bark. (Photograph courtesy of Andrew Ford.)

Photograph 17: Plot 10 (EP32) McIlwraith Range. In this hybrid forest type (Mesophyll Vine Forest fan palm variant / Simple Notophyll Vine Forest) the most common tall tree is Golden Penda (*Xanthostemon chrysanthus*). (Photograph courtesy of Matt Bradford.)

Photograph 18: Plot 10 (EP32) McIlwraith Range. The understorey of the plot is moderately dense with saplings, vines, pandans (*Pandanus gemmifer*) and fan palms (*Licuala ramsayi*) the common components. (Photograph courtesy of Matt Bradford.)

Photograph 19: Plot 10 (EP32) McIlwraith Range. Repainting the tree marking on the plot. The measurement position ring being painted by Trevor Parker (foreground) is located higher on the stem than usual because of a stem deformity. (Photograph courtesy of Matt Bradford.)

Photograph 20: Plot 11 (EP33) Curtain Fig. Vine and shrub species make up about one quarter of the plant species recorded from the plot in this Complex Notophyll Vine Forest. The tallest trees on the plot range from 32 to 43 m in height. (Photograph courtesy of Matt Bradford.)

Photograph 21: Plot 12 (EP34) Russell River. This forest is a well-developed example of Complex Mesophyll Vine Forest. The abundance of hemi-epiphytes on tree trunks is a characteristic of this forest type but can make precise measurement of stem diameters difficult. (Photograph courtesy of Andrew Graham.)

Photograph 22: Plot 12 (EP34) Russell River. On stem G20, a Red Tulip Oak (*Argyrodendron peralutum*), the painted measurement position is located just above the buttresses. Many bracket fungi are clearly evident on the middle buttress and subsequently the tree was recorded as ‘dead’ in 2002. (Photograph courtesy of Andrew Graham.)

Photograph 23: Plot 12 (EP34) Russell River. Stem I 15 is another example of the Red Tulip Oak (*Argyrodendron peralutum*). Above the buttresses, the relatively slender stem (0.36 metre dbh) reaches to 34 metres. (Photograph courtesy of Andrew Graham.)

Photograph 24: Plot 13 (EP35) Whyanbeel. This site is a typical example of regularly disturbed Mesophyll Vine Forest. Because of the repeated cyclonic disturbances, there is an abundance of small stems across much of the plot. (Photograph courtesy of Andrew Graham.)

Photograph 25: Plot 13 (EP35) Whyanbeel. Severe tropical Cyclone Rona (12 February 1999) was responsible for the toppling of this Wattle (*Acacia celsa*). Numerous canopy gaps were formed on the plot at this time. (Photograph courtesy of Andrew Graham.)

Photograph 26: Plot 13 (EP35) Whyanbeel. In the high intensity light below a canopy gap caused by the 1999 cyclone, a Wattle seedling (*Acacia celsa*) has germinated from the soil seed bank and successfully established in the groundstorey. (Photograph courtesy of Andrew Graham.)

Photograph 27: Plot 14 (EP37) Eungella. In this example of a feather palm variant of Complex Notophyll Vine Forest, the tallest trees ranged from 32 to 42 metres high at plot establishment. This Mackay Tulip Oak (*Argyrodendron actinophyllum* ssp. *diversiflorum*) has a 0.69 metre dbh and is 32 m high. (Photograph courtesy of Andrew Ford.)

Photograph 28: Plot 14 (EP37) Eungella. Andrew Ford examines and records species and stem damage adjacent to a canopy gap resulting from a recent treefall on the plot. (Photograph courtesy of Dan Metcalfe.)

Photograph 29: Plot 14 (EP37) Eungella. The Piccabeen Palm (*Archontophoenix cunninghamiana*) is abundant and dominates the midstorey over much of the plot. (Photograph courtesy of Andrew Ford.)

Photograph 30: Plot 14 (EP37) Eungella. This plot is located on the margin of the escarpment and receives a relatively high orographic rainfall. Dan Metcalfe and Matt Bradford contemplate a day of wet fieldwork as further moisture is intercepted directly from the clouds rolling across the site. (Photograph courtesy of Andrew Ford.)

Photograph 31: Plot 15 (EP38) The Crater. The soil at this plot is enriched with pyroclastic basaltic fragments and supports Complex Notophyll Vine Forest. Tree K 10, a Northern Brush Mararie (*Geissois biagiana*) is 35 metres in height and 1.34 metres in diameter. (Photograph courtesy of Andrew Graham.)

Photograph 32: Plot 15 (EP38) The Crater. The lower slope section of the plot is located on a valley infill of friable, dark grey sandy loam about five metres deep. (Photograph courtesy of Andrew Ford.)

Photograph 33: Plot 15 (EP38) The Crater. Bob Hewett uses a ladder to measure the tree diameter at a stem measurement position above the high buttresses. (Photograph courtesy of Andrew Graham.)

Photograph 34: Plot 17 (EP41) Oliver Creek. This forest, a floristic variant of Complex Mesophyll Vine Forest, is located on a gently sloping, poorly sorted fan deposit on the footslopes of Mount Hemmant. Weathered metamorphic gravel and cobbles cover most of the surface of the plot. (Photograph courtesy of Andrew Graham.)

Photograph 35: Plot 17 (EP41) Oliver Creek. During heavy rainfall, gully-head erosion in the ephemeral creek actively reworks the upper sections of the alluvial fan and the creek overflows its channel, depositing new debris and shifting previous deposits. Tree O 18 is a Daintree Penda (*Lindsayomyrtus racemoides*). (Photograph courtesy of Andrew Graham.)

Photograph 36: Plot 17 (EP41) Oliver Creek. The shallow rooting pattern of many rainforest trees make them susceptible to toppling in very strong winds, particularly when soils are saturated. This treefall occurred during Cyclone Rona in 1992. (Photograph courtesy of Andrew Graham.)

Photograph 37: Plot 17 (EP41) Oliver Creek. This small canopy gap was formed on the plot during Cyclone Rona. Such periodic disturbances, at varying scales of intensity and extent, are characteristic of the coastal rainforests. (Photograph courtesy of Andrew Graham.)

Photograph 38: Plot 17 (EP41) Oliver Creek. The Daintree Penda (*Lindsayomyrtus racemoides*) is the most common tree on the on the plot. In 2000, a dense carpet of well-established *L. racemoides* seedlings extended across much of the plot except for those areas disturbed by the creek and its overflow. (Photograph courtesy of Andrew Graham.)

Photograph 39: Plot 17 (EP41) Oliver Creek. In the lowland forests of the Daintree area, the tree *Ryparosa javanica* is conspicuous because it bears flowers and fruits both on the trunk and in the canopy. (Photograph courtesy of Andrew Graham.)

Photograph 40: Plot 18 (EP42) Iron Range. This typical Semi-Deciduous Mesophyll Vine Forest occurs on a riverine plain. The centre of the plot is located on a scroll (an alluvial sedimentary rise) and has a dense understorey of seedlings and shrubs. (Photograph courtesy of Matt Bradford.)

Photograph 41: Plot 18 (EP42) Iron Range. Along the eastern, northern and western plot margins, the bed of the seasonal overflow channel is almost devoid of small tree and understorey growth. (Photograph courtesy of Matt Bradford.)

Photograph 42: Plot 18 (EP42) Iron Range. This actively eroding section of gully with exposed tree roots is relatively close to the river in the northern section of the plot. (Photograph courtesy of Matt Bradford.)

Photograph 43: Plot 18 (EP42) Iron Range. Adam McKeown (on the ladder) is encouraged by Trevor Parker in a demanding measurement of tree B 18, a Leichhardt Pine (*Nauclea orientalis*). (Photograph courtesy of Matt Bradford.)

Photograph 44: Plot 18 (EP42) Iron Range. *Tetrameles nudiflora* is a pan-tropical tree and this individual (stem D 14) is 32 metres high with a dbh of 0.95 metre above its characteristic buttresses. An abundance of such large stems appears to be a feature of the forest type. (Photograph courtesy of Matt Bradford.)

Photograph 45: Plot 18 (EP42) Iron Range. The bank of the Claudie River is eroding adjacent to subplot M. In 1979 high river levels caused erosion of the stream bank and tree falls on the plot. This erosion has continued with the riverbank cutting back 25 metres by 1998. (Photograph courtesy of Matt Bradford.)

Photograph 46: Plot 19 (EP43) Mount Baldy. This Simple Microphyll Vine-Fern Forest plot is centered on the midslope of a major spur and extends from the upper slope down to the lowerslope landform elements. The tallest trees have high, broad crowns that structurally dominate the uppermost canopy. (Photograph courtesy of Andrew Ford.)

Photograph 47: Plot 20 (EP44) Fantail Logging Area. In this ridge top section of the plot in Simple Notophyll Vine Forest, Jana Kaeppler looks up an outstanding specimen of White Eungella Satinash (*Syzygium wesa*). This tree has a dbh of 1.01 metres and is 39 metres high. (Photograph courtesy of Andrew Ford.)

Photograph 48: Plot 20 (EP44) Fantail Logging Area. A view of the midslope section of the plot. The maximum basal area recorded from this plot (59.4 m^2 ha^{-1}) is typical of well-developed forests on wet, upland to highland sites. (Photograph courtesy of Andrew Ford.)

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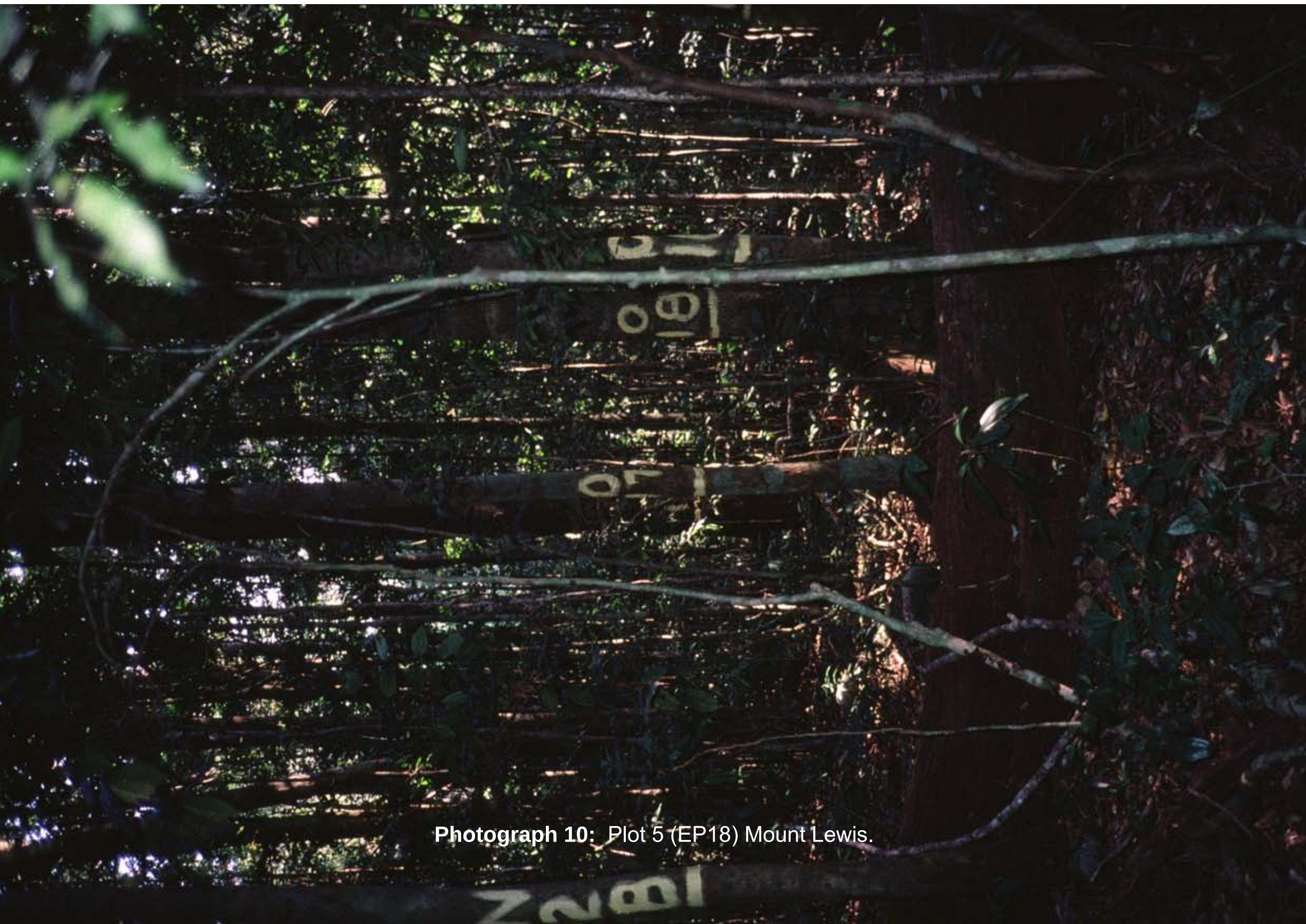
Photograph 8: Plot 4 (EP9) Robson Logging Area.

Photograph 9: Plot 5 (EP18) Mount Lewis.



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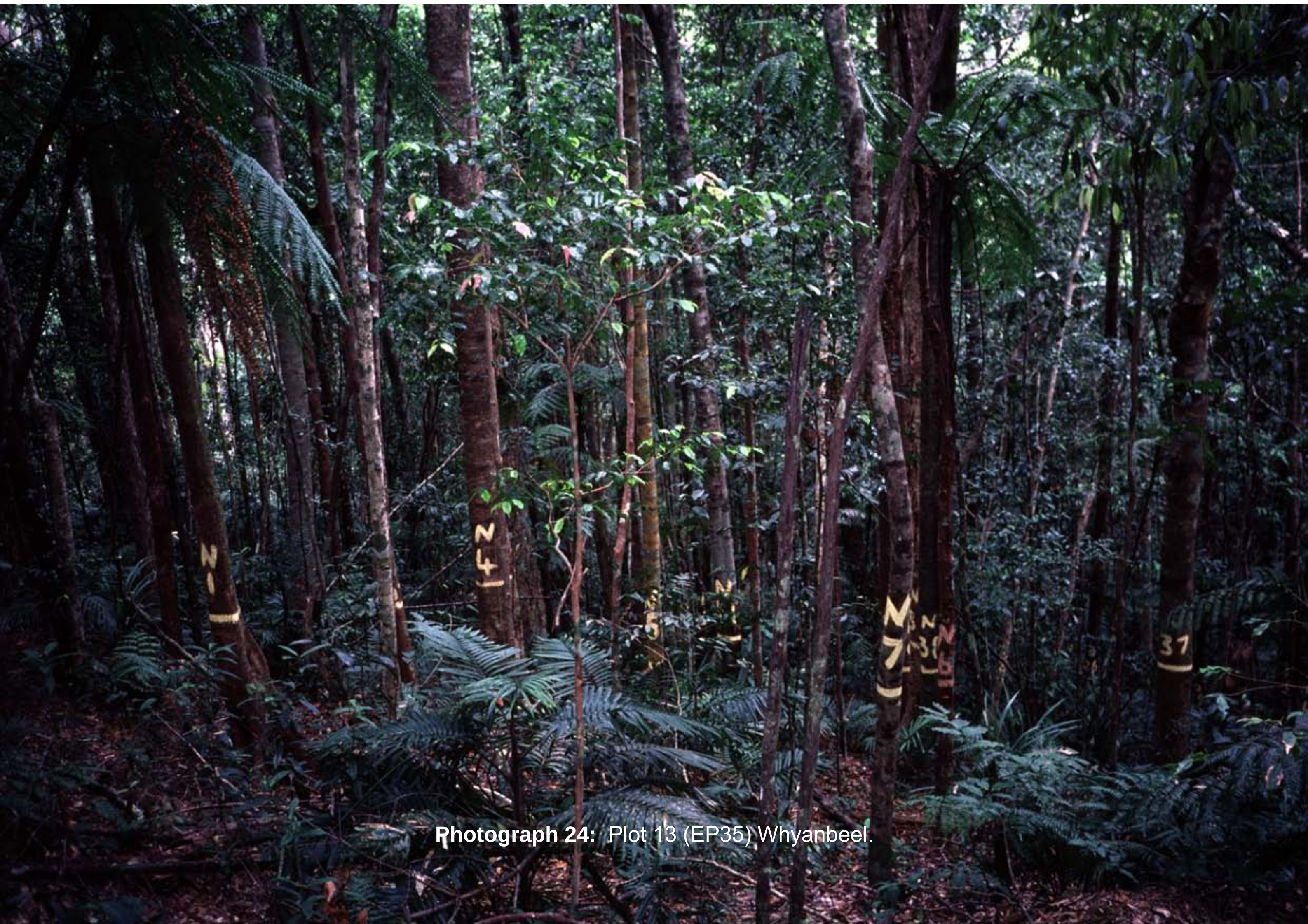

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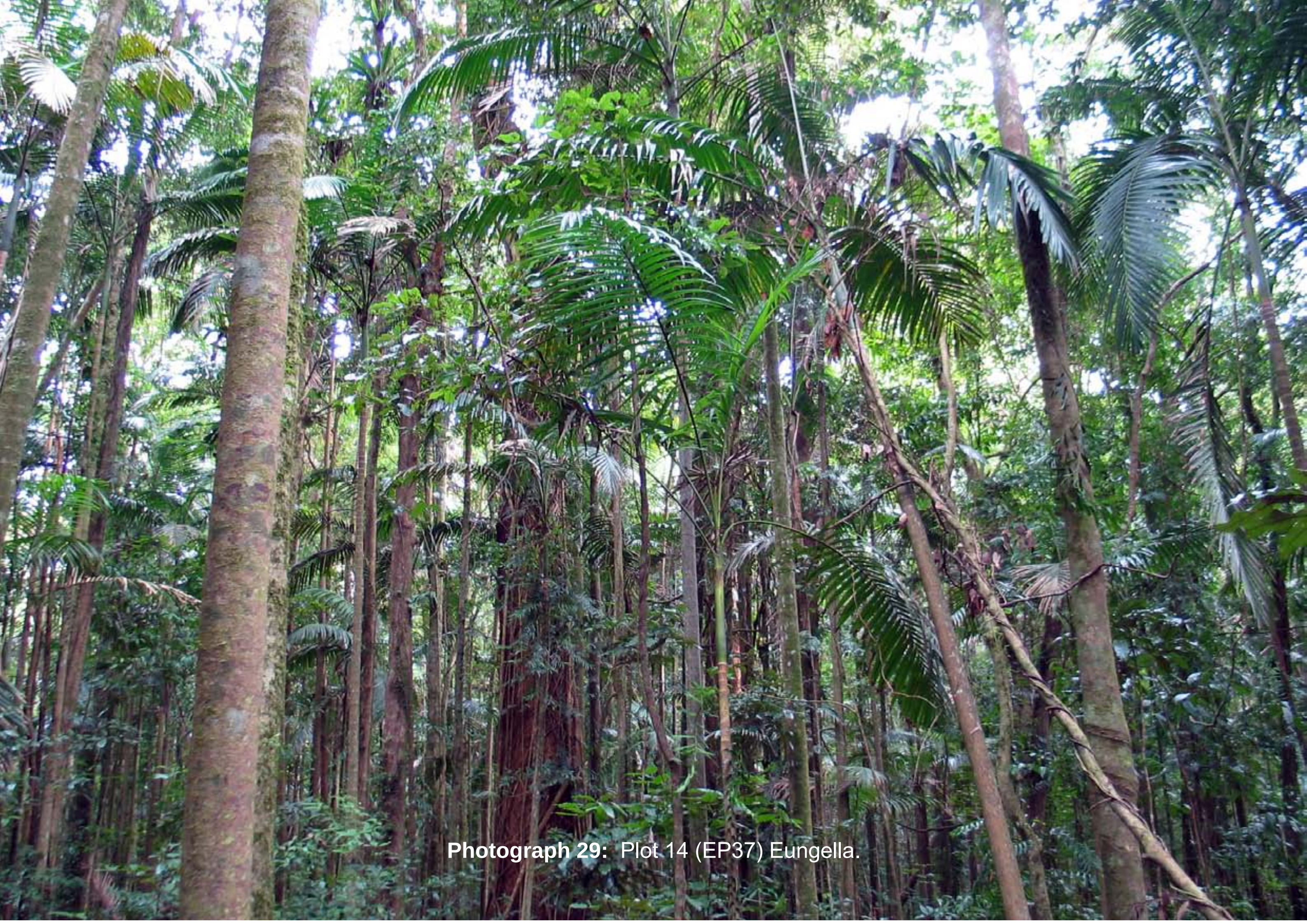

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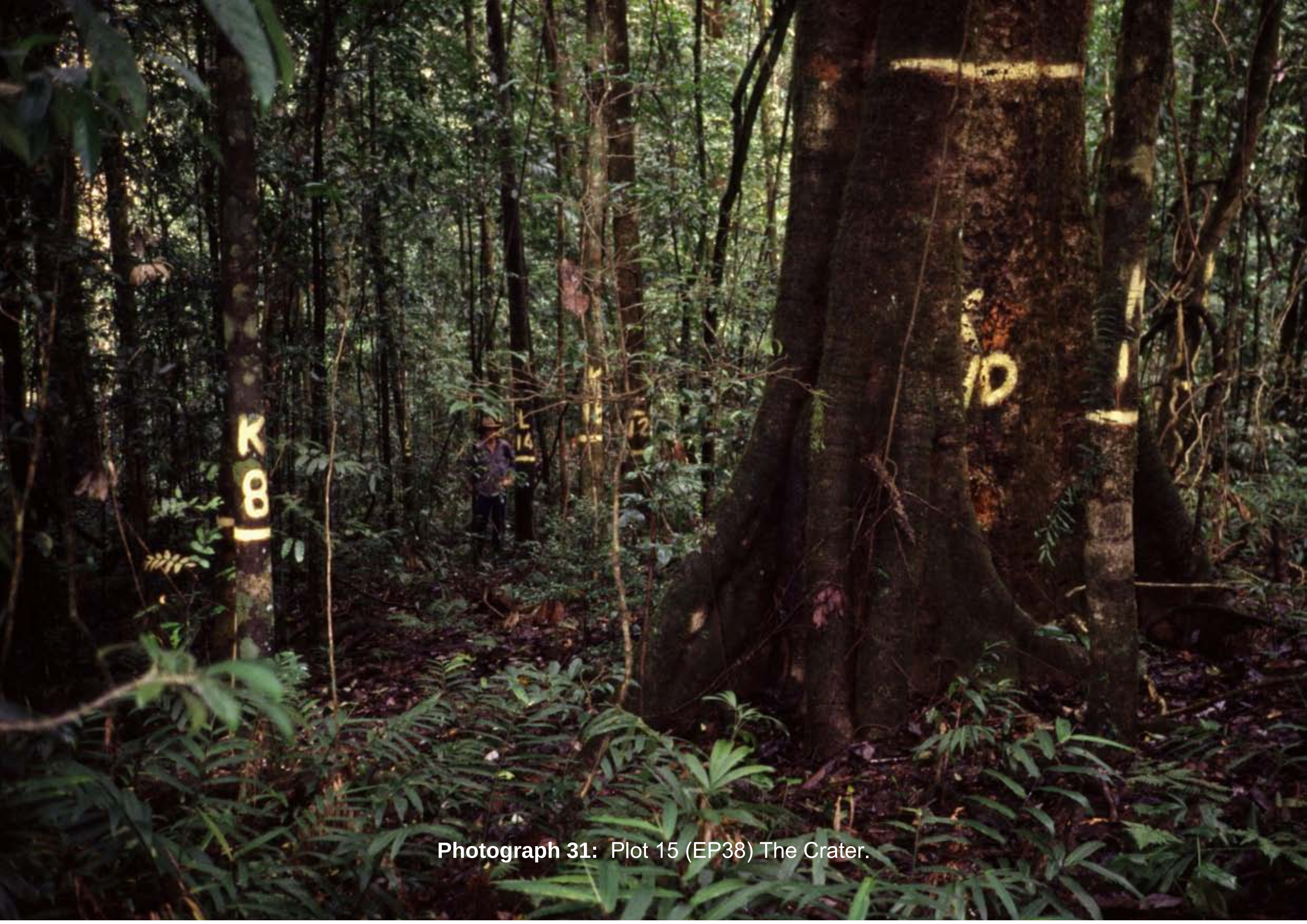

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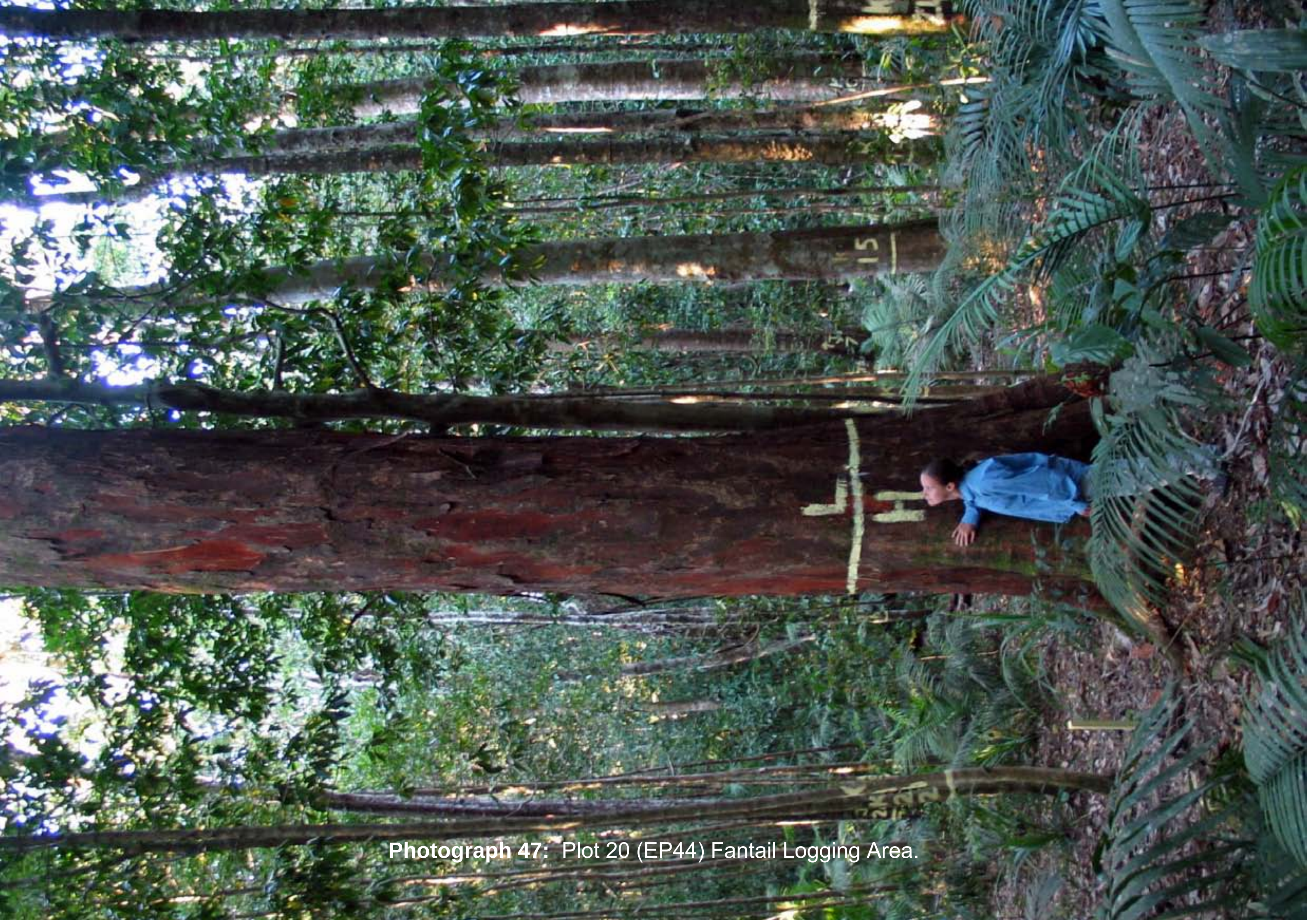

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