

(ms. received 3.9.1982)

STRUCTURAL AND FLORISTIC VARIATION IN
THE FOREST COMMUNITIES OF THE WEST TAMAR, TASMANIA.

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(with three tables and five text-figures)

ABSTRACT

BROWN, M.J. & BUCKNEY, R.T., 1983 (31 viii): Structural and floristic variation in the forest communities of the West Tamar, Tasmania. *Pap. Proc. R. Soc. Tasm.*, 117: 135-152. <https://doi.org/10.26749/rstpp.117.135> ISSN 0080-4703. National Parks & Wildlife Service, P.O. Box 210, Sandy Bay, Tasmania and School of Life Sciences, N.S.W. Institute of Technology, P.O. Box 123, Broadway, New South Wales.

The forest communities in the West Tamar were sampled by a stratified random process using 55 plots selected after preliminary analysis of 243 Forestry Commission continuous forest inventory plots, which occur in the area.

A total of 13 floristic units were recognised and described. The relationship of the floristic units to changing water availability, drainage, soil fertility and fire frequency are assessed and the problems of structural versus floristic classifications of forest types are discussed.

INTRODUCTION

The dry forests of Tasmania occupy some of the most heavily utilised areas of the state. Clearing for agriculture and urban development, sawlog extraction, firewood getting and burning combined with stock grazing have all made their mark on this vegetation. The extent of relatively undisturbed dry forests has been reduced also by the establishment of softwood plantations of *Pinus radiata* and by the advent of the export woodchip industry. There are only comparatively small areas of dry forest vegetation contained within State Reserves (e.g. Jackson 1974). It is apparent that the remaining dry forests can only retain their integrity if there is sound management based on adequate ecological knowledge and description.

Descriptions of the drier lowland forests in the south and east of the State are accumulating. The vegetation in various parts of the Eastern Tiers has been discussed by Kirkpatrick (1981), Kirkpatrick *et al.* (1980), Wells *et al.* (1977), Duncan (1981) and Duncan *et al.* (1981). Accounts are also available of the dry forests on Maria Island (Brown & Bayly-Stark 1979a) and Schouten Island (Harris & Kirkpatrick 1982). Descriptions of forests in other areas of southeastern Tasmania have been given by Jackson (1965), Hogg and Kirkpatrick (1974), Ratkowsky & Ratkowsky (1976, 1977), Harris & Brown (1980) and Brown & Bayly-Stark (1979b). There are no equivalent descriptions published of the drier forests of northern Tasmania, but the need is evident.

In 1978, the Tasmanian Forestry Commission, Department of Environment and National Parks and Wildlife Service undertook jointly to conduct a survey of State Forests in an area bounded by the Bass Highway, Rubicon River and Tamar River (the West Tamar region, fig. 1). The aim of this survey was to provide base data for the evaluation of the potential impact on flora and fauna of proposed pine plantations in the region. An internal report was subsequently produced, but is not generally available. The present paper reports an analysis of the structural and floristic variation found in the forests of the region during that survey.

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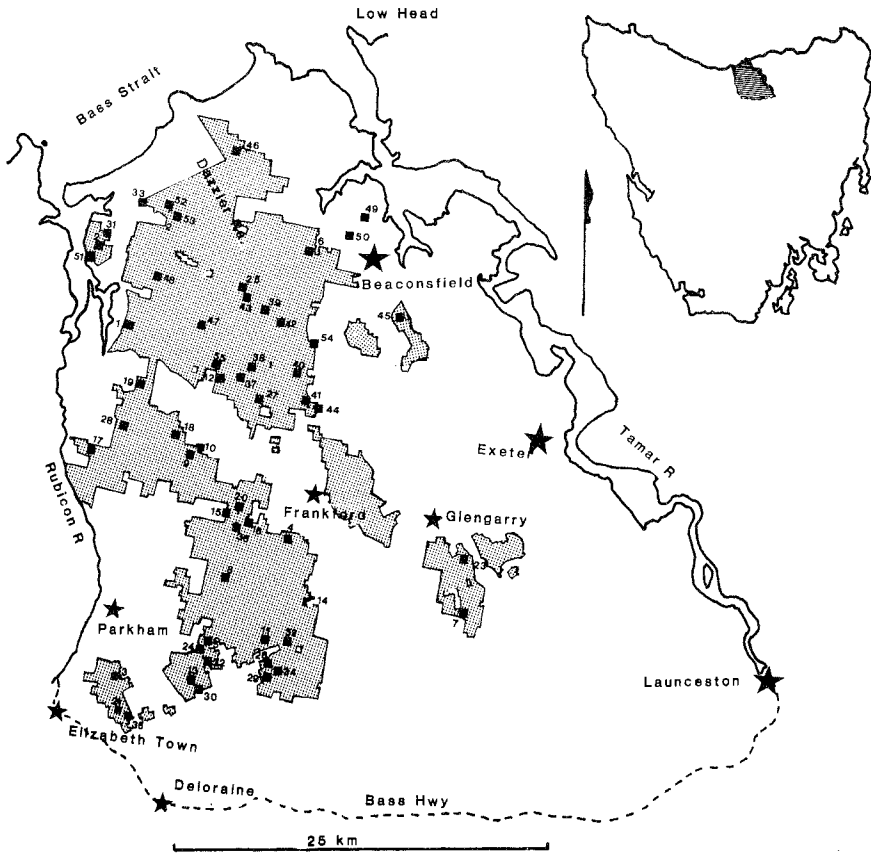


FIG. 1 - The West Tamar region, showing intensive sampling sites and extent of State Forest.

THE STUDY AREA

The West Tamar region (fig. 1) is bounded to the west by Port Sorell and the Rubicon River, to the south by the Bass Highway, and to the east by the Tamar River. The region has a temperate maritime climate (Langford 1965) but shows pronounced differences between coastal and inland/upland sites. The differences are recognised by Gentilli (1972) who categorised the region as moist subhumid warm (coastal), humid warm (inland) and humid cool (upland). The variations in temperature and rainfall throughout the study area are approximated by the data given in table 1 for Low Head, Mt Pleasant and Deloraine.

The surface geology of the region is diverse (McClenaghan & Baillie 1975). An unmetamorphosed sequence of interbedded Precambrian quartzwackes and phyllites occurs within the Dazzler and Asbestos Ranges. A variety of metamorphosed igneous and sedimentary rocks of Precambrian age occur near Port Sorell and Beaconsfield. Ordovician siltstones, mudstones, sandstones and limestones are found in the Cabbage Tree Hill area and at Flowery Gully. Quartzites and slaty siltstones of Silurian-Lower Devonian age occur near Frankford. The Parmeener Supergroup (unmetamorphosed marine sediments) is represented near Frankford, Glengarry and Beaconsfield. Triassic sandstones and mudstones of fluvial origin are

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TABLE 1

CLIMATIC DATA FOR SELECTED STATIONS NEAR THE STUDY AREA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
LOW HEAD (Coastal, elevation 28 m) 41°3'S, 146°47'E													
A	37	38	41	55	66	80	79	71	60	60	46	46	681
B	8	7	9	11	13	15	17	16	15	13	11	19	145
C	20.6	21.3	20.0	17.7	14.6	12.8	12.1	12.8	13.8	15.4	16.9	18.7	16.4
D	13.2	13.5	12.3	10.7	8.3	6.9	6.0	6.4	7.4	8.7	10.3	11.7	9.6
MT PLEASANT (at Launceston, 50 km inland, elevation 140 m) 41°28'S, 147°9'E													
A	43	54	45	61	79	76	95	99	70	64	54	57	797
B	7	6	8	11	12	13	16	16	14	11	11	9	134
C	23.2	24.0	21.2	17.5	14.0	11.6	11.2	12.3	13.9	16.7	18.5	20.6	17.1
D	10.9	11.7	9.8	7.8	5.1	2.8	2.5	3.6	5.0	5.9	7.8	9.9	6.9
DELORRAINE (45 km inland, elevation 253 m) 41°31'S, 146°38'E													
A	45	68	50	87	104	98	144	150	101	82	61	71	1061
B	8	8	9	14	14	14	18	19	16	13	12	12	157
C	22.7	22.3	20.2	16.2	12.9	10.9	10.5	11.3	12.4	15.2	16.8	19.0	15.9
D	9.6	10.3	8.7	6.2	3.1	2.2	1.5	2.8	2.8	4.5	6.2	7.2	5.4

A = precipitation (mm); B = number of raindays; C = mean daily maximum temperature (°C); D = mean daily minimum temperature (°C).

found near Parkham. The southern half of the study area is dominated by Jurassic dolerite. Isolated patches of Tertiary sediments occur widely in the lowland areas and extensive Quaternary deposits have been laid down by the present river systems.

The region has been divided into land systems by Pinkard (1980), who provides detailed descriptions of the land units which occur there. The topography is generally hilly in the north, being dominated by the Asbestos and Dazzler Ranges, which rise to 520 m. In the south, the land surface is more undulating at an average altitude of 150-200 m, but reaching 500+ m on some hills. A map of the vegetation (after Kirkpatrick & Dickinson, 1983) is shown in fig. 2.

The approximate area of State Forest in the region is 38 400 ha. Existing pine plantations occupy 1 700+ ha of State Forest and the establishment of a further 2 200 ha of such plantations is planned by 1990. The remaining 34 500 ha of State Forest are to be managed primarily for hardwood extraction for the sawlog and woodchip industries.

MATERIALS AND METHODS

A two-stage process was used for sampling the forests in the region. The forests were classified initially using the Forestry Commission data from 243 continuous forest inventory (CFI) plots, established in the region. CFI plots are permanently marked, randomly allotted locations, 0.2 ha in area, within a stratified system of forest types determined by photographic interpretation (PI). In addition to the standard forestry data collected for estimates of volume and growth, the height, coverage and species of eucalypts are listed for each plot, and the understorey and ground vegetation are recorded in broad floristic groups characterised by one or several commonly occurring species considered by the Forestry Commission to be indicative of the sites (Anon. 1977). For example, the "wet sclerophyll" group (As, table 2), is characterised by the presence of such species as *Pomaderris apetala*, *Olearia argophylla*, and/or *Phebalium squameum*.

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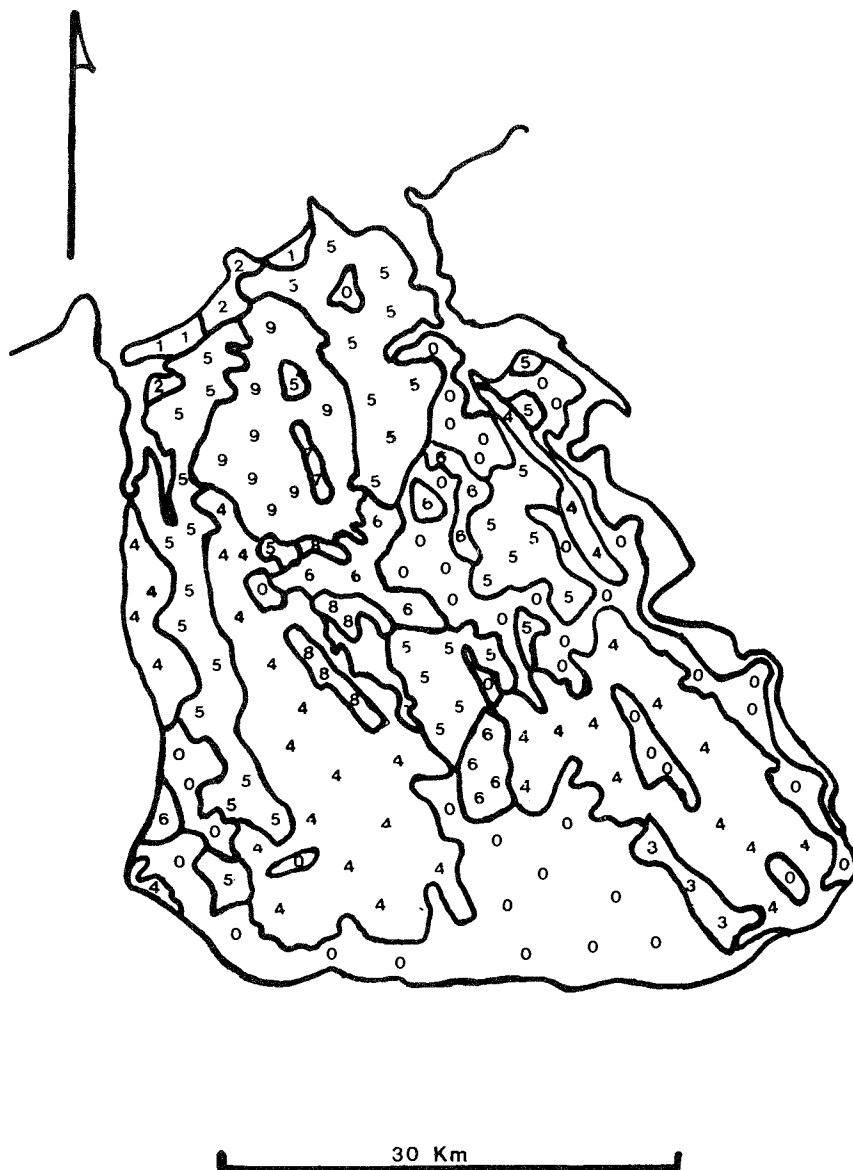


FIG. 2 - Vegetation of the West Tamar region (after Kirkpatrick & Dickinson, 1983).
 0 - cleared land; 1 - coastal dune complex; 2 - heath; 3 - woodland; 4 - grassy forest on dolerite; 5 - heathy forest; 6 - *E. obliqua* (tall) open-forest; 7 - *E. delegatensis* tall open forest; 8 - *E. regnans*/*E. obliqua* very tall open-forest; 9 - complex of eucalypt forest with varying understorey and rainforest.

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TABLE 2

CHARACTERISTICS OF THE VEGETATION.

Data obtained from the continuous forestry inventory plot sheets and used in the initial analysis of 243 sites.

(A) HEIGHT OF DOMINANT VEGETATION

Native eucalypts: 45-60 m (E2); 30-45 m (E3); 12-30 m (E4)

(B) EUCALYPT SPECIES

Eucalyptus obliqua (obl); *E. amygdalina* (amy); *E. delegatensis* (del); *E. ovata* (ova); *E. viminalis* (vim); *E. regnans* (reg).

(C) OTHER TREE SPECIES

Acacia melanoxylon (Bt); *Nothofagus cunninghamii* (Mt); *Atherosperma moschatum* (St); *Acacia dealbata*/A. *mearnsii* (Wt).

(D) UNDERSTOREY SHRUB GROUPS

Pomaderris apetala/Olearia *argophylla*/Phebalium *squameum* (As); *Bedfordia salicina*/Olearia *viscosa*/Olearia *lirata* (Bs); *Helichrysum dendroideum*/Cassinea *aculeata* (Ds); other tall scrub on wet sites (Fs); *Banksia marginata*/Casuarina spp./Bursaria *spinosa*/Dodonaea *viscosa*/Exocarpos *cupressiformis* (Gs); *Xanthorrhoea australis* (Ks); *Dicksonia antarctica* (Ms); *Pultenaea juniperina*/Epaeris spp./Lomatia *tinctoria*/Aotus *ericoides*/Dillwynia spp./Daviesia spp. (Ps); *Leptospermum* spp./Melaleuca spp./Callistemon spp. (Ts); *Acacia verniciflua* (Ws).

(E) GROUND SPECIES GROUPS

Bauera rubioides (Ag); *Pteridium esculentum* ± herbs (Bg); *Gahnia* spp. (Cg); *Senecio* spp. (Fg); grasses and herbs (Gg); *Blechnum* spp./*Polystichum proliferum* (Hg); Bryophytes (Mg); *Lepidosperma* spp./*Lomandra longifolia*/Diplarrena *moraea*/Dianella spp./*Juncus* spp. (Sg); *Histopteris incisa*/Hypolepis spp. (Wg).

A total of 32 characters were available for the initial analysis. These consisted of three PI height classes and the presence or absence of six eucalypt species, four other tree species, ten understorey shrub groups, and nine ground layer groups (table 2). These data were analysed by the monothetic divisive programme DIVINF, using normal (sites by attributes) and inverse (attributes by sites) analyses to produce a two-way table of sites and attributes. Cut-off levels were selected arbitrarily at 25 groups for sites and 15 groups for attributes.

Two plots were selected to be representative of each of the 25 site groups for subsequent intensive field sampling. Selection of the plots was made on a stratified random basis to ensure geographical and geological coverage of the study area. These 50 plots were supplemented by a further five selected to include forested vegetation types not represented by the CFI plots. There were thus 55 plots included in the field sampling; their locations are given in fig. 1.

The height, composition and percent coverage of each stratum of vegetation at each plot was recorded, together with nature and age of any disturbances evident, including recent fires. The vegetation on each plot was assigned to a structural alliance following the system of Specht (1970), except that a category called "very tall open-forest" was added to include forests in which the average dominant heights of trees exceeded 45 m. A collection of the 328 vascular plants present was made and voucher specimens are held by N.P.W.S. Botanical nomenclature follows Curtis (1963, 1967), Curtis & Morris (1975) and Willis (1970) except when authorities are given. Notes were made also about the aspect, topography, rock type, soils, drainage and ground surface coverage at each plot.

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Species presence-absence data from the 55 field plots were classified to produce ten groups using the programme MULTBET. This programme produced an agglomerative classification of sites by the 203 species which occurred in two or more plots. The classification is based on a matrix of similarities determined from the information statistic. The programme GROUPER was run to determine those species which contributed maximally to the clustering of groups. The programmes DIVINF, MULTBET and GROUPER are all contained within the TAXON library (Dale *et al.* 1979), available on the CSIRO CYBER 76 computer.

RESULTS AND DISCUSSION

1. Computer Analyses

The preliminary classification resulting from the DIVINF analysis is shown in fig. 3. The classification provides a logical structural grouping of plots on a basis of the average dominant height class and the presence and absence of indicator species of eucalypts and of "dry sclerophyll shrubs" (Gs). The groups were found to be in broad concurrence with the range of variation of forest types traversed during the field survey.

A dendrogram showing the relationships among the 55 field plots sampled is presented in fig. 4. The plots were classified arbitrarily to the ten-group level, which corresponds closely with the point at which there is an exponential increase in information gain. However subsequent examination of the floristic variation within the groups indicated that two groups were heterogeneous. These groups were subdivided to give a final total of 13 floristic units for the forests within the region. Table 3 details the classification of the sites resulting from the MULTBET analysis and shows the occurrence of diagnostic species by sites. The species in this table are those determined by the GROUPER analysis to have contributed maximally to the fusion of particular groups. Some species are included more than once because they are used at more than one level of the classification. A feature of the characteristic species is the absence of eucalypts, excepting *Eucalyptus ovata*. The lack of continuity between the occurrence of particular eucalypts and of particular floristic units is emphasised in the descriptions of the floristic groups recognised by the MULTBET analysis.

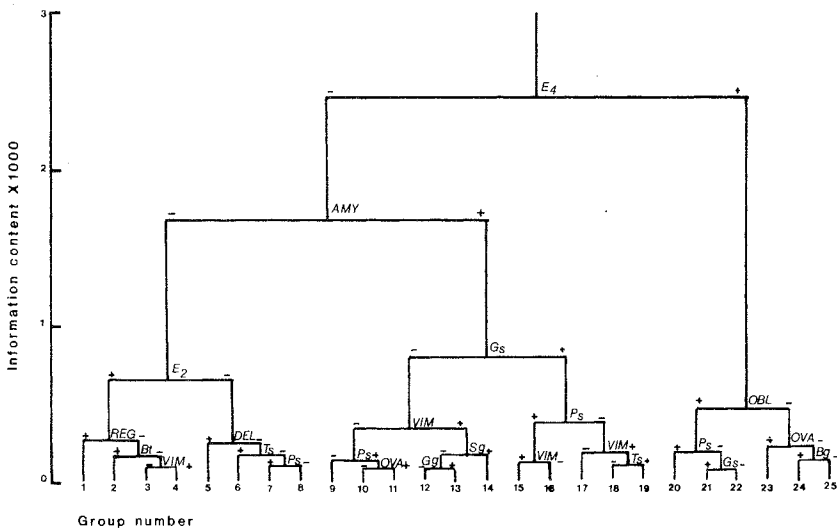


FIG. 3 - DIVINF analysis of the 243 continuous forest inventory plots. The characters on which divisions are made are abbreviated as in table 2.

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2. Descriptions of the 13 Floristic Units

Summary descriptions of the 13 floristic units are given in the appendix.

3. Ecological Relationships Among the Plant Communities

The vegetation in the study area responds to diverse but interacting environmental conditions. However, the major responses can be described in terms of soil fertility, water availability, drainage and fire history.

The role of site factors other than fire

Soil fertility is a compounded variable which is broadly related to the mineral content of the geological substrate. However, local climate, topography and past geomorphological processes interact with the vegetation of the site and the weathering characteristics of the particular rock type to produce variations in the soil fertility. In the study area, the siliceous soils are the least fertile, and soils derived from dolerite and the recent river alluviums are the most fertile.

Water availability is determined partly by rainfall, the water-holding capacity of the soil and by the degree of evapotranspirational stress at the site. In general, north and northwest aspects have lower water availability than east and southeast facing slopes and gullies because they lie in the path of prevailing winds and are subject to greater insolation. Gullies and sheltered east to southeast slopes also receive more local rainfall due to wind shadow effects. Water availability is increased also on ridges at higher altitudes, both through orographic rainfall and through reduced transpiration of plants caused by the relatively high frequency of low cloud along the ridges. The drainage of

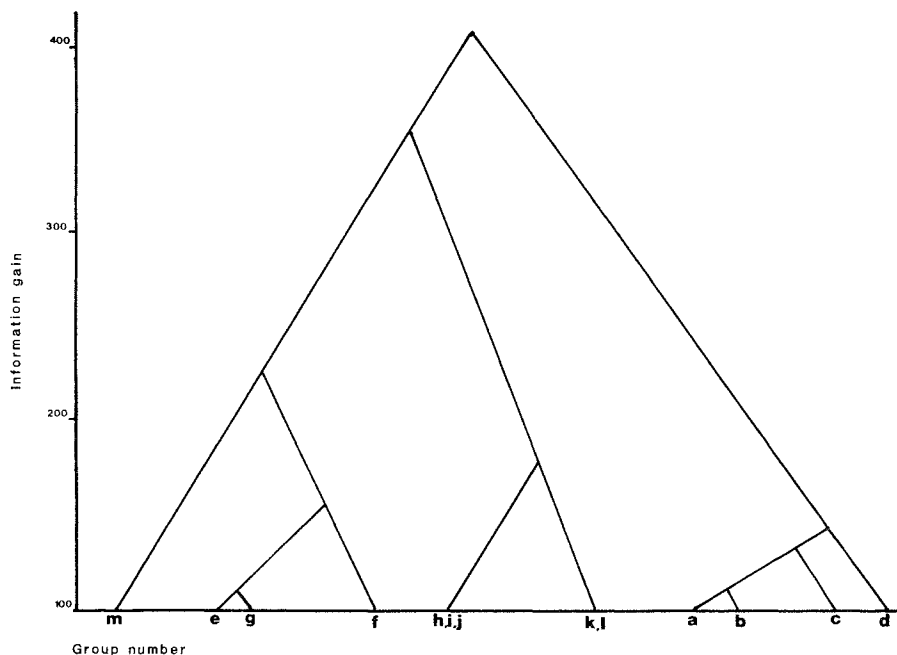


FIG. 4 - MULTBET classification of the 55 sites sampled in the field survey. The characteristic species of the floristic groups a-m are given in table 3.

TABLE 3

TWO WAY TABLE OF SPECIES AND PLOTS.
Plots are arranged left to right in ascending numerical order.

Species	Floristic Unit												
	a	b	c	d	f	e	g	m	j	i	h	k	l
<i>Astroloma humifusum</i>	++	+++++	+++	++++	+ ++	+ +							
<i>Diplarrena moraea</i>	+++	++	+	+ +	++++								
<i>Bossiaea prostrata</i>	++	+++?+	+++		+ +								
<i>Acrotriche serrulata</i>	+	+++++	+++	++++	+++	++ +						++	++
<i>Viola hederacea</i>	+++++	+++	++++	++++	+++++	+++++	+ +				+	+	+
<i>Hypericum japonicum</i>				++++	+	+							
<i>Gnaphalium collinum</i>				+++	+	+++ +	+	+		+	+	+	
<i>Carex breviculmis</i>		+		++++									
<i>Veronica calycina</i>		+	++	++++	+ +	+ +		+			+		
<i>Clematis aristata</i>	+	+	+	++++	+	++++	+ +	+ ++					
<i>Bossiaea prostrata</i>	++	+++?+	+++		+ +								
<i>Acacia dealbata</i>	+	++++	+++	++	+++	++		++					
<i>Acacia stricta</i>	+++++	+											
<i>Lomandra longifolia</i>	+++++	+	++++	++ +	++++	++		+			++	++	+ ++
<i>Coprosma quadrifida</i>		+++		+ +	+++	+++	+	+++ +					
<i>Acacia botrycephala</i>			+							+	++	+++	++ +
<i>Amperea xiphoclada</i>			+							+	++	+++	+
<i>Leptospermum scoparium</i>	+	+		+			++	++		+	++	+++	+++
<i>Leucopogon ericoides</i>			+									+++	+++
<i>Tetradthea pilosa</i>	+++	++	+	++++	+ +							++	++ +
<i>Leucopogon australis</i>												+++	++
<i>Zieria arborescens</i>						+ ++		+++	+	++++	++		
<i>Coprosma quadrifida</i>		+++		+ +	+++	+++	+	+++ +					
<i>Oxalis corniculata</i>	+	++	++	+++	+	++++	++++	++++	++				
<i>Clematis aristata</i>	+	+	+	+	++++	+	++++	++	+	++			
<i>Pomaderris apetala</i>						+	++	+	++	+	++++		
<i>Polystichum proliferum</i>					+	++		++++					
<i>Acaena novae-zelandiae</i>	++	+ +		++	++	+++	+ +	+ +	+				

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sites is conditioned by the interaction between the geological substrate, the physical and chemical properties of the soil, the local topography and the vegetation.

The relationship between the different floristic units of the forests which occur in the study area and the sum of the above environmental determinants is demonstrated schematically in fig. 5. For completeness, structural forms of vegetation other than those surveyed, but which are known to occur in the region (e.g. Kirkpatrick 1977) have also been included in this figure. The numbers in the figure do not refer to actual plot locations or floristic units, but represent sites with similar soil, drainage and moisture characteristics. For example, circle number 1 represents all sites having the characteristics of high soil fertility, good drainage and high water availability. The vegetation types on such sites correspond to floristic unit "m", i.e. are either closed forests of *Nothofagus cunninghamii* and *Atherosperma moschatum* in gully corridors or very tall open-forests of *Eucalyptus regnans* and/or *E. obliqua* with a dense understorey of mesophytic shrubs such as *Acacia melanoxylon* and *Olearia argophylla* together with epiphytic ferns and a layer of *Dicksonia antarctica* and *Polystichum proliferum*.

Circle number 2 represents well-watered, freely draining sites of intermediate soil fertility such as is found on the Precambrian phyllite-dominated rocks of the Dazzler ridges. Tall open-forest of *Eucalyptus delegatensis* and/or *E. obliqua* with a wet sclerophyll-scrub understorey occurs on these sites (floristic unit i). Circle number 3 represents freely draining sites having high water availability but low soil fertility - for example the Precambrian ridges along the Dazzler Range where quartzwacke predominates. Such sites are characteristically occupied by floristic unit j. As one further example, circle number 19 represents fertile sites of high water availability and impeded drainage, for example on some lowland alluvial flats, where a form of floristic unit g (closed scrub) containing *Melaleuca ericifolia* and *Acacia melanoxylon* is found.

In general, these different types of vegetation intergrade along topographic sequences in response to gradients of soil fertility, water availability and drainage. Nevertheless, other influences such as fire, temperature differences associated with altitude, frost hollows or areas of cold air drainage may locally outweigh the factors discussed above and give rise to local variations in the flora. However the most important deflecting influence is fire.

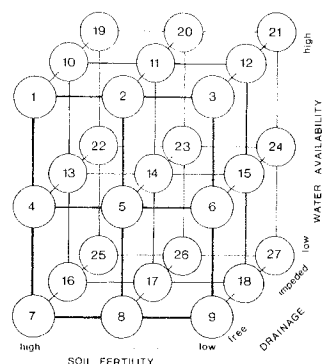
The role of fire

Fire has been and remains a major influence on the vegetation and its effects must be superimposed onto the above scheme. The interaction between the vegetation and the fire regime at a site acts in two different ways.

Firstly, the interaction stabilises and emphasises the difference between structural units. In the study area, the average fire frequency in the different vegetation types is probably as follows: rainforests in gully corridors >100 years; shrubby wet very tall open-forests 20-100 years; scrub 8-20 years; shrubby open-forest 8-15 years; heathy woodland to open-forest 5-10 years; grassy woodland to open-forest 2-8 years; heaths 3-15 years. The actual fire frequency within these classes is determined by a combination of vegetation characteristics (fuel and moisture loadings), site factors (climate, aspect, topography) and the occurrence of an ignition source.

Secondly, the interaction may produce deflected floristic associations within a particular vegetation type. Chance plays a major part in this process. Two sites which are floristically similar may appear very different because of the altered abundance of species within them. Local changes in the abundance of species are as attributable to fire history as they are to other influences. The time interval between fires, the intensity of successive fires, the time of year of the burn and the nature of the fuel loads in surrounding vegetation will vary from place to place. These variables in turn influence the availability of seed in different species, the suitability of the site for the propagation of each species and the ratio of seed to vegetatively propagating species (cf. Purdie 1977a,b), thereby altering the relative abundances of the different species. Due to the feed-back between fire regime and the nature of the vegetation, local changes can initiate a process of ecological drift (Jackson 1968). Thus differences can become

FIG. 5 - Schematic representation of the relationships of plant communities to inferred gradients of soil fertility, drainage and water availability. The encircled numbers are keyed as listed below. The eucalypts are abbreviated as in table 2. C - closed, F - forest, H - heath, L - low, O - open, S - scrub, Sg - sedgeland, T - tall, V - very, W - woodland. Short pricklies (Ps) and saggis (Sg) are defined in table 2.



Number	Structure	Floristic Unit	Dominants	Understorey	Ground Layer
1	CF VTOF	m	myrtle, sassafras <i>reg ± obl</i>	mesophytes mesophytes	ferns, epiphytes ferns, epiphytes
2	(V)TOF	i	<i>del, obl</i>	wet sclerophyll	ferns, sedges
3	LOF,LW	j	<i>amy</i>	scrub (<i>Bauera</i>)	<i>Gahnia</i>
4	TOF	a	<i>obl-amy</i>	wattles, dry/wet sclerophyll	grasses, saggis
5	OF	h	<i>obl-amy</i>	layered shrubs	grasses/short pricklies
6	LOF	k	<i>amy</i>	<i>Banksia,</i> <i>Casuarina</i>	heath
7	OF	a	<i>amy ± vim</i>	dry sclerophyll	grasses, saggis
8	OF	b	<i>amy ± vim</i>	dry sclerophyll	grassy heath
9	H	-	<i>Xanthorrhoea,</i> <i>Leucopogon</i>		dry heath
10	TOF	e	<i>obl, del ± ova</i>	wet sclerophyll <i>Callistemon</i>	ferns, sedges
11	(T)OF	e	<i>obl, del, vim, amy</i>	wet sclerophyll	sedges, short pricklies
12	(L)W	c	<i>amy ± ova</i>	tea trees	sedges, short pricklies
13	OF	f	<i>obl, amy, vim ± ova</i> (<i>E. pauciflora</i>)	dry/wet sclerophyll	short pricklies, sedges
14	OF	d	<i>obl, amy, vim ± ova</i>	tea trees, wattles	heath, sedges
15	OW	d	<i>amy ± ova</i>	-	heath
16	LOF,W	a	<i>amy, vim ± ova</i>	dry sclerophyll	grasses, sedges
17	OF	d	<i>amy ± ova</i>	sparse dry sclerophyll	grassy/heath
18	H	-	<i>Leptospermum, Epacris</i>	sclerophyll	heath
19	CS	g	<i>Melaleuca</i>	sedges	semi-aquatics
20	LOW,CS	g	<i>ova, Leptospermum</i>	sedges	semi-aquatics
21	SgH	-	<i>Lepidosperma, Baumea,</i> <i>Melaleuca</i>	-	semi-aquatics
22	W	g	<i>ova</i>	tea trees	-
23	W,S	g	<i>ova, tea trees</i>	tea trees	-
24	LOW	k	<i>ova</i>	tea trees	sedges/heath
25	LOF,W	d	<i>ova</i>	tea trees	sedges
26	LOF,LOW	k	<i>ova</i>		heath
27	H	-	<i>Sprengelia, Epacris</i>	-	<i>Selaginella</i>

stabilised by chance elimination and/or promotion of particular species, which in turn influences both the nature and likelihood of further fires.

4. The Utility of Structural and Floristic Classifications

The interactions of site factors with the fire regime have important consequences for the classification of forest vegetation in the study area. If a structural classification (based on the dominant eucalypts) is used, then areas which are floristically different may be classified as one type. For example, some of the *Eucalyptus obliqua*-*E. amygdalina* open-forest of the region has been altered considerably by repeated firing. This community has trees with generally poor form, sparse shrub and ground layers and a dense understorey of bracken. On the dolerite substrates of the southwestern part of the region, such seral communities contain relict herbaceous and grassy species which strongly associate these with other less disturbed sites on dolerite. In contrast, the same structural forms having dense bracken on siliceous substrates in the northeast of the study area contain relict heath species. These sites clearly have floristic affinities with other siliceous-based heathy forests which have not been excessively degraded.

Conversely, if a floristic classification is used, vegetation types having very different physiognomies would be grouped together. For example, relatively undisturbed communities of *Eucalyptus obliqua*-*E. delegatensis* very tall open-forests have a dense tall shrub understorey. More recently burnt sites support an understorey with a few sparse tall shrubs over a dense layer of bracken, but with young wet sclerophyll shrubs underneath. The latter case will often represent a seral stage of regeneration but the structural heterogeneity may also be more or less permanent, due to the pyrogenic nature of bracken. An increase in the frequency of fires in such a bracken community may result in an ecological drift towards a floristically dissimilar (e.g. heathy) understorey. The types of problems arising from use of the alternative classifications appear to be inherent in the nature of the vegetation-environment processes. They are certainly not unique to this study. Similar disparities have been noted and discussed by Hogg & Kirkpatrick (1974) for the East Risdon area, and by Harris & Kirkpatrick (1982) for Schouten Island. The achievement of an adequate means of typification of Tasmania's dry forests remains central to the needs of both plant ecologists and land managers.

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APPENDIX

A SUMMARY DESCRIPTION OF THE 13 FLORISTIC UNITS.

(a) GRASSY (SEDGEY) TALL OPEN-FOREST

Habitat: fertile loams and clay-loams of varying drainage at medium high elevations on dolerite, at low attitudes on Permian mudstones and on serpentinite.

Eucalypt alliances: *Eucalyptus amygdalina* ± *E. obliqua* ± *E. viminalis* ± *E. ovata* (tall) open-forest.

Average number of species: (31-)47(-67).

Characteristic species:

Tall shrubs/low trees: *Acacia stricta*, *A. verticillata*, *A. dealbata*, *Melaleuca ericifolia*, *Banksia marginata*, *Exocarpos cupressiformis*.

Low-medium shrubs: *Lomatia tinctoria*, *Epacris impressa*, *Pultenaea gunnii*, *Tetratheca pilosa*.

Undershubs: *Acrotriche serrulata*, *Astroloma humifusum*, *Bossiaea prostrata*.

Ferns: *Pteridium esculentum*.

Sedges/saggs: *Lomandra longifolia*, *Diplarrena moraea*, *Lepidosperma laterale*.

Herbs: abundant, averaging nine species per 0.2 ha plot.

Grasses: abundant, averaging four species per plot.

(b) GRASSY-SHRUBBY OPEN-FOREST

Habitat: shallow-medium clay-loams derived from dolerite, at medium elevations on upper slopes and ridges. Boulders are common.

Eucalypt alliances: *Eucalyptus amygdalina*, *E. viminalis* ± *E. ovata* ± *E. pauciflora* open-forest.

Average number of species: (44-)51(-61).

Characteristic species:

Tall shrubs/low trees: *Coprosma quadrifida*, *Acacia dealbata*, *Exocarpos cupressiformis*.

Low-medium shrubs: *Lomatia tinctoria*, *Pultenaea gunnii*, *Pimelea glauca*, *Leucopogon virgatus*.

Undershubs: *Acrotriche serrulata*, *Astroloma humifusum*, *Bossiaea prostrata*, *Billardiera scandens*.

Ferns: *Pteridium esculentum*.

Sedges/saggs: none consistent.

Herbs: abundant, averaging 12 species per plot.

Grasses: abundant, averaging five species per plot.

(c) SEDGEY-SHRUBBY OPEN-FOREST

Habitat: on freely draining, shallow sites of the upper slopes and ridges. Boulders and outcrop are common. Soils are either dolerite-derived clay loams or sandy loams on Precambrian rocks.

Eucalypt alliances: *Eucalyptus obliqua* ± *E. viminalis* ± *E. amygdalina* ± *E. delegatensis* open-forest.

Average number of species: (30-)42(-50).

Characteristic species:

Tall shrubs/low trees: *Acacia melanoxylon*, *Banksia marginata*, *Exocarpos cupressiformis*.

Low-medium shrubs: *Lomatia tinctoria*, *Pultenaea juniperina*, *Epacris impressa*, *Persoonia juniperina*, *Pultenaea gunnii*, *Tetratheca pilosa*, *Coprosma hirtella*.

Undershubs: *Astroloma humifusum*, *Acrotriche serrulata*, *Billardiera scandens*.

Ferns: *Pteridium esculentum*.

Sedges/saggs: *Lomandra longifolia*, *Dianella tasmanica*, *Lepidosperma laterale*.

Herbs: abundant, averaging seven species per plot.

Grasses: scattered to sparse, averaging four-five species per plot.

(d) SEDGEY TALL OPEN-FOREST

Habitat: on shallow, gravelly but fertile clays where drainage is partly impeded, on terraces at medium altitudes on dolerite and on Permian mudstone on lowland flats.

Eucalypt alliances: *Eucalypt viminalis* ± *E. obliqua*; *E. viminalis* ± *E. ovata* tall open-forest.

Average number of species: (46-)53(-57).

Characteristic species:

Tall shrubs/low trees: *Exocarpos cupressiformis*, *Banksia marginata*, *Cassinia aculeata*, *Acacia melanoxylon*.

Low-medium shrubs: none consistent.

Undershubs: *Acrotriche serrulata*.

Ferns: *Pteridium esculentum* ± *Lindsaea linearis*.

Sedges/saggs: *Gahnia grandis*, *Diplarrena moraea*, *Carex breviculmis*, *Lepidosperma laterale*, *Dianella tasmanica*, *Lomandra longifolia*.

Herbs: abundant, averaging 15 species per plot.

Grasses: patchy, averaging 2-3 species per plot.

(E) DRY/WET VERY TALL OPEN-FOREST

Habitat: shallow sandy loams formed from dolerite and Permian mudstones. On the upper midslopes, broad ridges and shallow gullies at medium-high altitudes where available moisture is increased through orographic rainfall or by stripping of fog and low cloud.

Eucalypt alliances: *Eucalyptus obliqua* ± *E. viminalis* ± *E. regnans*; *E. amygdalina* ± *E. ovata* very tall open-forest.

Average number of species: (30-)40(-49).

Characteristic species:

Tall shrubs/low trees: *Olearia lirata*, *Pultenaea daphnoides*, *Zieria arborescens*, *Pomaderris apetala*, *Coprosma quadrifida*, *Acacia melanoxylon*.

Low-medium shrubs: none consistent.

Undershubs: none consistent.

Ferns: *Pteridium esculentum* ± *Polystichum proliferum*.

Sedges/saggs: *Luzula flaccida* ± *Gahnia grandis*; *Dianella tasmanica*, *Lomandra longifolia*.

Herbs: abundant, averaging 12 species per plot.

Grasses: patchy-sparse, averaging 4-5 species per plot.

(f) WET/DRY TALL OPEN-FOREST

Habitat: sheltered aspects of upper midslopes, terraces and ridgetops. At higher elevations on free draining clay-loams derived from dolerite, boulders are common.

Eucalypt alliances: *Eucalyptus obliqua* ± *E. viminalis* ± *E. amygdalina* ± *E. delegatensis* tall open-forest.

Average number of species: (41-)47(-53).

Characteristic species:

Tall shrubs/low trees: *Olearia lirata*, *Bedfordia salicina*, *Acacia melanoxylon*, *Coprosma quadrifida*, *Acacia verticillata*, *Acacia dealbata*, *Exocarpos cupressiformis*, *Bursaria spinosa*, *Cassinia aculeata*.

Low-medium shrubs: *Lomatia tinctoria*, *Epacris impressa*, *Coprosma hirtella*, *Tetratheca pilosa*, *Pultenaea juniperina*.

Undershubs: *Gonocarpus teucrioides*, *Billardiera scandens*, *Acrotriche serrulata*.

Ferns: *Blechnum nudum*, *Pteridium esculentum*, *Asplenium flabellifolium*.

Sedges/saggs: *Lomandra longifolia*, *Dianella tasmanica*, *Luzula flaccida*.

Herbs: common, averaging 9 species per plot.

Grasses: sparse, but averaging 4-5 species per plot.

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(g) SCRUB (SCRUBBY OPEN-WOODLAND TO OPEN-FOREST)

Habitat: Quaternary alluviums bordering the larger creeks at low elevations; also in localised pockets on drainage lines at higher elevations.

Eucalypt alliances: *Eucalyptus ovata* ± *E. amygdalina* ± *E. obliqua* open-forest, woodland and open-woodland. Also occurs as closed scrub without eucalypts.

Average number of species: (35-)39(-44).

Characteristic species:

Tall shrubs/low trees: *Acacia verticillata*, *Leptospermum lanigerum*, *Melaleuca ericifolia*, *Cassinia aculeata*.

Low-medium shrubs: *Bauera rubioides*, *Leptospermum scoparium*, *Epacris impressa*, *Pultenaea gunnii*.

Undershubs: none consistent.

Ferns: *Blechnum wattsii* ± *B. nudum*, *Gleichenia dicarpa*, *Pteridium esculentum*.

Sedges/saggs: *Lepidosperma elatius*, *Dianella tasmanica* ± *Gahnia grandis*.

Herbs: common, averaging 9 species, including some distinctive aquatic species (*Myriophyllum* sp., *Triglochin procera*).

(h) HEATHY DRY/WET OPEN-FOREST

Habitat: freely draining sandy loams derived from Precambrian or Ordovician siliceous rocks. At low to medium elevation on gentle basal and midslopes of hills.

Eucalypt alliances: *Eucalyptus obliqua* ± *E. amygdalina* open-forest.

Average number of species: (33-)36(-39).

Characteristic species:

Tall shrubs/low trees: *Pultenaea daphnoides*, *Casuarina littoralis*, *Acacia verticillata*, *Zieria arborescens*.

Low-medium shrubs: *Lomatia tinctoria*, *Epacris impressa*.

Undershubs: *Gonocarpus teucroides*, *Billardiera scandens*.

Ferns: *Pteridium esculentum*, *Blechnum nudum*.

Sedges/saggs: none consistent.

Herbs: sparse, averaging 4 species per plot.

Grasses: sparse, averaging 2 species per plot.

(i) HEATHY-SHRUBBY VERY TALL OPEN-FOREST

Habitat: on clay loams derived from Precambrian phyllite dominated rocks on the upper midslopes, ridges and across small dissection gullies of the Dazzler Range.

Eucalypt alliances: *Eucalyptus obliqua*, *E. delegatensis* very tall open-forest.

Average number of species: (17-)23(-34).

Characteristic species:

Tall shrubs/low trees: *Zieria arborescens*, *Monotoca glauca*.

Low-medium shrubs: *Pultenaea juniperina*, *Epacris impressa*.

Undershubs: *Gonocarpus teucroides* ± *Amperea xiphioclada*.

Ferns: *Pteridium esculentum* ± *Blechnum wattsii*.

Sedges/saggs: *Dianella tasmanica* ± *Lepidosperma laterale*.

Herbs: none consistent.

Grasses: generally absent.

(j) SCRUBBY LOW OPEN-FOREST

Habitat: on freely draining sandy loams derived from Precambrian rocks where quartzwacke is predominant. At medium elevations on shallow side slopes and flat spurs above small dissection gullies of the Dazzler Range.

Eucalyptus alliances: *Eucalyptus amygdalina* low open-forest.

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Average number of species: 13-14.

Characteristic species:

Tall shrubs/low trees: *Banksia marginata*, *Leptospermum scoparium*.
 Low-medium shrubs: *Bauera rubioides*, *Phebalium bilobum*, *Dillwynia glaberrima*.
 Undershubs: *Amperea wipoclada*.
 Ferns: none consistent, *Pteridium esculentum* and *Gleichenia microphylla*
 Sedges/saggs: *Gahnia grandis*.
 Herbs: none consistent.
 Grasses: none.

(k) HEATHY LOW WOODLAND

Habitat: on flat marine terraces at low elevations on infertile siliceous soils derived from Tertiary alluvium.

Structural associations: *Eucalyptus amygdalina* ± *E. ovata* low woodland.

Average number of species: (40-)43(-48).

Characteristic species:

Tall shrubs/low trees: *Casuarina littoralis*, *Banksia marginata*.
 Low-medium shrubs: *Epacris impressa*, *Leptospermum scoparium*, *Acacia botrycephala*, *Bossiaea cinerea*, *Leucopogon australis*, *L. ericoides*, *Persoonia juniperina*, *Tetratheca pilosa*, *Leucopogon collinus*, *Pimelea linifolia*.
 Undershubs: *Amperea wipoclada*.
 Ferns: *Pteridium esculentum*.
 Sedges/saggs: *Xanthorrhoea* spp., *Lomandra longifolia*.
 Herbs: common, averaging 5 species per plot.
 Grasses: none observed.

(l) HEATHY-LAYERED (TALL) OPEN-FOREST

Habitat: freely draining sandy loams derived from Precambrian siliceous and Permian mudstone rocks. On upper mid-slopes and ridges of low hills flanking the Dazzler and Asbestos Ranges.

Structural alliances: *Eucalyptus obliqua* ± *E. amygdalina* (tall) open-forest.

Average number of species: (40-)43(-48).

Characteristic species:

Low trees/tall shrubs: *Banksia marginata*, *Acacia verticillata*, *Monotoca glauca*.
 Low-medium shrubs: *Epacris impressa*, *Persoonia juniperina*, *Fultenaea gumii*, *Leptospermum scoparium*, *Leucopogon ericoides*, *Lomatia tinctoria*, *Tetratheca pilosa*, *Acacia botrycephala*.
 Undershubs: *Billardiera scandens*.
 Ferns: *Pteridium esculentum*.
 Sedges/saggs: *Lepidosperma laterale*, *Gahnia grandis*, *Lomandra longifolia*.
 Herbs: sparse, averaging 3 species per plot.
 Grasses: sparse, only *Tetrarrhena distichophylla* found.

(m) SHRUBBY WET VERY TALL OPEN-FOREST TO RAINFOREST

Habitat: fertile, well drained soils where water availability is high, in the deeply incised gullies on sheltered eastern aspects along the Dazzler-Asbestos Ranges and in deep gorges at lower levels, e.g. Saxons Creek, Holwell Gorge, Notley Gorge.

Eucalypt alliances: ± *Eucalyptus regnans* ± *E. obliqua* ± *E. delegatensis* ± *E. viminalis* very tall open forest. Also without eucalypts in ± *Nothofagus cunninghamii* ± *Atherosperma moschatum* ± *Acacia melanoxylon* closed forests.

Average number of species: (13-)27(-33).

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Characteristic species:

Tall shrubs/low trees: *Olearia argophylla*, *Pomaderris apetala*, *Acacia melanoxylon*, *Coprosma quadrifida*, *Atherosperma moschatum*, *Zieria arborescens*.

Low-medium shrubs: none.

Undershrubs: none.

Ferns: *Dicksonia antarctica*, *Polystichum proliferum*, *Rumohra adiantiformis*, *Grammitis* sp., *Polyphlebium venosum*, *Microsorium diversifolium*, *Hymenophyllum* spp.

Sedges/saggs: none consistent.

Herbs: occasional, e.g. *Clematis aristata*.

Grasses: sporadic, only in disturbed areas.
