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TASMANIAN HIGH MOUNTAIN VEGETATION I - A RECONNAISSANCE SURVEY OF THE EASTERN ARTHUR RANGE AND MOUNT PICTON

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(with three tables, four text figures and two plates)

ABSTRACT

KIRKPATRICK, J.B., 1980 (31 v): Tasmanian high mountain vegetation I - a reconnaissance survey of the Eastern Arthur Range and Mt Picton. *Pap. Proc. R. Soc. Tasm.*, 114: 1-20 (incl. 2 plates) ISSN 0080-4703. Department of Geography, University of Tasmania, Hobart, Tasmania, Australia.

The high mountain vegetation of Mt Picton and the Eastern Arthur Range varies structurally from closed-forest to low closed-heath and is composed of at least two associations, and eight sub-associations, containing 128 higher plant species of which 76 occur on both mountains. Only one and four respectively of extremely fire sensitive species occur on Mt Picton and the Eastern Arthur Range, the former having been burnt recently and the latter probably centuries ago. Differences in fire history, soils, geomorphology and precipitation may account for the observed differences in the range and composition of the plant communities and floras of the two mountains. The flora of Mt Picton is shown to generally have more species in common with mountains with relatively fertile soils, while that of the Eastern Arthur Range has a general more species in common with mountains where the soils are predominantly extremely poor.

INTRODUCTION

Although Tasmania constitutes less than 0.9 per cent of the total area of the Commonwealth of Australia it contains more than 50 per cent of the nation's area of high mountains as defined by Costin (1973). Tasmanian alpine vegetation is characteristically dominated by shrubs, in contrast to the predominantly herbaceous vegetation found in the high country of Australia (Costin 1973) and New Zealand (Cockayne 1928). Approximately 50 per cent of the vascular plant species found in the plateaus and peaks of the mountains of Tasmania are Tasmanian endemics, and many more species are found in Tasmania and New Zealand but are absent from the Australian mainland. The literature contains only a few accounts of the Tasmanian high mountain plant communities, their local distribution patterns and their relationships to environmental variables. The vegetation of Mt Wellington (Martin 1940), the Central Plateau (Jackson 1973), Mt Field and Mt Rufus (Davies 1978), the West Coast Range (Kirkpatrick 1977) and Cradle Mountain (Sutton 1929) has been thus described. This paper describes the high mountain vegetation of Mt Picton and the Eastern Arthur Range in the heart of the wilderness area of south-western Tasmania (figure 1) and discusses the environmental relationships of the plant communities, their floristic relationships and management problems.

The Eastern Arthur Range extends for approximately 8 km from Luckmans Lead in the north to Lake Geeves in the south (figure 2). Only a few peaks exceed 1000 m, the main ridge varying from 910 m to approximately 1140 m in altitude. The range has been subject to glacial erosion in the past and is subject to periglacial and fluvial erosion at present. Glaciers have carved deep cirque basins to the north, east and south of the Precambrian quartzite range leaving the higher jagged peaks uncovered, but moved across the divide in places such as Goon Moor and Thwaites Plateau where the landscape is smoothed. The soils are skeletal on the steeper slopes and shallow, acid peats on the gentler slopes. The mean annual precipitation and its seasonal distribution pattern are unknown, but are likely to approximate those experienced at Strathgordon (table 1). Short periods of snow cover can occur at any time of the year, yet the range may be bare of snow for periods in the coldest months. The prevailing westerly

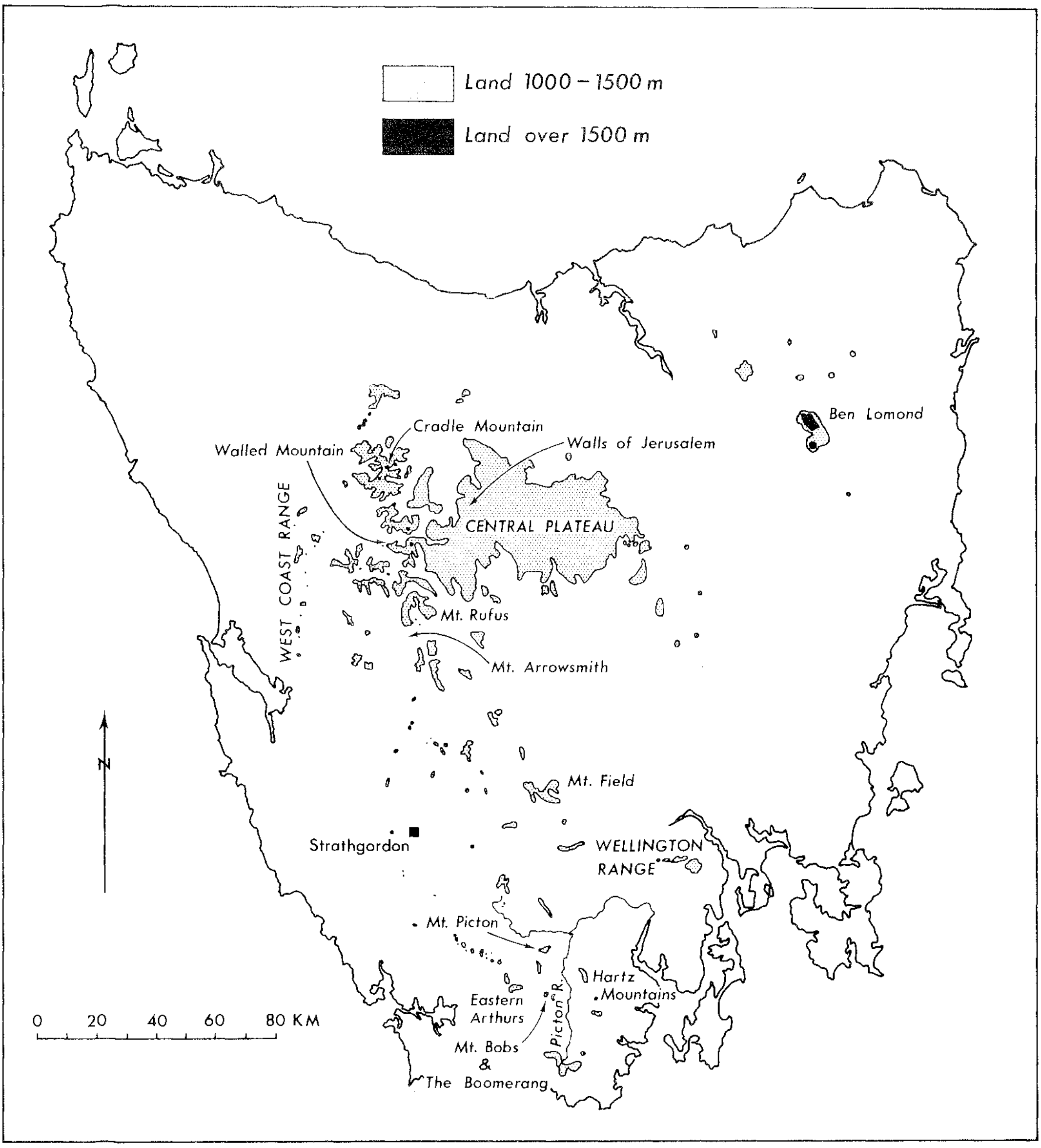

FIG.1- Locations mentioned in the text.

winds are sufficiently strong to have created, in combination with low temperatures and ice, wind stripes in the vegetation of some of the moors and distinct asymmetry in exposed shrubs.

The climate of Mt Picton is probably similar to that of the Eastern Arthur Range except that precipitation may be less as a result of the screening effect of windward ranges. Mt Picton consists of a Jurassic dolerite arete overlying a Permian mudstone shelf. The peak of Mt Picton attains 1310 m and the shelf varies between 850 m and 975 m in altitude. The shelf is partly overlain by moraine derived from dolerite. The southern slope of the mountain (not described in this paper) is bounded by several moraine-dammed lakes. The soils vary from acid peats in the flatter areas to alpine humus and skeletal soils on the steep dolerite slopes.

Nomenclature follows Curtis (1963, 1967) and Curtis and Morris (1975) for gymnosperms and dicotyledons, (Willis (1970) for monocotyledons, and Wakefield (1975) for pteridophytes except where authorities are given (Appendix). Terminology describing the structural forms of vegetation follows Specht (1970) except that his closed-heath has been divided into closed-heath (0.2-2.0 m tall) and low closed-heath (less than 0.2 m tall).

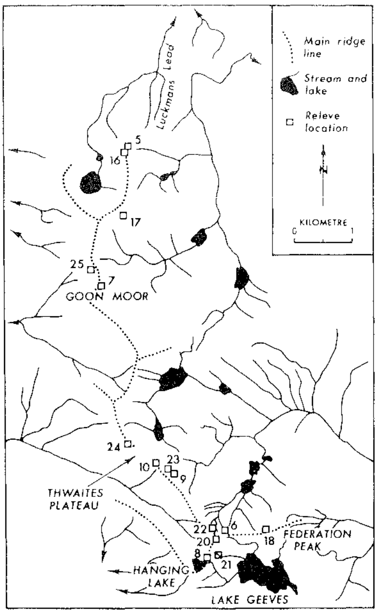

FIG.2.- The location of releves in the Eastern Arthur Range

METHODS

Lists were made of the vascular plants present in twenty four releves of variable size but within relatively homogeneous vegetation, during January 1976. Structural characteristics, dominance and relationships to other structural-dominance types and environmental variables were also noted. The lists included almost all the species in the local area of the particular structural-dominance type, searching being continued until no further species were found or until the vegetation type changed. Releve locations were chosen to encompass as much of the range of structural-dominance types as was possible in the time available for the work and did encompass all high altitude vegetation types dominated by shrubs or herbs occupying areas greater than 10 ha as well as some types covering a lesser area and some types dominated by trees.

The releve species presence and absence data were arranged into a matrix which was then resorted with the aim of grouping releves with similar species compositions and species with similar releve compositions. This phytosociological analysis reveals both the species that tend to consistently occur together in the vegetation studied and the releves that are floristically related. In this paper the term association is used to describe groups of species that are jointly present and jointly absent in a large number of releves in the study area and the term subassociation is used to describe groups of species that positively and negatively co-occur within the matrices defined by the associations. The matrices for the two associations recognized are presented in full as the best single device for clearly presenting the floristic

TABLE 1

PRECIPITATION DATA FOR STRATHGORDON (8 YEARS) AND HARTZ MOUNTAINS (12 YEARS)

Strathgordon	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
Mean (mm)	137	96	137	234	272	257	294	267	292	207	194	243	2630
Raindays	17	11	16	21	22	23	25	23	22	21	19	24	244
Hartz Mountains													
Mean (mm)	91	95	116	184	205	152	146	139	182	142	142	113	1707

relationships of the vegetation, including floristic continua that would not be revealed by a simple listing of species by types defined on the basis of structure and dominance. They also allow the reader to assess my classificatory judgments and to make realistic comparisons with data collected elsewhere. The procedure and terminology used are closely similar to those used by some practitioners of the continental school of phytosociology (Mueller-Dombois and Ellenberg 1974). However, no attempt can be made to construct truly representative formal syntaxonomies (Braun-Blanquet 1932) for Australian vegetation without widespread collecting of releve data. Thus the associations and subassociations revealed by analysis are highly unlikely to be universal for the species concerned, although they are real for the study area.

Species lists from Mt Picton and the Eastern Arthur Range formed the basis for floristic analysis. In the case of Mt Picton the list applies to the north face, the summit ridge, the northern shelves and Hewardia Ridge. It does not include species confined to *Leptospermum nitidum* closed-scrub or *Nothofagus cunninghamii* closed-forest, but does include the species found only in *Eucalyptus coccifera* open-forest. The Eastern Arthur Range list includes all the species observed in a traverse of the range from 5 (figure 2) to Federation Peak and Hanging Lake. This traverse passed through all the moors of the upper part of the range and some of the forest and scrub. The lists made from collections and field observations were supplemented by records contributed by Mr. T. Moscal and Mr. R. Williams. The presence or absence of species found in the Eastern Arthur Range or Mt Picton on other mountains of Tasmania was determined from the literature for Mt Wellington (Ratkowsky and Ratkowsky 1976), from the literature and my unpublished notes for Mt Field (Davies 1978), Mt Rufus (Davies 1978), Cradle Mountain (Sutton 1929) and the West Coast Range (Kirkpatrick 1977), and from my unpublished notes for Mt Bobs/Boomerang, Hartz Mountains and the Walls of Jerusalem.

SPECIES ASSOCIATIONS

Tables 2 and 3 while revealing some strong associations between certain groups of species, show the essentially continuous nature of floristic variation within and between the two mountains. The releves in the first table are characterized by the high constancy of *Donatia novae-zelandiae, Oreobolus pumilio, Carpha alpina, Epacris serpyllifolia, Calorphus minor, Sprengelia incarnata, Drosera arcturi* and *Pentachrondra pumila*, an association common in the West Coast Range (Kirkpatrick 1977), at Cradle Mountain (Sutton 1928) and undoubtedly elsewhere in the western mountains. The subassociations grade into each other in a sequence from low elevation Picton releves to high elevation Eastern Arthur releves. The subassociation consisting of *Oreobolus acutifolius, Bauera rubioides* and *Gleichenia alpina* is confined to the shelves on the northern and western slopes of Mt Picton. The overlapping subassociation consisting of *Gleichenia alpina, Lycopodium fastigiatum* and *Celmisia longifolia* again consists entirely of Mt Picton releves. The two large and overlapping subassociations of *Anenome crassifolia-Isophysis tasmanica-Diplaspis cordifolia* and *Diplaspis cordifolia-Actinotus moorei-Dracophyllum milliganii-Helichrysum pumilum* are found in both ranges. The sub-

TABLE 2

THE LOW CLOSED-HEATH ASSOCIATION

	RELEVES									
	1	2	3	4	5	7	8	9	10	6
Donatia novae-zelandiae	x	x	x	x	x	x	x	x	x	x
Oreobolus pumilio	x	x	x	x	x	x	x	x	x	x
Carpha alpina	x	x	x	x	x	x	x	x	x	x
Epacris serpyllifolia	x	x	x	x	x	x	x	x	x	
Calorophys lateriflorus	x	x	x	x	x	x	x	x	x	
Sprengelia incarnata	x		x	x	x	x	x	x	x	x
Drosera arcturi	x		x	x	x	x	x	x	x	x
Pentachondra pumila	x	x	x	x	x	x	x		x	
Actinotus suffocata	x	x	x	x		x	x		x	
Astelia alpina	x	x	x		x	x	x	x		
Oreobolus acutifolius	x	x	x							
Bauera rubioides	x	x	x		x			x		
Gleichenia alpina	x	x	x	x						
Lycopodium fastigiatum		x	x	x					x	
Celmisia longifolia		x	x	x				x		
Anenome crassifolia		x	x	x	x		x	x		
Eucalyptus vernicosa			x	x	x	x				
Isophysis tasmanica		x	x	x	x	x	x	x		
Diplaspis cordifolia		x		x	x	x	x	x	x	
Actinotus moorei			x	x	x	x	x	x	x	
Dracophyllum milliganii			x	x	x	x	x	x	x	
Helichrysum pumilum				x	x	x	x	x	x	
Ewartia meredittheae						x	x	x	x	
Forstera bellidifolia						x	x	x	x	
Richea curtiseae						x	x		x	
Diselma archeri						x	x		x	
Euphrasia hookeri					x	x			x	x
Erigeron stellatus		x	x		x	x		x	x	x
Mitrasacme archeri				x			x		x	x
Abrotonella forsterioides						x	x		x	x
Euphrasia spp.	x			x	x			x		
Helichrysum milliganii			x	x		x	x			x
Xyris marginata				x	x				x	
Cyathodes dealbata	x					x	x			
Stylidium graminifolium	x		x							
Drosera pygmaea	x			x						
Rubus gunnianus		x	x							
Orites revoluta			x	x						
Richea scoparia			x	x						
Danthonia sp.							x			x

Additional species: *Gaimardia fitzgeraldii, Centrolepis monogyna, Microlaena tasmanica* (1); *Haloragis montana, Diplarrhena latifolia, Leptospermum nitidum, Senecio pectinatus* (2); *Leucopogon milliganii, Cyathodes petiolaris, Richea milliganii* (3); *Exocarpos humifusus, Monotoca submutica, Scaevola hookeri, Persoonia gunnii, Blandfordia punicea, Drimys lanceolata* (4); *Actinotus bellidioides, Baeckea leptocaulis, Milligania densiflora* (5); *Pterygopappus lawrencii, Celmisia saxifraga* (6); *Gentianella diemensis* (7).

High Mountain Vegetation - Eastern Arthur Range and Mount Picton

TABLE 3

THE HEATH, SCRUB AND FOREST ASSOCIATION

	RELEVE													
	12	13	14	18	20	17	24	25	23	15	16	11	21	22
Structure	CS	CH	OH	OH	CH	LOF	CS	OS	CS	OH	CH	OF	CS	CH
Richea scoparia	x	x	x	x	D	x	D	x	D	x	D		x	D
Astelia alpina	x	x	x	x	x	x	x	x	x	x	x	x		x
Drimys lanceolata	x	x	x	x	x	x	x	x	x		x	x		x
Nothofagus cunninghamii	D				x	x	x	x	D	x	D	x	x	x
Exocarpos humifusus	x	x		x	x	x		x	x	x	x	x		x
Hierochloe fraseri	x	x	x	x										
Trochocarpa cunninghamii	x	x	x	x		x	x							
Richea sprengeloides	x	x	x	x	x							x		
Coprosma nitida	x	x	x	x	x						x	x		
Helichrysum backhousii	x	x	x					x	x		x			
Prionotes cerinthoides	x			x	x	x	x		x		x	x	x	
Senecio leptocarpus		x		x	x	x	x				x	x		x
Isophysis tasmanica				x	x	x	x	x	x	x				
Anemone crassifolia				x	x	x	x	x	x	x				
Richea pandanifolia	x	x		x	x	x	x	x					x	
Athrotaxis selaginoides				x	x	D		D					x	x
Uncinia compacta				x			x	x						x
Euphrasia spp.			x	x	x	x					x			
Erigeron stellatus				x	x	x				x				
Cyathodes parvifolia	x	x			x		x	x	x	x	x	x		
Eucryphia milliganii				x			x	x	x	x	x	x		
Epacris serpyllifolia				x			x	x	x	x	x	x		
Bauera rubioides								x	x	x	x	x		
Eucalyptus vernicosa								x	x	D	x	x		
Monotoca submutica									x	x	x	x		
Pentachondra pumila			x	x	x	x		x			x			x
Oreobolus acutifolius				x		x		x		x	x			x
Carpha alpina		x	x	x		x		x						x
Orites diversifolia	x	x				x		x		x		x		x
Dracophyllum milliganii				x		x		x		x			x	
Diplarrhena latifolia				x			x			x			x	x
Diplaspis cordifolia				x	x			x						x
Celmisia longifolia								x	x	x				x
Persoonia gunnii	x			x						x	x			
Orites revoluta	x	x								x	x			
Poa sp.	x			x				x						x
Olearia pinifolia	x	x			x									x
Tetracarpaea tasmanica							x	x		x		x		
Calorophus lateriflorus		x						x	x			x		
Telopea truncata	x									x		x		
Gahnia grandis		x								x		x		
Richea milliganii							x			x		x		
Cenarrhenes nitida										x	x	x		
Olearia persoonioides							x						x	
Olearia ledifolia	x			x	x									
Luzula spp.	x			x										
Gaultheria hispida	x	x												
Oxalis lactea		x		x										x
Rubus gunnianus		x	x											

	12	13	14	18	20	17	24	25	23	15	16	11	21	22
Haloragis montana		x				x								
Mitrasacme archeri			x	x		x								
Geum talbotianum			x	x										
Dichosciadeum ranunculaceum			x	x	x									
Danthonia spp.			x	x										
Aciphylla procumbens			x	x										
Celmisia saxifraga			x	x										
Oreobolus pumilio				x				x		x				
Sprengelia incarnata								x		x		x		
Actinotus moorei				x						x				
Agastachys odorata									x	x				
Cyathodes petiolaris									x	x				
Blandfordia punicea				x						x				
Richea curtiseae				x						x				
Pimelea milliganii				x						x				
Forstera bellidifolia						x		x						
Drosera arcturi				x		x		x						
Archeria comberi				x		x							x	
Abrotonella scapigera				x										x
Gentianella diemensis				x	x									
Microlaena tasmanica				x				x						
Donatia novae-zelandiae				x				x						
Orites milliganii					x								x	
Senecio primulifolius							x						x	x

D = dominant, CH = closed-heath, CS = closed-scrub, LOF = low open-forest, CF = open forest, OH = open-heath, OS = open-scrub.

Additional species: *Eucalyptus coccifera* (D), *Gleichenia alpina, Leptospermum nitidum, Lomatia polymorpha, Banksia marginata, Melaleuca squamea, Anodopetalum biglandulosum* (11); *Atherosperma moschatum* (12); *Ewartia planchonii, Podocarpus lawrencii* (D), *Polystichum proliferum* (13); *Acaena montana, Archeria serpyllifolia* (D); *Ewartia meereditheae, Leptospermum rupestre, Orites acicularis* (14); *Helichrysum pumilum* (15); *Archeria hirtella, Monotoca empetrifolia, Lycopodium scariosum* (17); *Milligania stylosa, Grammitis armstrongii, Cyathodes dealbata, Abrotonella forsterioides, Diselma archeri* (18); *Nothofagus gunnii* (D)(21); *Helichrysum milliganii* (22); *Blechnum wattsii* (24).

association *Richea curtiseae-Ewartia meereditheae-Forstera bellidifolia-Diselma archeri* is confined to the Eastern Arthurs, and the weak subassociation *Euphrasia hookeri-Erigeron stellulatus-Abrotonella forsterioides-Mitrasacme archeri* is found on some of the higher moors of the Eastern Arthurs.

The species characterizing the association shown in table 3 are *Richea scoparia, Astelia alpina, Drimys lanceolata, Nothofagus cunninghamii* and *Exocarpos humifusus*. As in the case of the first association, the subassociations overlap between releves (table 3). *Hierochloe fraseri-Trochocarpa cunninghamii-Helichrysum backhousei-Richea sprengeloides* is the subassociation found largely on highly exposed, well-drained rocky areas. Another strong subassociation, consisting of *Bauera rubioides, Eucalyptus vernicosa, Monotoca submutica, Eucryphia milliganii* and *Epacris serpyllifolia* occurs in less exposed situations on rocky well-drained sites. The other subassociations appear to relate to a variety of microhabitat conditions, most importantly soil depth, exposure and drainage.

THE PLANT COMMUNITIES OF MT PICTON

The altitudinal sequence of plant communities on well-drained sites on the northern face of Mt Picton consists of *Nothofagus cunninghamii-Atherosperma moschatum* closed-forest on the slopes of Red Rag Scarp (3 km north of Mt Picton; alt. 400 m) *Eucalyptus coccifera* open-forest to low open-forest from roughly 800 m to 1040 m (11, table 3; plate 1), *Nothofagus cunninghamii* closed-scrub from 1040 m to 1100 m (12, table 3), *Podocarpus lawrencii* closed-heath from 1100 m to 1190 m (13, table 3; plate 1) and *Archeria serpyllifolia* open-heath (14, table 3) which is found in the most exposed situations at the higher altitudes. *Eucalyptus vernicosa* open-heath (15, table 3) is found in well-drained situations marginal to the *Donatia novae-zelandiae-Epacris serpyllifolia* low closed-heath occupying areas of poor drainage and shallow soils on mudstone shelves (1-4, table 3; plate 1). Communities dominated by herbs are largely confined to ill-drained sites with deep soils, and are restricted in area. *Gahnia grandis* open tussock-sedgeland is the most extensive of these communities, *Milligania densiflora* closed-herbland and *Astelia alpina* closed herbland being restricted to flats around lakes and long and gently sloping drainage channels (plate 1).

An interesting herbaceous community has formed along a drainage channel near 3 (figure 2, plate 1), where hummocks with the form of bolster plants are found above a predominantly subterranean stream. These hummocks support a complete cover less than one centimetre tall of *Ewartia planchonii*, *Rubus gunnianus*, *Acaena montana*, *Plantago tasmanica*, *Haloragis montana*, *Cotula* sp., *Drosera arcturi*, *D. pygmaea* and an unidentified small tufted grass. Occasional individuals of *Richea pandanifolia* and *R. scoparia* are emergent from this marsupial-grazed sward (plate 1). Communities of similar physiognomy occur on physiographically similar sites near Mt Rufus (Davies 1978), near Cradle Mountain and at the Walls of Jerusalem. The origin of the bolster-shaped hummocks in the latter areas at least seems unlikely to be through the death of bolster plants and subsequent colonization by other species as there is no evidence of such a process occurring at present. However, progressive colonization of *Sphagnum* mounds by grasses and herbs can be observed at these localities.

THE PLANT COMMUNITIES OF THE EASTERN ARTHUR RANGE

The vegetation of the Eastern Arthur Range does not exhibit the clear altitudinal zonation found on the northern face of Mt Picton. On the lower slopes of the range to an altitude of approximately 900 m the following alliances (*sensu* Specht, Roe and Broughton 1974) are widespread: *Athrotaxis selaginoides-Nothofagus cunninghamii* closed-forest, *N. cunninghamii* closed- forest, *Eucalyptus nitida* open-forest and open-scrub, *Leptospermum nitidum* closed-scrub, *Gymnoschoenus sphaerocephalus* hummock sedgeland. Above this altitude the vegetation is a complex consisting largely of heath, scrub and low forest. Forest, mostly dominated by *A. selaginoides*, occurs mainly below the cliffs and steep rocky slopes of the eastern slopes of the range. The structure varies from low open-forest with prostrate shrubs and herbs in the openings (e.g. 17, table 3) through low closed-forest to closed-forest in the most sheltered situations with deeper soils than those generally found on the higher parts of the range.

The exposed western slopes above 900 m are almost entirely covered with scrub. *Richea scoparia* closed-scrub (e.g. 24, table 3) dominates the steeper slopes and on gentler slopes merges into *A. selaginoides* open-scrub with a dense understorey of tall shrubs dominated by *R. scoparia* (plate 2). Along the margins of those parts of the closed-heath where drainage conditions ensure constant moisture in the soil the *R. scoparia* understorey is replaced by an understorey of diverse height and dominance (e.g. 25, table 3). On the upper eastern face of the range there are at least two small patches of deciduous closed-scrub dominated by *Nothofagus gunnii* (e.g. 21, table 3).

R. scoparia scrub grades into *R. scoparia* heath (e.g. 20 and 22, table 3) with increasing exposure and shallowness of soils on moderate to steep west-facing slopes. With a combination of more favourable edaphic and topographic conditions krummholtz *Nothofagus cunninghamii* co-dominates with *R. scoparia* (e.g. 23, table 3). The areas occupied by this community appear to be such that moisture stress would occur with a lesser frequency than in most of the area occupied by *R. scoparia* heath.

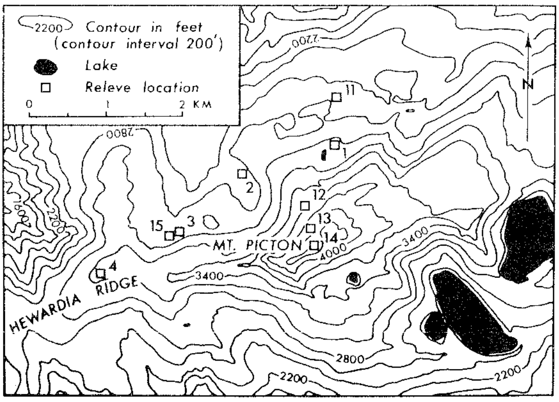

FIG.3.- The location of releves at Mt Picton

Low closed-heath dominated variously and in mixture by bolster plants (*Donatia novae-zelandiae, Abrotonella forsterioides, Dracophyllum minimum* and *Pterygopappus lawrencii*), shrubs (*Dracophyllum milliganii* and *Epacris serpyllifolia*), and tussock and mat-forming graminoids (*Oreobolus pumilio, Carpha alpina* and *Isophysis tasmanica*) occurs on ill-drained areas, usually of gentle slope (e.g. table 2; plate 2). The bolster plant cover increases with altitude as does the number of species of bolster plant. The low closed-heath at site 5 virtually lacks bolster species, *D. novae-zelandiae* being rare, and *I. tasmanica, O. pumilio* and *D. milliganii* being dominant. In contrast, all the bolster species known to be present in the range form a coalescing series of cushions at 6 in the wind gap to the west of Federation Peak. *Donatia* is the common bolster plant on all the Eastern Arthur moors, *Abrotonella* being widespread but infrequent, and *Pterygopappus* and *Dracophyllum* being confined to the highest altitudes.

The quartzite monolith of Federation Peak is covered extremely sparsely by small tussock grasses in the genera *Poa, Danthonia* and *Hierochloe* and small shrubs such as *Richea sprengeloides* and *Archeria serpyllifolia*. Large and soft-leaved herbs such as *Geum talbotianum, Aciphylla procumbens, Milligania stylosa* and *Dichosciadeum ranunculaceum* dominate sheltered crevices and cracks. Cliff faces that are sheltered from the sun by their aspect and subject to almost constant seepage support almost pure herblands of *Milligania densiflora*.

DISCUSSION

Although Mt Picton and the Eastern Arthur Range share at least 76 out of the pooled list of 128 species, they differ markedly in their vegetation. The clear altitudinal zonation present on Mt Picton is not only lacking in the Eastern Arthur Range but also includes two vegetation types of some area, *Eucalyptus coccifera* open-forest and *Podocarpus lawrencii* closed-heath, completely absent from the latter range. A range of communities dominated by either *Athrotaxis selaginoides* and *Richea scoparia* was not observed on Mt Picton, although small areas of communities dominated by the former species have survived in parts of the South Picton Range where fires have not reached, and the latter species is widespread. *A. selaginoides* has extreme fire susceptibility in common with *Nothofagus gunnii* and *Diselma archeri*, two other species found in the Eastern Arthur Range but not on Mt Picton. The latter two species are rare in the Eastern Arthur Range and *A. selaginoides* has much smaller trunks at equivalent altitudes than trees observed at Mt Bobs, the Boomerang, Mt Anne, Cradle Mountain and the West Coast Range. These facts suggest that in relatively recent times, perhaps only two or

PLATE 1

Open-heath on the summit of Mt Picton looking east (top left); *Donatia* low closed-heath and *Eucalyptus coccifera* open-scrub at North Lake, Mt Picton (top right); *Podocarpus lawrencii* closed-heath with emergent *Richea pandanifolia* on the margins of the boulder stream on the north face of Mt Picton (centre left). *Donatia* low closed-heath along watercourse, *Astelia alpina* closed-herbland and *Nothofagus cunninghamii* open-scrub in an area formerly dominated by *Athrotaxis selaginoides* on the northern shelf of Mt Picton (centre right); *Isophysis-Donatia* low closed-heath with *Eucalyptus vernicosa* heath on the rises at site 3 (fig. 2) (bottom left); *Plantago-Ewartia* herbland on raised mounds along a subterranean stream near site 3 (fig. 2) (bottom right).

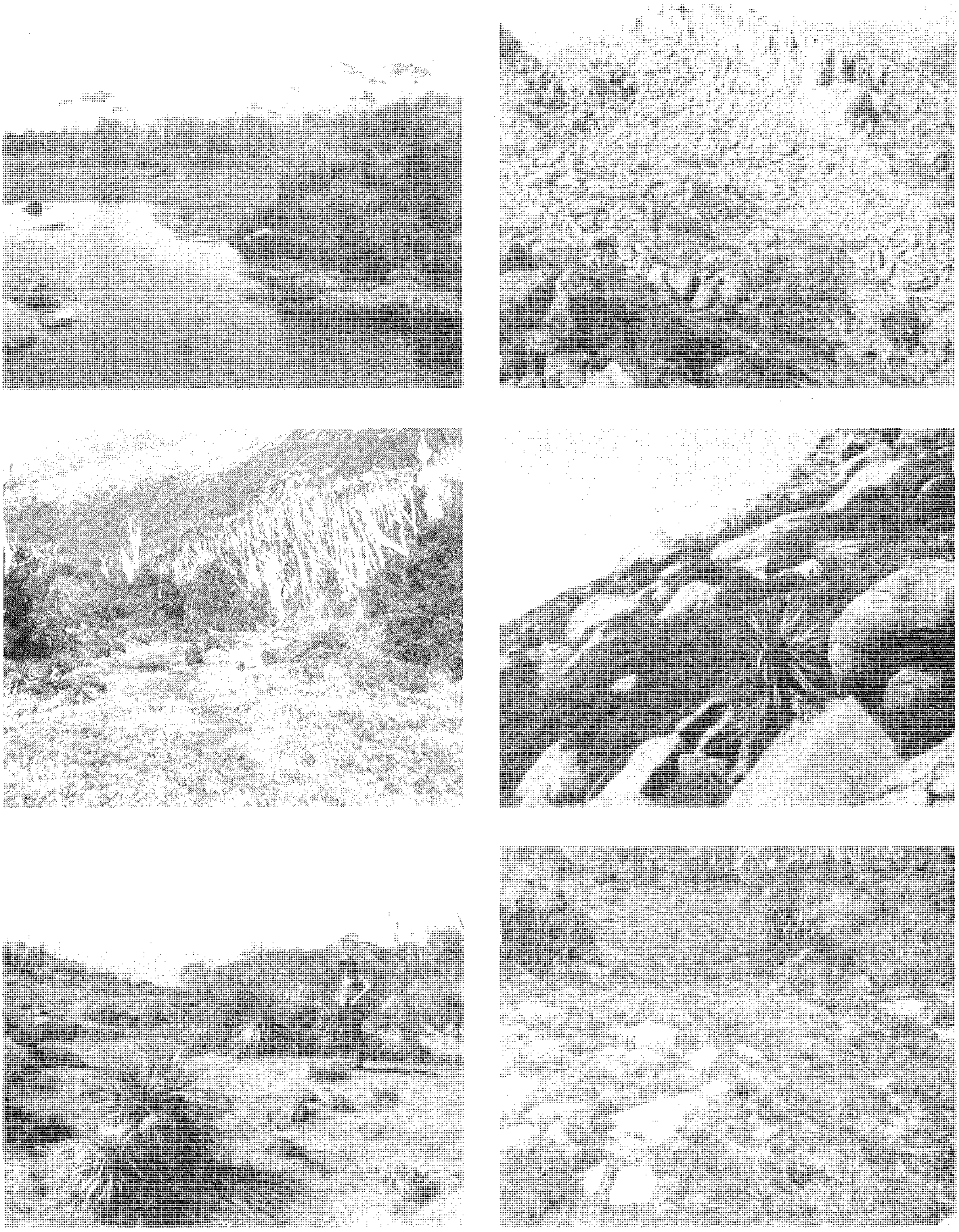

PLATE 1.

High Mountain Vegetation - Eastern Arthur Range and Mount Picton

PLATE 2

Epacris serpyllifolia-Isophysis-Dracophyllum milliganii low closed-heath at site 5. *Helichrysum pumilum* is in bloom (top left); Goon Moor (middleground) looking north and showing the topographic relationship between the closed-heath (dark) and low closed-heath (light). The path is visible in the bottom right-hand corner (top right); closed-scrub and *Nothofagus cunninghamii* low closed-forest on the steep eastern slopes of the Eastern Arthur Range (middle left); *Richea scoparia* closed-heath and closed scrub with emergent *Athrotaxis selaginoides* (the dark tree) on the western slopes of the Eastern Arthur Range (middle right); Erosion in the low closed-heath at Thwaites Plateau. Wind stripes are evident in the vegetation and these have been accentuated by foot traffic (bottom left); The southern shore of Hanging Lake looking towards its exit. Low closed-heath in the foreground, *Diselma archeri* and krummholtz *A. selaginoides* along the lake shore and *R. scoparia* closed-heath on the opposite slopes (bottom right).

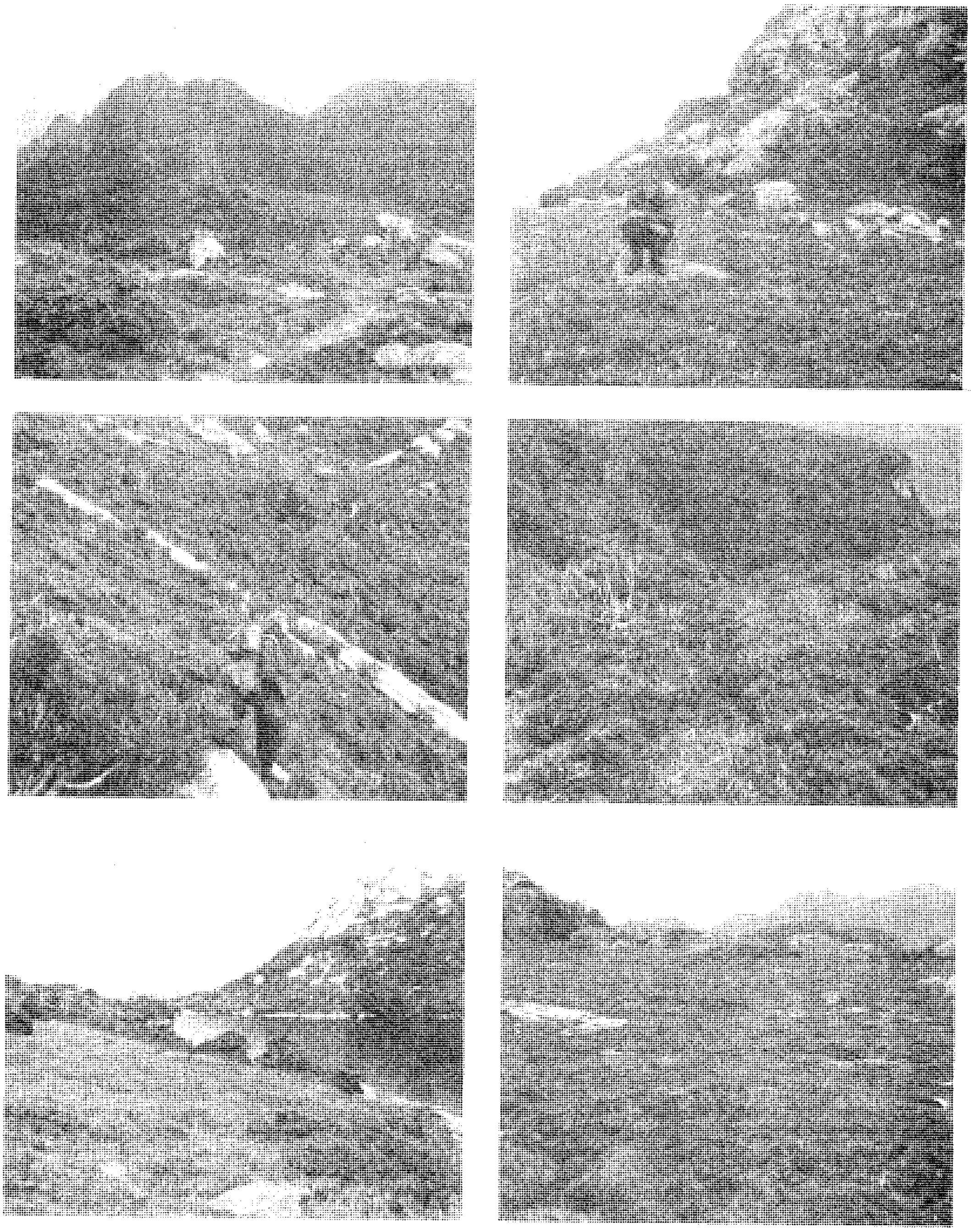

PLATE 2.

three centuries ago, most of the top of the Eastern Arthur Range was burnt out and has since been slowly recolonized by *A. selaginoides* and *D. archeri*, a process that appears not to be complete. The apparent absence of *Microcachrys tetragona* from both mountains is somewhat puzzling as this species is abundant throughout most of the western mountains of Tasmania. Its lack of resistance to fire could explain its absence from Mt Picton which has been burnt in this century. Its absence from the Eastern Arthurs is less easily explained, although it has less of a tendency to occur along streams, which protect some adjacent plants during fire, than the three fire sensitive species found in the Eastern Arthur Range. Climatic control of its absence seems unlikely given the abundance of the species on the nearby Mt Bobs-Boomerang complex. Shallow, peaty soils on glacially eroded quartzose rocks support *Microcachrys* throughout much of its range, making edaphic exclusion unlikely. The apparent absence of another gymnosperm, *Podocarpus lawrencii*, from the Eastern Arthur Range may result from the relative lack of boulder streams and stable scree slopes in this range. These form the main habitat for the species elsewhere in the state (Martin 1940, Jackson 1973, Kirkpatrick 1977).

Some of the differences in the flora and vegetation between the two mountains may be accounted for by differences in fire history; however, their differing geology may be more important. Both mudstone and dolerite, the rocks which form Mt Picton, weather faster than the Eastern Arthur Range quartzite and their weathering products contain more clay and more plant nutrients. Species such as *Orites acicularis* and *O. revoluta* that occur typically on mountains with relatively deeper, more clayey and fertile soils are present on Mt Picton but are absent from the Eastern Arthur Range, and species such as *Orites milliganii* and *Pimelea milliganii* that are typical of the quartzite mountains of the west are found in the Eastern Arthur Range but not on Mt Picton.

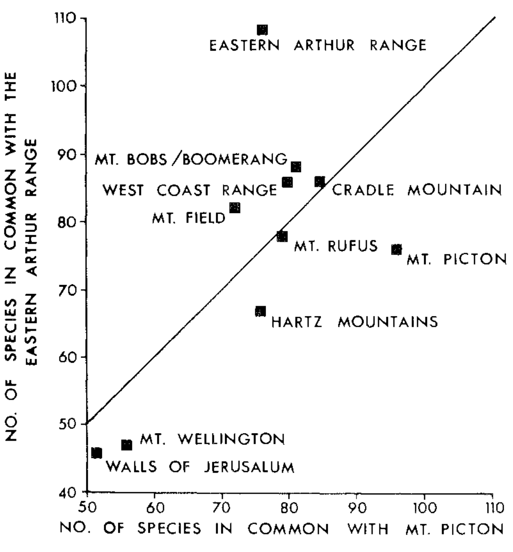

FIG.4.- Floristic similarities between Mt Picton, the Eastern Arthur Range and other mountains.

The importance of surface geology is also hinted at in figure 4 which shown that the mountains with a greater number of species in common with Mt Picton than the Eastern Arthur Range are those that could be expected to have the deeper, more clay rich and more fertile soils out of the mountains included in the analysis. The Walls of Jerusalem and Mt Rufus have considerable areas of dolerite and also include soils on siltstone. These latter soils are deep and free of the lag deposit of rocks that partially covers most dolerite soils. They are some of the few alpine soils in Tasmania on which there can be found large areas of vegetation dominated by grasses and forbs. The Hartz Mountains and Mt Wellington consist of dolerite and occur in areas of relatively low rainfall. All of the other ranges included in the analysis have some areas of dolerite within the high mountain zone. However, the West Coast Range, Cradle Mountain and Mt Bobs/Boomerang have large areas of highly siliceous substrata and the four ranges occur in areas of extremely high precipitation which would result in more leaching of nutrients than would be experienced on drier mountains of similar surface geology.

The high mountain floras of Mt Picton and the Eastern Arthur Range include high proportions of Tasmanian endemic species (Eastern Arthur Range 60 per cent, Mt Picton 57 per cent). The nearby Mt Bobs/Boomerang complex has a similarly high figure (57 per cent) compared with the (approximate) 50 per cent of Cradle Mountain and the West Coast Range and the (approximate) 33 per cent of Mt Wellington. However, only one species found on the mountains studied here is an endemic confined to the southern mountains in Tasmania (*Senecio primulifolius*), suggesting a screening of species that occur elsewhere than Tasmania by climatic and edaphic factors rather than a distinct development of local endemism.

The number of observed species in the high mountain flora of the two ranges is relatively low when compared with some other Tasmanian mountains. The Eastern Arthur Range has 108 species and Mt Picton 96, compared with 140 at the Walls of Jerusalem, 142 at Mt Rufus, 144 at Mt Field and 178 at Cradle Mountain. Other isolated and small high mountain 'islands' have similarly small floras (Hartz Mountains 104, Mt Bobs/ Boomerang 114, West Coast Range (a series of 'islands') 118, Mt Wellington 121). Habitat island effects (McArthur and Wilson 1967) may be important in explaining this variation in species numbers.

Federation Peak, the highest point in the Eastern Arthur Range, provides one of the main goals for wilderness recreation in southeastern Australia, and with the rest of the range is included in the South-West National Park. A rapidly increasing number of walkers are traversing the range. This foot traffic has been sufficient to create a well-worn track through most of its length, a spreading muddy morass in some flat areas and a line of erosion on some steep slopes. The track passes through all the high moors, the low closed-heath of which is one of the more susceptible of the high mountain vegetation types to disturbance by trampling (Calais, personal communication). Mt Picton lies outside the national park and the state of the tracks on the slopes of the mountain suggest that they are older but less frequently used. The impact of trampling is localized but readily apparent. The effects of nutrient concentration around campsites are more subtle, leading to a qualitative change in the flora, as by the invasion of exotics, although this has not yet been observed.

The vegetation of both mountains is sensitive to fire. In the case of Mt Picton there is little doubt that all species found on the mountain at present would return after a fire, as the extremely fire-susceptible species are absent. However, the severe accelerated erosion that follows fire in the Tasmanian high country (Jackson 1973) leads to a long-lasting reduction in vegetation cover. In the case of the Eastern Arthur Range a fire would lead to the loss of the gymnosperm species and *Nothofagus gunnii* from the flora and a reduction in the stature and cover of the vegetation. The fire hazard has increased in both areas in recent years. Roads and forestry regeneration operations which require the use of fire have penetrated to the southern, eastern and northern lower slopes of Mt Picton, and recreational use of the Eastern Arthur Range has increased. Whether planned burning of inflammable vegetation types to the windward of fire-susceptible mountain vegetation increases or decreases the likelihood of fire in the mountains is still open to question, given that one escape of fire could change the nature of mountain vegetation for centuries.

ACKNOWLEDGEMENTS

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Species observed at Mt Picton and/or the Eastern Arthur Range and their recorded occurrence on other mountains

	EA	MP	BB	WC	CM	MF	HM	MR	MW	WJ
PTERIDOPHYTA										
Aspidiaceae										
Polystichum proliferum	-	x	-	-	x	x	x	x	x	x
Blechnaceae										
Blechnum wattsii Tindale	x	x	x	-	x	x	-	x	-	-
Dennstaedtaetiaceae										
Histiopteris incisa	x	-	-	-	x	x	-	x	x	-
Gleicheniaceae										
Gleichenia abscida Rodway E	x	-	x	-	-	-	-	-	-	-
G. alpina R. Br.	-	x	x	x	x	x	x	x	x	x
Hymenophyllaceae										
*Hymenophyllum peltatum**	x	-	-	-	-	-	-	-	-	-
*H. rarum**	x	-	-	-	-	-	-	-	-	-
Lycopodiaceae										
Lycopodium fascigiatum	x	x	x	-	x	x	x	x	x	x
L. scariosum	x	-	x	x	x	x	x	x	x	x
L. varium	x	-	x	-	x	x	-	x	x	-
Grammitidaceae										
Grammitis armstrongii	x	-	x	x	-	-	-	x	x	-
Polypodiaceae										
*Microsorium diversifolium**	-	x	-	-	-	-	-	-	-	-
GYNOSPERMAE										
Cupressaceae										
Diselma archeri E	x	-	x	x	x	x	-	x	-	x
Podocarpaceae										
Phyllocladus aspleniifolius E	-	x	x	x	x	x	x	x	-	-
Podocarpus lawrencii	-	x	x	x	x	x	x	x	x	x
Taxodiaceae										
Athrotaxis selaginoides E	x	-	x	x	x	x	x	-	-	-
MONOCOTYLEDONEAE										
Centrolepidaceae										
Centrolepis monogyna Benth. E	x	x	-	x	x	-	x	-	x	-
Gaimardia fitzgeraldii F. Muell. + Rodway E	x	x	-	x	-	x	-	-	-	-
Trithuria filamentosa Rodway* E	-	x	-	-	x	-	-	x	-	-
Cyperaceae										
Carpha alpina	x	x	x	x	x	x	x	x	x	x
Gahnia grandis	x	x	x	x	x	x	x	x	x	-
Oreobolus acutifolius S.T. Blake E	x	x	x	x	x	x	x	x	-	x
O. pumilio	x	x	x	x	x	x	x	x	x	x
Scirpus spp.	-	x	x	-	x	x	x	-	x	x
Uncinia compacta	x	-	x	x	x	x	x	x	x	x
Gramineae										
Danthonia fortunae-hibernae	x	x	-	x	-	x	x	-	-	-
D. pauciflora R. Br.	x	x	x	x	x	-	x	x	x	-
Hierochloe fraseri	x	x	x	x	x	-	x	-	x	x
Microlaena tasmanica Hook. E.	x	x	x	x	x	-	x	x	-	-
Poa gunnii Vickery E	x	x	x	x	x	x	x	x	x	x
Hypoxidaceae										
*Campynema lineare** Labill. E	x	-	-	-	x	x	-	x	-	-
Iridaceae										
Diplarrhena latifolia Benth. E	x	x	x	x	x	x	x	x	-	x

High Mountain Vegetation - Eastern Arthur Range and Mount Picton

	EA	MP	BB	WC	CM	MF	HM	MR	MW	WJ
Isophysis tasmanica (Hook.) T. Moore E	x	x	x	x	-	x	x	-	-	-
Libertia pulchella	x	-	-	-	x	-	-	x	-	-
Juncaceae										
Luzula spp.	x	x	x	x	x	x	x	x	x	x
Liliaceae										
Astelia alpina	x	x	x	x	x	x	x	x	x	x
Blandfordia punicea Sweet E	x	x	x	x	x	-	-	x	-	-
Milligania densiflora Hook. E	x	x	x	x	x	x	x	x	-	-
M. stylosa (F. Muell. ex Hook. f.) F. Muell. ex Benth. E	x	-	-	-	-	-	x	-	-	-
Orchidaceae										
Pterostylis dubia R. Br. E	x	-	x	-	-	-	-	-	-	-
Restionaceae										
Calorophus lateriflorus	x	x	x	x	x	x	x	x	x	x
Xyridaceae										
Xyris marginata Rendle E	x	x	x	x	-	-	-	x	-	-
DICOTYLEDONEAE										
Compositae										
Abrotonella forsterioides E	x	-	x	-	-	x	-	-	x	x
A. scapigera E	x	-	x	x	x	x	x	x	-	-
Celmisia longifolia	x	x	x	x	x	x	x	x	x	x
C. saxifraga E	x	x	x	x	x	x	-	x	x	x
Cotula spp.	-	x	-	-	x	-	-	x	x	x
Erigeron stellatus	x	x	x	x	x	x	x	x	-	x
Ewartia mereditheae E	x	x	x	x	x	x	x	x	-	
E. planchonii E	x	x	x	-	x	x	x	x	x	-
Helichrysum backhousii E	x	x	x	x	x	x	x	x	x	x
H. milliganii E	x	x	x	x	x	x	-	x	-	x
H. pumilum E	x	x	x	x	x	x	-	x	-	-
H. scorpioides	x	-	-	-	x	x	-	-	x	x
Olearia ledifolia E	x	x	x	x	x	x	x	x	x	x
O. persoonioides sensu lato E	x	-	x	x	x	x	x	x	x	-
O. pinifolia E	x	x	x	x	x	x	x	x	x	x
Pterygopappus lawrencii E	x	-	x	x	x	x	-	x	-	x
Senecio leptocarpus	x	x	x	x	x	x	x	-	x	x
S. primulifolius E	x	-	-	-	-	-	-	-	-	-
S. pectinatus	x	x	x	x	x	x	x	x	x	x
Cunoniaceae										
Bauera rubioides	x	x	x	x	x	x	x	x	x	x
Droseraceae										
Drosera arcturi	x	x	x	x	x	x	x	x	x	x
D. pygmaea	-	x	-	x	x	-	-	x	x	x
Epacridaceae										
Archeria comberi E	x	-	-	x	-	x	-	-	-	-
A. hirtella E	x	-	x	x	x	-	-	-	-	-
A. serpyllifolia E	x	x	x	x	x	x	x	-	-	-
Cyathodes dealbata E	x	x	x	x	x	x	x	x	x	x
C. parvifolia E	x	x	x	x	x	x	x	x	x	x
C. petiolaris E	x	x	-	x	x	x	x	x	x	x
Dracophyllum milliganii E	x	x	x	x	-	x	-	-	-	-
*D. minimum** E	x	-	x	x	x	x	x	x	-	-
Epacris serpyllifolia	x	x	x	x	x	x	x	x	x	x
Leucopogon milliganii E	-	x	-	x	x	-	-	-	-	-
Monotoca submutica Jarman E	x	x	x	x	x	-	x	x	-	-
Pentachondra pumila	x	x	x	x	x	x	x	x	x	x

	EA	MP	BB	WC	CM	MF	HM	MR	MW	WJ
Prionotes cerinthoides E	x	x	x	x	x	x	x	x	-	-
Richea curtiseae A.M. Gray E	x	-	x	-	x	-	-	-	-	-
R. milliganii E	x	x	x	x	-	x	x	-	-	-
R. pandanifolia E	x	x	x	x	x	x	x	x	-	-
R. scoparia E	x	x	x	x	x	x	x	x	x	x
R. sprengelioides E	x	x	x	x	x	x	x	x	x	x
Sprengelia incarnata	x	x	x	x	x	x	x	x	x	-
Trochocarpa cunninghamii E	x	x	x	x	x	x	x	x	-	-
Ericaceae										
Gaultheria hispida E	-	x	x	x	x	x	x	x	x	-
Escalloniaceae										
Tetracarpaea tasmanica E	x	x	x	x	x	x	x	x	x	-
Eucryphiaceae										
Eucryphia milliganii E	x	x	x	x	-	-	x	-	-	-
Fagaceae										
Nothofagus cunninghamii	x	x	x	x	x	x	x	x	x	x
N. gunnii E	x	-	x	x	x	x	-	x	-	x
Gentianaceae										
Gentianella diemensis	x	x	x	x	x	x	x	x	x	x
Goodeniaceae										
Scaevola hookeri	-	x	-	x	x	x	x	x	x	x
Haloragaceae										
Haloragis montana	x	x	x	-	x	x	x	-	x	x
Loganiaceae										
Mitrasacme archeri E	x	x	x	x	x	x	x	x	-	x
Myrtaceae										
Baeckea leptocaulis E	x	-	-	x	-	-	-	-	-	-
Eucalyptus coccifera E	-	x	-	-	x	x	x	x	x	x
E. vernicosa E	x	x	x	x	x	x	x	-	-	-
Leptospermum nitidum	x	x	x	x	x	x	x	x	-	-
L. rupestre E	-	x	-	-	x	x	x	x	x	x
Oxalidaceae										
Oxalis lactea	x	x	x	x	x	x	x	x	x	x
Plantaginaceae										
Plantago tasmanica	-	x	x	-	x	x	x	x	x	x
Proteaceae										
Agastachys odorata E	x	x	x	x	-	-	x	x	-	-
Cenarrhenes nitida E	x	x	x	x	x	x	x	x	-	-
Orites acicularis E	-	x	x	-	x	x	x	x	x	x
O. diversifolia E	x	x	x	-	-	x	x	x	x	-
O. milliganii E	x	-	-	x	-	-	-	-	-	-
O. revoluta E	-	x	x	x	x	x	x	x	x	x
Persoonia gunnii E	x	x	x	x	x	x	x	x	-	-
Telopea truncata E	-	x	x	x	x	x	x	x	-	-
Ranunculaceae										
Anemone crassifolia E	x	x	-	x	x	-	-	-	-	-
Rosaceae										
Acaena montana E	x	x	x	x	x	x	x	x	x	x
Geum talbotianum E	x	x	x	-	-	-	x	x	-	-
Rubus gunnianus E	-	x	x	x	x	x	x	x	x	x
Rubiaceae										
Coprosma nitida	x	x	x	x	x	x	x	x	x	x
Santalaceae										
Exocarpos humifusus E	x	x	x	x	x	x	x	x	x	x
Scrophulariaceae										
Euphrasia spp.	x	x	x	x	x	x	x	x	x	x

		EA	MP	BB	WC	CK	MF	HM	MR	MW	WJ
E. hookeri	E	x	-	x	x	x	-	-	-	-	-
Stylidiaceae											
Donatia novae-zelandiae		x	x	x	x	x	x	x	x	-	-
Forstera bellidifolia	E	x	-	-	x	x	x	-	x	-	-
Stylidium graminifolium		-	x	x	x	x	-	x	x	-	-
Thymelaeaceae											
Pimelea milliganii	E	x	-	-	x	-	-	-	-	-	-
Umbelliferae											
Aciphylla procumbens	E	x	x	-	-	x	x	x	-	-	-
Actinotus bellidioides		x	-	-	-	x	x	-	x	-	-
A. moorei	E	x	x	x	x	x	x	-	x	-	-
A. suffocata		x	x	x	x	x	x	-	x	-	-
Dichosciadium ranunculaceum	E (var.)	x	x	x	x	x	x	-	x	-	-
Diplaspis cordifolia	E	x	x	x	x	x	x	-	x	-	-
Oreomyrrhis ciliata	E	x	-	x	-	x	-	-	x	-	x
Winteraceae											
Drimys lanceolata		x	x	x	x	x	x	x	x	x	x

E = Tasmanian endemic species; EA = Eastern Arthur Range; MP = Mt Picton; BB = Mt Bobs and the Boomerang; WC = West Coast Range; CM = Cradle Mountain; MF = Mt Field; HM = Hartz Mountains; MR = Mt Rufus; MW = Mt Wellington; WJ = Walls of Jerusalem; * = observed by T. Moscal or R. Williams but not by the author.