REEFTON SOIL SURVEY

SURVEY AREA

The experimental catchments are located south of the Great dividing Range being sub-catchments to the East Armstrong Creek, approximately 30 km east of Warburton and north-west of the upper Yarra Dam. A plan of the catchments and location map appear in fig. 1.

Physiography

The experimental catchments are part of the central uplands. The catchments are bounded by the Reefton Spur to the east and a narrow plateau to the north. The East Armstrong Creek, starting in catchment 6 is the outfall for catchments 1-5.

The physiography of the catchments is the result of deep dissection into sedimentary rock producing a ridge/gully sequence with truncated spurs due to down cutting by East Armstrong Creek. The plateau area within catchment 6 and the higher portion of the Reefton Spur are the remnants of the pre-dissection era.

Climate

Table 1 gives an indication of precipitation variation over the experimental area (see also fig. 1 for the location of data points). Measurements were either taken from ground level rain gauges or from mast rain gauges above the tree canopy as for points 9-13. The figures indicate that the highest average value is in a drainage line in catchment 6 (no. 5; 1509.4 mm) whilst the lowest recorded is on a ridge between catchments 2 and 3 (no. 13: 996 mm).

Table 1: Precipitation distribution

Rain Gauge no.	Annual average Jan '67-Dec '80 (mm)	Elevation + (metres)	Site * Aspect (° from N)	Site* Slope (°)	Annual average May '78-Dec '80 (mm)	Rank
1	1272.3	448	330	6.75	1265.4	8
2	1286.6	448	330	6.75	1246.5	9
3	1232.1	640	339	20	1232.1	10
4	1320.0	759	341	12.5	1320.0	5
5	1490.8	628	171	8.5	1509.4	1
6	1446.4	663	112	10.25	1483.1	3
7	1476.8	780	191	5	1493.6	2
8	1303.4	686	307	15	1303.4	6
9[1]	1170.9	609	244	8.25	1298.3	7
10[1]	1221.0	589	176	30	1212.4	11
11[1]	1271.6	510	241	10	1323.2	4
12[1]	1208.7	608	8	29	1198.1	12
13[1]	968.1	689	301	26	996.4	13

* data from field measurements
+ data from 1:800 contour map
1 traverse sites; mast rain gauges

Data from Wu, A. and Papworth, M.P. (1981)

Figure 1 – Reefton – Location and plan of the experimental catchments

Geology

The geology of the Reefton area is shown in fig. 2.

The survey area is underlain by Lower Devonian sediments which have been classified into two groups; Montys Hut formation and Norton Gully Sandstone.

Montys Hut Formation consists of thinly-bedded sandstone, siltstone and claystone which is extensively folded, often vertically and has occasional minor faulting and fracturing.

Norton Gully Sandstone Formation consists of sandstone, siltation and claystone, the sandstone being variable thickness but thicker than in Montys Hut Formation. Vertical bedding and similar fractured and weathered siltstone and claystone strata are a feature of both formations.

Although the folding of the strata is variable, the occurrence of vertical bedding would seem to be conductive to the percolation of water into the rock. This is particularly likely on the thinly-bedded siltstone and claystone which have a greater weathering potential, and especially so where the beds have been fractured.

The thinly-bedded strata are also susceptible to warping due to regolith creep, particularly where gradients are steep. Plate 1 shows a road cutting through thinly-bedded vertical strata. Also evident are the thin skeletal soils and the resultant creep of loosened rock material, warping downslope.

Geological structure also has an effect on landscape with some drainage lines following structure planes and cleavages.

Topography

The experimental catchments cover an area of approximately 1, 040 hectares. Of this total area, catchment 6 occupies 530 ha or 51% of the total area. The catchments range in size from 69 ha to 530 ha. Catchment size and other physical characteristics are presented in Table 2. See also plate 2.

Relative relief is the difference in elevation between the highest and lowest points in each catchment. Overall, the relative relief is approximately 405 metres; individual catchment figures are given in table 2. Similarity between the lower catchments 1, 3 and 4 is evident, these having lower relief marked increase. Catchments 2, 5 and 6 have distinctively larger relative relief values.

Table 2: Catchment Characteristics

	Catchment	Area (ha)	Circularity Ratio	Relative Elevation	Axis Length (m)	Relief Ration
	1	69.5	0.57	280	1020	0.275
	2	80.2	0.59	325	1838	0.177
	3	94.5	0.63	295	1623	0.182
	4	108.5	0.81	240	1658	0.145
	5	156.5	0.56	375	2070	0.181
	6	530.6	0.47	395	4995	0.080
Total		1039.8				

Axis length is the length of base axis from the stream weir to the 'divide' at the upper point of the axis. Values are given in table 2. The axis length of catchment 1 is small compared with the other catchments, such as catchment 2. However, catchment 2 is only marginally greater than catchment 1 in area. Catchment 6 has the longest axis length, being the largest catchment by also has the lowest circularity ration and therefore is the most linear of the catchments. See table 2.

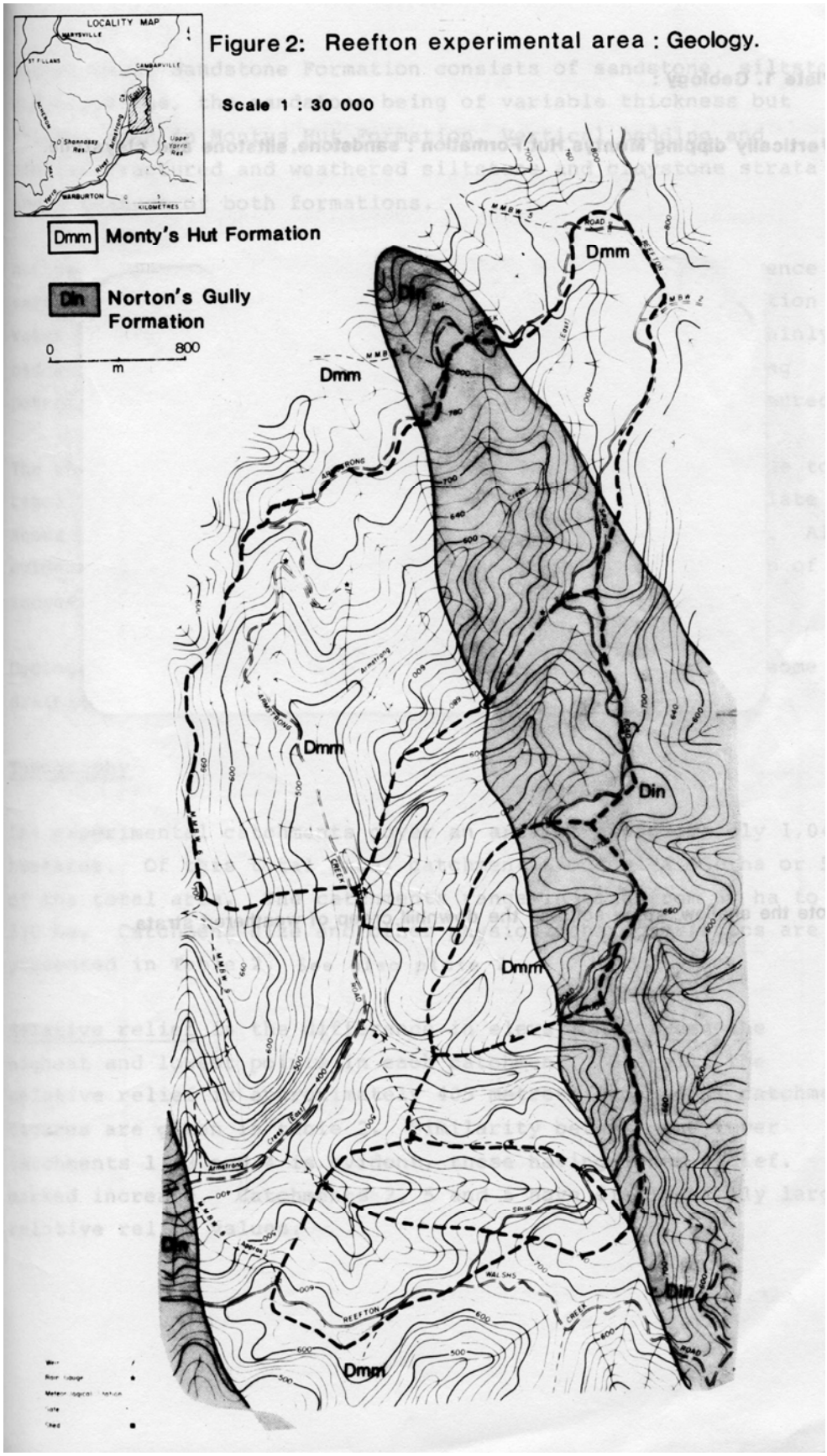


Figure 2 – Reefton experimental area: Geology

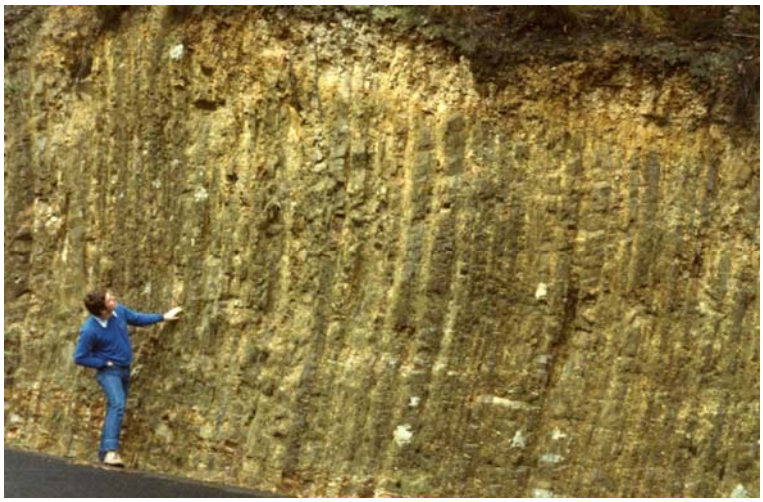


Plate 1 – Geology: Vertically dipping Montys Hut Formation: sandstone, siltstone and claystone

Note the shallow stony soil and the downhill creep of weathered strata.

The **relief ratio** if the relative relief divided by the total axis length and this parameter indicates that catchments 2 to 5 differs significantly different, being more compact while catchment 6 shows greater linearity.

Channel slopes are evident from channel profiles in fig 3. These indicate a number of benches as indicated on the contour map. This benched appearance is also evident on the ridges from crest profiles and on the side slopes, particularly on the northern slopes of catchments 1 to 5 and all sides in catchment 6. It is possible that the benching is due to differential weathering of rock strata. Another possibility could be the differential denudation due to past climatic regimes, or uplifting and differential erosive activity. The former is most likely but some modification sue to the past climatic and erosive phases may explain the incision of the main gullies and nickpoints which are occasionally seen at a level about 40 metres higher than the drainage lines.

Circularity ratios are ratios of the catchment area to the area of circle having the same perimeter. It can be seen from Table 2 that catchment 4 has the highest value of 0.81, being the most circular whilst catchment 6 with a value of 0.47 is the most linear.

Slope

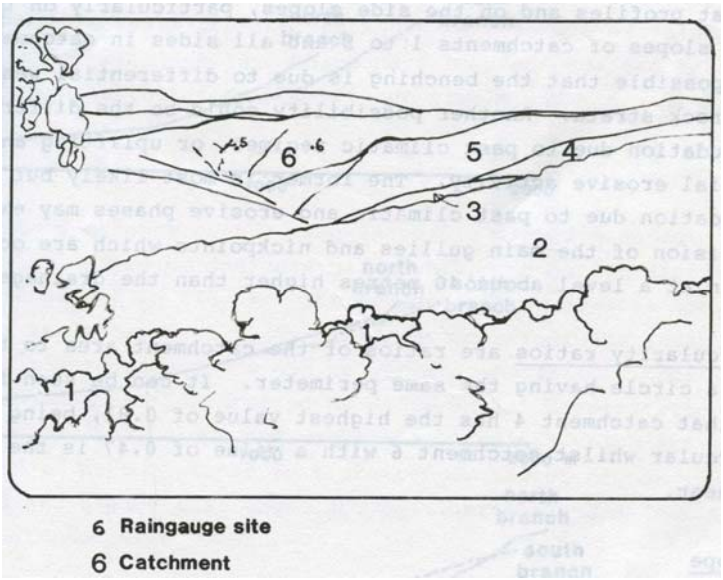
Slope classes and their distribution are shown in Map 1. These are based on a forestry commission vegetation survey report (Baxter, Black & Smith, 1980). The benching effect referred to above and the steep sideslopes and narrow ridges are evident from the distribution of the slope classes. There is a possibly greater proportion of steeper slopes than mapped sue to contour intervals being smoothed out by dense vegetation which obscures the ground surface when viewed from aerial photographs.

It was also found that for a number of catchments, particularly 2 to 5, the south facing slopes were steeper than north-facing slopes and were not dissected in contrast to northern slopes. Field measurements along transects indicated slopes averaging 50% on the main slopes with varying steepness along crests and some incised gully sides. Only in catchment 1 did a mappable area of lower gradient occur.

Drainage

Drainage lines are incised into the landscape, there being few depositional area. Upper drainage lines are not incised but the primary fully streams are incised and have a series of ‘miniweirs’ formed by fallen logs which have trapped bed-load material. Gully erosion is therefore present but stable under normal flows.

Plate 2 – Reefton – View of catchments, looking from catchment 1 to catchment 6



Aspect

Due to the topography of the area there are distinct aspect patterns influenced by drainage alignment. These aspect distributions are depicted in fig 4. The proportions of aspects for each catchment are shown in fig 5. These aspects indicate areas with differing moisture balances due to varying insolation inputs. The differences are accentuated by differential precipitation, relative elevation, slope and vegetation, factors which are considered to be correlated to a greater or lesser degree. Figures 4 and 5 show that there are similarities and differences between catchments.

Catchment 1 is the most northerly facing catchment, with a westerly component. Catchment 3 is similar to catchment 1 but has a greater southerly component. Catchment 2 shows little range of aspect with contrasting NW/SW aspect which indicates the catchment's linearity (see fig 4).

Thus from catchments 1 to 6 there is a gradation from predominantly north-facing to predominantly south-facing aspects. There is a correlation of aspects with vegetation and it was hypothesised that a similar correlation would exist with regard to the distribution of different soils. Aspect differences were found to be pronounced in the field and substantiated the general correlation between aspect, vegetation and soils.

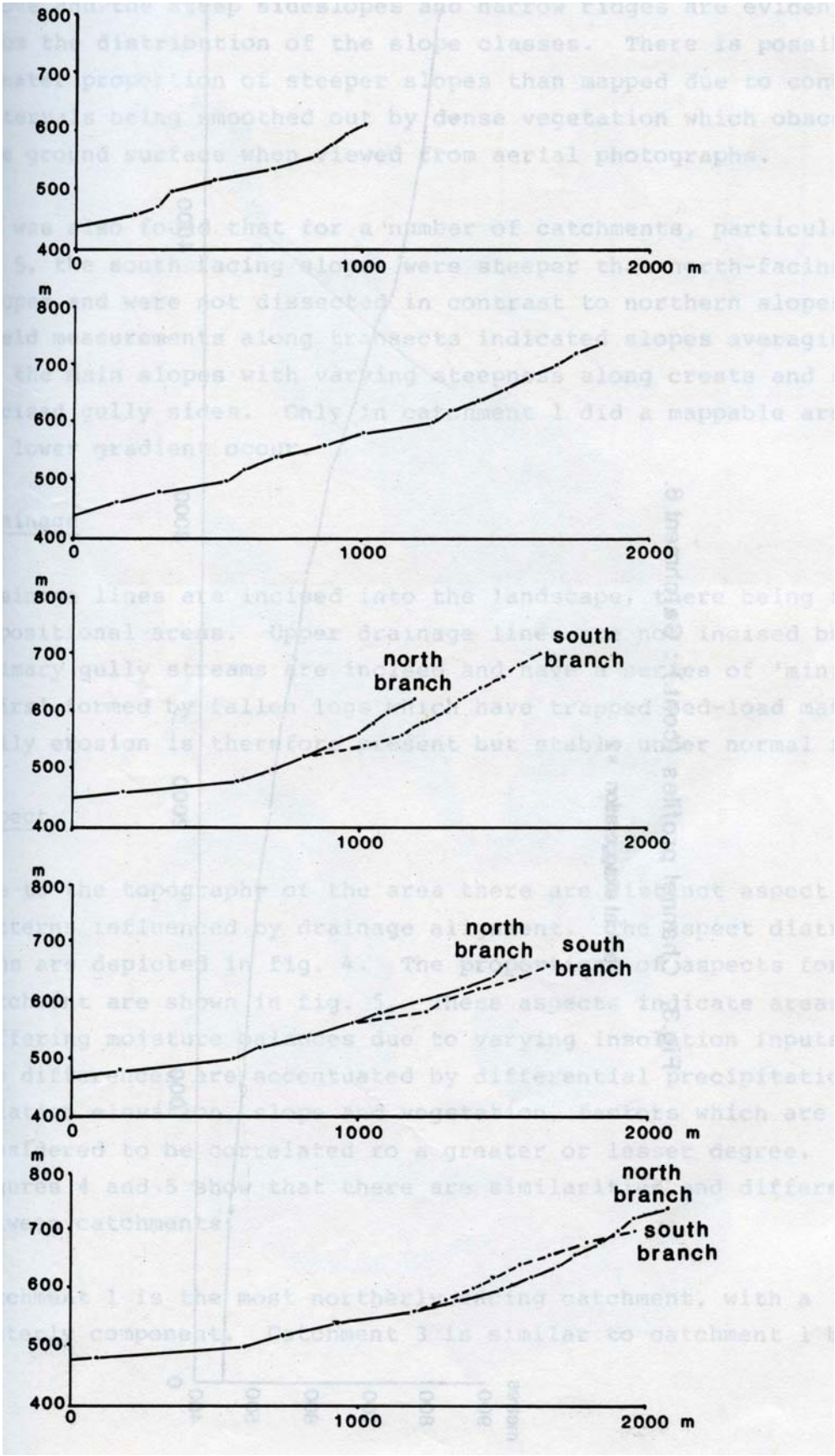


Figure 3 – Channel profile: Catchments 1-5 (vertical exaggeration) x 2

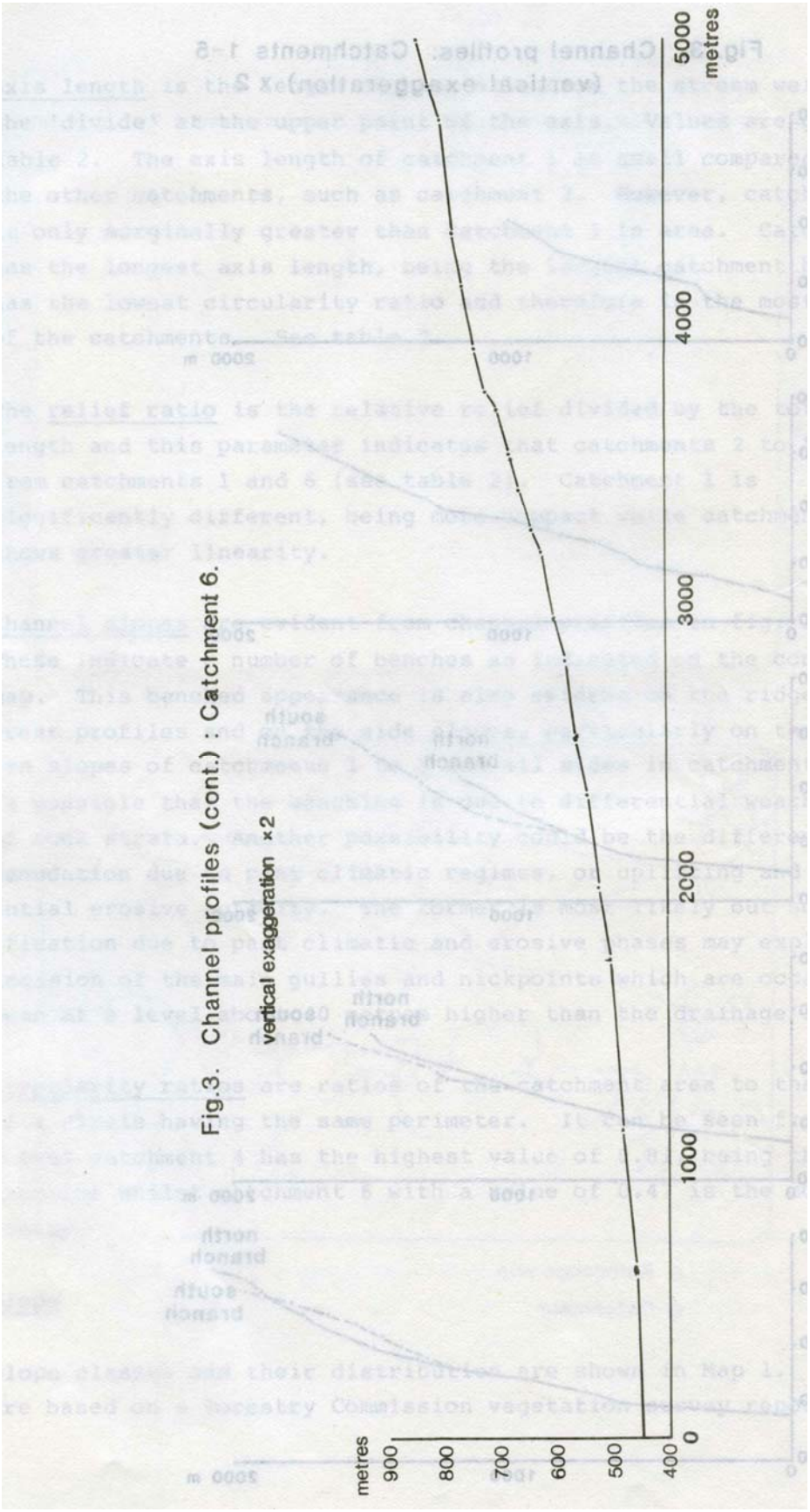


Figure 3 – Channel profile (cont): Catchment 6 (vertical exaggeration) x 2

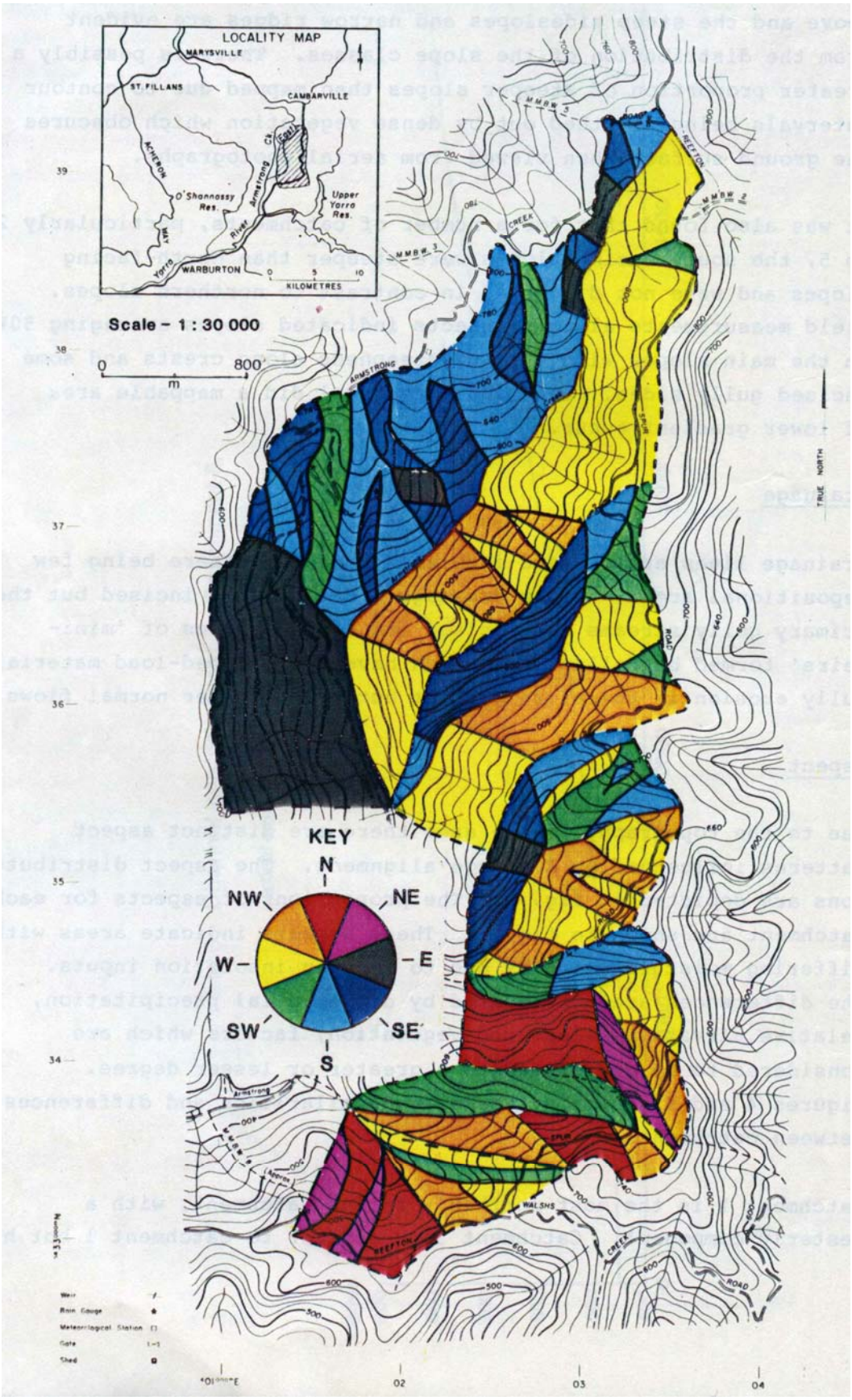


Figure 4 - Aspect

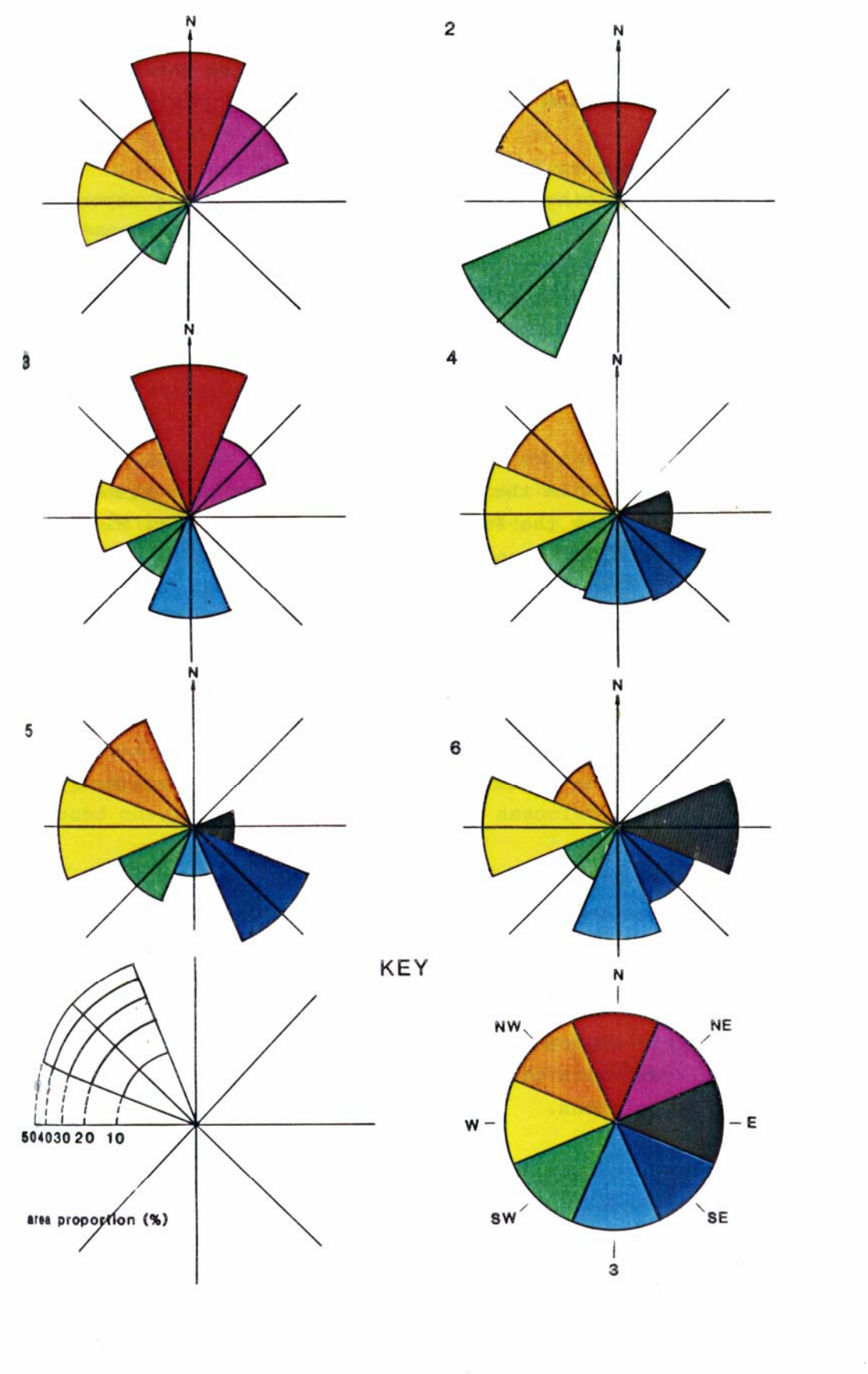


Figure 5 – Aspect Proportions: Catchments 1 to 6

Vegetation

The vegetation patterns in the Reefton survey area have been classified and mapped by the Forestry Commission (Baxter, Black & smith, 1980).

Six associations of overstorey species have been identified and can be grouped into wet and dry sclerophyll forest. There is a subdivision of the associations taking into account species distribution and regrowth areas due to past logging activity.

The first association is dominated by Mountain Ash (*Eucalyptus regnans*) (see map 2).

Subdivisions of the classification take into account the association of Mountain Grey Gum (*E. cypellocarpa*) and Messmate (*E. obliqua*) with the dominant Mountain Ash which also occurs in pure stands. This vegetation association occupies most of the lines and southerly aspects. Individual trees of particular species can be found with other vegetation associations, though with the above conditions.

The understorey is a 'wet' forest type with acacia (*A. dealbata*, *A. obliquinervia*) and other species such as *Bedfordia salicina* (Blanket leaf) and *Pomaderris aspera*. Tree ferns were present in most gullies and on some slopes. Ground ferns (bracken) were present in some places, particularly cleared area. There is little ground cover apart from leaf litter except where clearing has enable some tree regrowth as well as bracken and grass growth.

The second grouping is the Messmate association. In such areas Messmate is dominant in associations with Mountain Grey Gum and narrow-leaf Peppermint (*E. radiata*). Messmate is also found as regrowth with or without other species. This association occupies mainly southerly aspects but also on some westerly and easterly aspects. These positions are drier than those for Mountain Ash but wetter than for other associations.

There is greater differentiation between species of this association in catchment 2 than in catchment 6. In the latter, the species of the association are evenly distributed whereas in catchment 2 Mountain Grey Gum occupies positions close to the stream, the messmate and narrow-leaf peppermint are located further upslope. The understorey is generally of a 'dry' type with *Pultenaea juniperina* and *Pteridium esculentum* (bracken) being common in wetter places. With increasing dryness a greater through patchy ground cover occurs, particularly native grasses. Where the aspect and canopy density and to some extent past logging are combined facilitating greater dryness there is little ground cover, particularly on drier associations.

The third grouping is the Brown Stringybark (*E. baxteri*) association. Together with narrow-leafed peppermint the brown stringybark occupies the lower slopes with northerly and westerly aspects. There are also sporadic occurrences of mountain grey gum in wetter positions. The understorey is shrubby, in most places denser downslope where taller understorey species occur. Ground cover is particularly sparse on the upper reaches of this association.

The fourth grouping is the Silvertop (*E. sieberi*) association. This association consists of predominantly silvertop and some narrow-leaf peppermint and occurs on the drier ridges, crests and upper slopes with northerly and westerly aspects.

Understorey development is poor as is general tree height and association often grades into the Brown Stringybark association. Silvertop regrowth also occurs and the understorey is denser in those areas. Silvertop was found to be generating in some areas of the Messmate and Brown Stringybark associations.

The fifth grouping is the Peppermint (*E. radiata*, *E. dives*) association which is limited in pure stands to catchment 1 with some occurrences on other dry sites, particularly on northerly aspects. The 'dry' shrubby understorey dominates below the canopy with greater variety of species on moister southerly aspects and adjacent to drainage lines.

The sixth grouping is the Gully association consisting of 'wet', tall understorey species such as acacia (*A Dealbata*, *A. Obliquinervia*, *A. melanoxylon*) Hazel pomederris (*Pomederris*

aspera) and Blanket-leaf (*Bedfordia Salicina*). Tree and ground ferns are also present and all are part of the understorey for the Mountain Ash association.

Vegetation Distribution

Distribution of vegetation types can be explained in terms of slope, aspect, elevation exposure and soil depth. A sequence of vegetation types with decreasing moisture (and moisture availability) can be identified. The sequence ranges from the Mountain Ash and Gully associations with the greatest moisture availability, decreasing through the Messmate, Brown Stringybark and Silvertop associations with the Peppermint association having the least moisture availability.

As a general trend this correlation is paralleled by changes in observable soil characteristics. The sequences identified are therefore distributed in terms of the factors mentioned above i.e. and aspect map should show similarities between particular aspects and particular tree associations.

Table 3 is modified from Baxter, Black, sith (1980) and gives the distribution of vegetation types I the various catchments. The Mountain Ash groups increases in proportion from 0 in catchment 1 to 40.5% of catchment 6. A very high proportion (60.5%) of catchment 1 is under Brown Stringybark. Both catchments 1 and 2 have high Silvertop proportions (26.1% and 30.4% respectively). Catchment 2 is dominated by the Messmate association.

For the total area, Mountain Ash (29.8%), Messmate (33.4%) and Brown Stringybark (20.5%) were the most widely distributed associations. Brown Stringybark accounts for 34.3% of catchment 4 and 34% of catchment 5, but catchment 5 has a greater percentage of Mountain Ash (38.8%) and therefore a greater proportion of wetter type vegetation (17.8% of catchment 4 is under mountain ash).

Table 3 Vegetation*: vegetation type for each catchment (hectares) and proportion of catchment per vegetation type.

	Catchment						
Vegetation type	1	2	3	4	5	6	Total
1A			6.8	5.9	32.2	42.0	86.9
1B		3.2			0.7	68.4	72.3
1C						4.1	4.1
10			2.0	13.5	28.1	98.3	141.9
Mountain Ash Total (ha)		3.2	8.8	19.4	61.0	212.8	305.2
(% of catchment)		(4.4)	(9.7)	(17.8)	(38.8)	(40.6)	(29.8)
2A		32.2	22.5	28.4	5.6	225.5	314.2
2B						13.1	13.1
2C		3.4	5.9		1.1	4.3	14.7
Messmate total		35.6	28.4	28.4	6.7	242.8	342.0
(% of catchment)		(46.6)	(31.3)	(26.2)	(4.3)	(46.2)	(33.4)
3. Brown stringybark total	39.6	14.4	24.3	37.4	53.3	41.0	210.0
(% of catchment)	(60.5)	(18.8)	(26.8)	(34.3)	(34.0)	(7.8)	(20.5)
4A	17.1	23.3	21.4	20.3	29.5	28.4	139.9
4B			0.9		0.7		1.6
Silvertop total	17.1	23.2	22.3	20.3	30.2	28.4	141.5
(% of catchment)	(26.1)	(30.4)	(24.7)	(18.6)	(19.2)	(5.4)	(13.9)
5. Peppermint total	8.8		0.9				9.7
(% of catchment)	(13.4)		(1.0)				(0.9)
6. Gully total			5.9	3.4	5.9		15.2
(% of catchment)			(6.5)	(3.1)	(3.7)		(1.4)
TOTAL	65.5	76.4	90.6	108.9	157.1	525.1	1023.6
TOTAL (% catchment)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

* adapted from Bates, Black and Smith (1980)