THE INFLUENCE OF PRE-EUROPEAN FIRES IN THE TIRITEA CATCHMENT, NORTHERN TARARUAS

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INTRODUCTION

The deterioration of the plant cover of the city water catchment in the upper Tiritea Valley is causing some concern to the Palmerston North City Council. Many areas formerly in forest have been reduced to scrub, tussock and turf. Although most of the catchment has a "burnt-over" appearance there is no definite record of fires. The vegetation of the Tararuas has been described by Zotov (1938) and Zotov *et al.* (1938), but only passing reference has been made to the portion between the Mangahao River and the Manawatu Gorge.

The upper Tiritea catchment is enclosed by the tortuous main ridge of the Tararua Range and two of its side spurs. The main ridge undulates between 1300 and 1848 ft. with the two spurs from it dipping down to around 500 ft. at the outfall where the two dams are sited. Most of the country is rolling but many spurs drop steeply into the Tiritea Stream. This stream, draining about two-thirds of the catchment, and the Little Tiritea Stream draining the remaining third discharge separately into the main dam at 570 ft. The flow seldom falls below 3½ million gallons per day and even in dry periods delivers more than one million g.p.d. (Vickerman *et al.* 1945). There is some movement of the shattered greywacke on the steeper slopes but little of this reaches the streams. The measured siltation rate is about 0.02 per cent of the stream flow (Hogg 1951). This is regarded as normal for country of this nature.

Lying on the sag of the Tararua Range the catchment receives strong and persistent winds with a predominant east-west trend. Figures given in Fig. 1 are the 1941–51 averages for Palmerston North. The heaviest recorded gale was in 1936 when widespread damage was caused in the catchment as elsewhere in the Tararuas. Rainfall records for the filter house at an elevation of 430 ft. show an average of 46.4 inches per annum on 168 rain days. On the crest of the range annual precipitation is probably in excess of 100 inches. Here frequent fog to some extent counters part of the moisture loss due to wind.

VEGETATION

All the catchment has been forested sometime in the past but the 927 acres of private land on Brown's Flat and at the heads of the western and northern side streams were cleared for farming around 1900. The portion vested in the City Council has a wide variation in plant cover from healthy forest to communities of scrub, tussock and turf.

Below 1,000 ft. the cover is dominated by tawa (*Beilschmiedia tawa*) but there are overmature emergent rimu (*Dacrydium cupressinum*) and northern rata (*Metrosideros robusta*). Both species have failed to replace themselves and persist particularly in the deeper gullies, as relics of a former rimu/northern rata forest. Few kamahi (*Weinmannia racemosa*) remain but logs of this species and of northern rata are evenly distributed over the whole catchment. Miro (*Podocarpus ferrugineus*) is the only podocarp of consequence remaining. It equals rimu in numbers along the streams but, unlike rimu, extends to the heads of most gullies.

Above 1000 ft. scrub dominates, ranging from 2 to 20 ft. tall, with scattered, clean-boled miro standing above it. There are also increasing patches of tussock and turf. These communities are discernible:—

(i) Broad-leaved shrub community. This is the finger-like extension of the tawa forest to

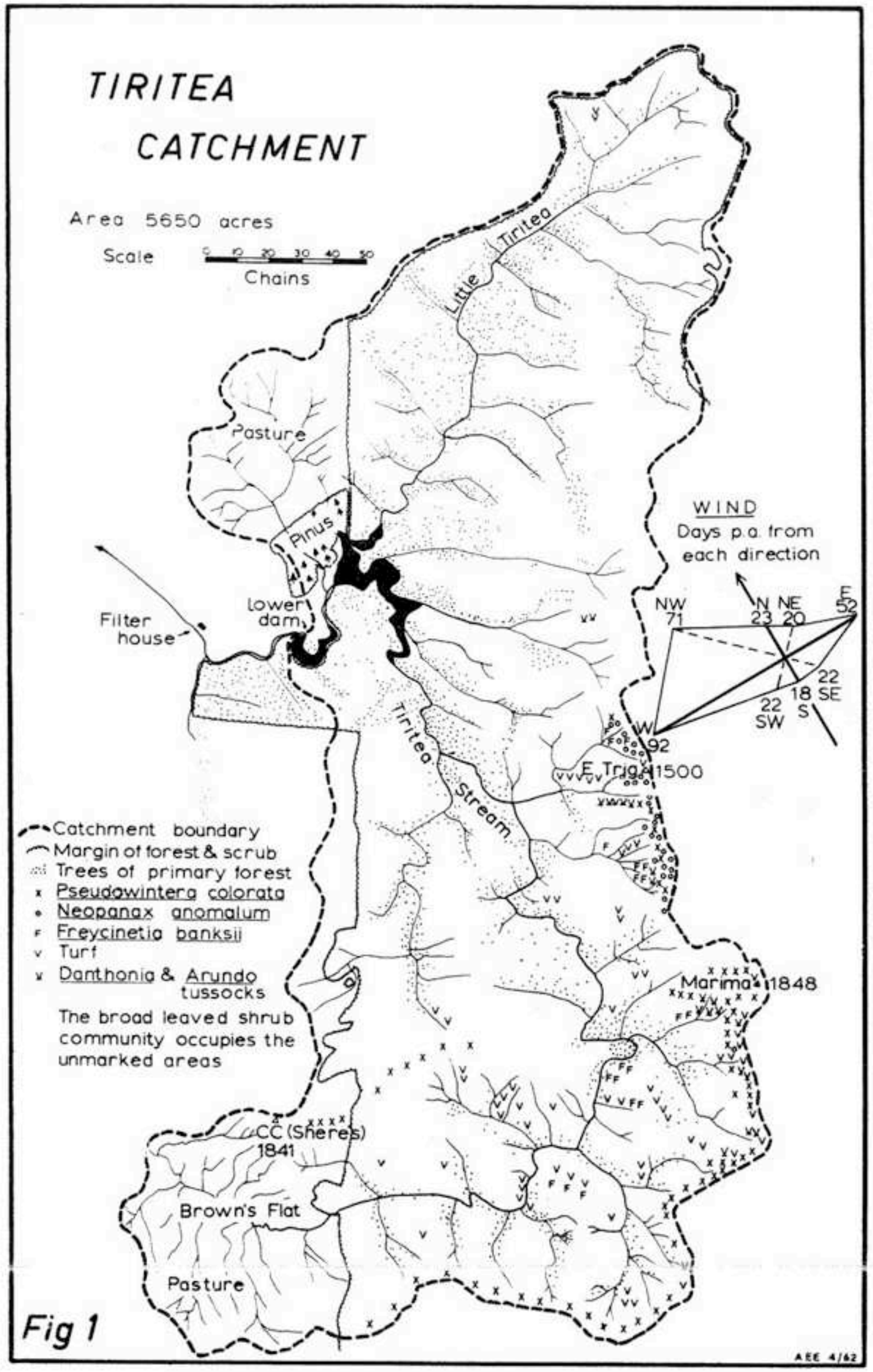

FIGURE 1. *Vegetation of the Tiritea catchment.*

FIGURE 2. Microlaena/Uncinia *sward in a light pool being replaced by turf as the site becomes more exposed.*

the summit of the range up gullies and sheltered slopes. With increasing altitude tawa is replaced by mahoe (*Melicytus ramiflorus*), pigeonwood (*Hedycarya arborea*), raurekau (*Coprosma australis*), toro (*Myrsine salicina*), putaputaweta (*Carpodetus serratus*), heketara (*Olearia rani*), *Pseudowintera axillaris, Cyathea smithii* and 2 species of lawyer (*Rubus*).

(ii) *Pseudowintera colorata* scrub becomes dominant on most exposed sites above 1,600 ft. and is the most extensive community at higher altitudes. At its margin where it merges with the broad-leaved scrub community it reaches a height of 15 ft. but on exposed ridges is dwarfed. On the ridge between E Trig and Marima its dwarfing is accompanied by a rising predominance of *Neopanax anomalum*.

(iii) *Neopanax anomalum* scrub is of more limited distribution than *Pseudowintera colorata* which it replaces on wind-swept ridges with shallow soils. It forms a blocky windroof at 8 ft. on the ridge north of E Trig but in other wind channels between E Trig and Marima it is dwarfed to 2 ft. There is no sharp boundary with the *Pseudowintera colorata* scrub but it is replaced on the crests of some ridges and dry knolls by turf or tussock.

(iv) Turfy areas occur only above 1,000 ft. These turfy patches are circular on E Trig and Marima summits — due possibly to clearing to expose the trig stations — but on the ridges are elongated. Nowhere are they more than a square chain in area. *Helichrysum filicaule*, the dominant plant, is usually accompanied by sweet vernal (*Anthoxyanthum adoratum*), *Notodanthonia* sp., *Veronica serpyllifolia, Wahlenbergia gracilis, Gnapnalium collinum, Libertia ixioides* and ragwort (*Senecio jacobaea*).

(v) The tussock communities are dominated by *Chionochloa conspicua* sbsp. *conspicua* and toetoe (*Cortaderia fulvida*). (These are referred to in Figure 1 by the superseded generic names *Danthonia* and *Arundo* respectively.) Most tussock areas in the south of E Trig are on windswept ridges.

(vi) Rangiora (*Brachyglottis repanda*) is ubiquitous above 1,000 ft. occurring with other broad leaved shrubs in the *Pseudowintera* scrub but dominating in a stunted form in some steep sunny wind channels such as the "blowhole" on E Trig.

(vii) Terrestrial kiekie (*Freycinetia banksii*) is a conspicuous feature of many ridges where it may exclude all other plants from an area of a square chain or more. Colonies apparently had their origin in the collapse of kiekie-clad trees.

CAUSES OF DETERIORATION

In the absence of recorded fires critical examination was made of animal and climatic factors but neither explained the destruction of the primary forest and its replacement by a number of diverse communities. Ring counts in the scrub communities were too variable to give an accurate date of the destruction but did point to the possibility of the cause being prior to the establishment of the constituent species. The answer was further obscured by the varying stages of decay of logs, suggesting not a sudden catastrophe but some continuous agency probably still operating. Not until the relic miro were aged and charcoal found in a number of places did a solution appear. On the scrub-dominant areas miro fell into two age classes, (i) up to 150 years and (ii) over 300 years. The presence of seedlings, saplings and trees of miro up to 150 years old placed the fire outside the time of pakeha occupation. The minimum age of the older trees set the other limit on the time of the fire. This 1660 to 1810 margin can be narrowed by assuming, firstly, that miro, not being a pioneer, did not re-establish for several decades after the fire, and secondly, that the surviving miro were at least 100 years old at the time of the fire. This places the fire at around 1760. Evidently the fire was not intense nor did it cover the whole catchment. It is interesting to note that Joseph Banks wrote in his diary on 16 October 1769 — "At night we were off Hawks Bay and saw two monstrous fires inland on the hills" (Morrell 1958). Maori fires were too numerous for this to be regarded as the same fire. Furthermore, the Tararuas would be obscured by the Puketoi Range or the Whangai Range. However, it indicates that there were fires in the area around that period.

Although not reported definitely, there may have been secondary fires in the catchment. In January 1898, after a particularly dry summer, a fire originating on the western side of the Tararuas and visible from Palmerston North swept over the range into northern Wairarapa (Christensen 1945, also Department of Lands & Survey Rept. 1898 and the *Pahiatua Herald* 14 January 1898). The western limits of the fire are not defined but the vegetation at the head of the Little Tiritea bears the stamp of a fire more recent than 1760.

STATUS OF COMMUNITIES

The occurrence of fire clarifies the status of scrub, tussock and turf communities. All are seral but the normal course of succession has been deflected by the absence of a clean burn, and by grazing and browsing mammals. Local soil and wind conditions have slowed up forest regeneration on the ridges.

There was apparently little vigorous podocarp regeneration after the fire due possibly to the formation of a close-canopied shrub community persisting into the first quarter of this century. Opening of this canopy appears to coincide with increasing populations of deer, cattle, sheep and opossums. Deer were liberated in 1901 (T. Strickland, pers. comm.) and in 1927 were considered to be numerous (F. Hayes, pers. comm.). During the second World War numbers rose to a high level and in the early post-war years large numbers were shot, as many as 20 frequently being seen by shooters in one day. There were wild cattle in the catchment from an early date but they were either shot out or drifted south. More recently cattle have penetrated fairly deeply as fences along the western boundary have deteriorated. Although sheep have been seen in many parts of the catchment they appear now confined to the head of the Little Tiritea, gaining access from adjacent farmland. Hayes states that the main opossum liberation was in 1907. They were fairly numerous around the caretaker's house in 1918 and were very numerous when the first season opened in 1921. Large numbers were taken in the Tiritea that year and for a number of years afterwards. Their numbers at present are not high. Although there are signs of pigs throughout, their numbers are greatest in the Little Tiritea and around Marima.

Recalling the condition of the vegetation in 1927, Hayes comments that the forest was very open. This is not true of the vegetation in 1962. Forest and scrub alike are not easy to traverse. Most of the low-growing species are unpalatable. Young plants of mahoe, in particular, are rare. The failure of mahoe, pigeonwood, toro, and other small secondary forest trees to maintain a closed canopy is consistent with past animal depredation but the 1936 gale was a contributory factor. There is evidence, too, of death of kamahi in the post-gale period as in the Ruahines between 1952 and 1955. Damage there was attributed to opossums.

The broken canopy has stimulated the development of turf and tussock and, to a lesser extent, the *Pseudowintera* and *Neopanax* scrub. There is ample evidence of development of a *Microlaena*/*Uncinia* sward in light pools and its replacement by tussock and turf as the site becomes more exposed when the remaining trees die (Fig. 2). The dynamics of the scrub communities are more difficult to elucidate. *Pseudowintera* invasion has almost certainly followed canopy deterioration but *Pseudowintera* is capable of directly replacing other broad leaved shrubs. Unpalatability, ability of its seedlings to withstand dense shading together with tolerance of thin soils and strong winds contribute to its success. As the species is more fire resistant than most shubs its dominance in some places may have been induced by fire. The *Neopanax* scrub is possibly a wind-induced development from *Pseudowintera* communities rather than a direct successional development from a decadent broad leaved shrub community.

In brief it appears that (i) the 1760 fire was the primary cause of the destruction of the forest cover; (ii) The broad leaved shrubs which followed suffered heavy animal damage; and (iii) deterioration of the shrub community resulted in the invasion of turf, tussock, *Pseudowintera* and *Neopanax* either directly or via an intermediate phase.

Future vegetation changes are difficult to predict, but at the higher altitudes non-forest communities are likely to persist for a long period as the present trend is away from forest. However, these changes, in the short run at least, probably will not significantly influence the soil and water conservation value of the vegetation.

CONCLUSION

This paper extends the known area of pre-European fires and the dating of a major fire elucidates some aspects of the forest dynamics of the Northern Tararuas. Although only the Tiritea catchment has been studied in detail, this same fire, or another in the same period, apparently swept much of the Otangaue, Kahuterawa and Tokomaru catchments.

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REFERENCES

CHRISTENSEN, V. A., 1945: *A brief history of early Tiritea.* Simon Printing Co. Ltd., Palmerston North, N.Z.

HOGG, G. F., 1951: *Water Supply Report.* P.N. City Council, Palmerston North, N.Z.

MORRELL, W. P. (Editor), 1958: *Sir Joseph Banks in New Zealand.* A. H. & A. W. Reed, Wellington.

VICKERMAN, H. CAMPBELL, R. A., and CORKILL, F. M., 1945: *Joint report on the city's water supply.* P.N. City Council, Palmerston North, N.Z.

ZOTOV, V. D., 1938: Some correlations between vegetation and climate in New Zealand. *N.Z. J. Sci. Tech.* 19: 474–487.

ZOTOV, V. D., *et al.*, 1938: An outline of the vegetation and flora of the Tararua Mountains. *Trans. Roy. Soc. N.Z.* 68: 259–324.

ORIGINS OF THE NEW ZEALAND ALPINE FLORA

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In Table 1 I have attempted to classify the New Zealand alpine and subalpine genera according to their probable country or region of origin. The scheme is tentative, but it is hoped that it comes sufficiently near to the truth to provide an overall picture of the sources of the New Zealand alpine flora.

Guesses as to the place of origin of a genus can be based on a variety of evidence, probably the most reliable being that of the fossil record. Not all genera are represented as fossils, however, and in many parts of the world the fossil record is virtually unknown. The available fossil evidence has been considered in this paper. Present day evidence includes any concentration of species of a genus in an area or any concentration of species regarded as primitive, for instance *Acaena* has most of its species and also most of its primitive species in South America. Where a genus has only one or a few living, or perhaps surviving species consideration of the distribution of related genera or of the family as a whole may be useful: thus *Pseudowintera* is restricted to New Zealand, but the family Winteraceae is predominantly tropical or subtropical in distribution. Morphological features characteristic of certain types of world vegetation may also be taken into account, for instance the living species of *Pseudopanax* are south temperate, but some have a juvenile form of a type exhibited by a number of tropical trees. In addition the family Araliaceae is predominantly tropical or subtropical in distribution.

Perhaps the most interesting group of genera is that regarded as originating in the extensive pre-quaternary tropical to subtropical zone. These appear to be basically forest genera, which in New Zealand have given rise to a few species suited to alpine and subalpine habitats. As a result the woody genera in this group exhibit a remarkable range of plant form. In *Dacrydium**, for instance, there is *D. cupressinum* at one extreme, one of our largest forest trees, and *D. laxifolium* at the other extreme, a prostrate subalpine shrub sometimes described as the smallest conifer in the world. In *Coprosma* there is a complete range from small forest trees, through small

* The conifers in this group have a much longer fossil record in the southern hemisphere than the angiosperms, so perhaps the problem of their origin should be regarded as a separate matter.