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PODOCARPUS AND OTHER HIGHLAND PLANTS IN EASTERN TASMANIA RELICTS FROM LAST GLACIAL TIMES?

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ABSTRACT

McPHAIL, M.K. and MOSCAL, A., 1981 (30 ix): *Podocarpus* and other highland plants in eastern Tasmania - relicts of Last Glacial times? *Pap. Proc. R. Soc. Tasm.*, 115, 1-3. https://doi.org/10.26749/rstpp.115.1 ISSN 0080-4703 Department of Geography, University of Tasmania, Hobart and Midway Point, Tasmania, Australia.

Podocarpus and other typically highland plants found growing at low elevations on the East Coast are probably relict from last glacial times. Their occurrence demonstrates the importance of plant competition in determining community composition and the need for caution when using modern botanical data to interpret the fossil record.

INTRODUCTION

In April of this year the shrub conifer *Podocarpus lawrencii* and the composites *Cotula alpina* and *Celmisia longifolia* were found (A.M.) growing at low elevations along the Douglas River in eastern Tasmania (41° 48'S; 143°55'E). Further collecting by Mark Noble (Australian National University) revealed a third unexpected composite, *Gnaphalium umbricola*, and the fern *Blechnum penna-marina* in the same area. Since all are typically subalpine-alpine species (see Curtis 1956, 1963; Jones and Clemesha 1976) their occurrence at low elevations calls for some comment.

LOCATION

The Douglas River rises in the low (maximum elevation 720 m) dissected plateau terrain south of Fingal Tier and flows southwards to reach the east coast in Maclean Bay, 10 km north of Bicheno. The source of the river is the Thompson Marshes but towards the middle and lower reaches the river is deeply incised into the plateau, flowing over several low waterfalls within a deep, shaded gorge. Both habitats are cool and moist, affording protection from fire, in contrast to the usual warm, subhumid and fire-prone environments of eastern Tasmania (Gentilli 1972). This is reflected in the composition of the riparian vegetation. The lower sector of the Thompson Marshes supports a heathland of *Leptospermum lanigerum-Melaleuca squarrosa-Callistemon viridiflorus* below scattered *Eucalyptus rodwayi* whilst riverbank communities downstream are mostly closed scrub and heath, usually *Notelaea ligustrina*, *Pomaderris apetala* and *Leptospermum lanigerum* but with some stands of *Nothofagus cunninghamii* and *Atherospermua moschatum*. The main *Podocarpus* stands occur above the waterfalls, growing on dolerite at about 420 m elevation. These consist of shrubs up to 2 m tall within *Nothofagus cunninghamii-Atherosperma* closed scrub, Individual *Podocarpus* shrubs are also found much lower down - to about 80 m elevation - and growing on sandstone and river gravels. Some are within reach of flood water and are shaped accordingly. The composites occur at elevations both higher and lower than *Podocarpus: Cotula alpina* and *Celmisia longofolia* in the lower Thompson Marshes at about 440 m, *Gnaphalium umbricola* and (*Blechnum penna-marina*) at about 60 m elevation. These elevations are compared with the altitudinal ranges of the same species on the north-facing slopes of Ben Lomond in table 1.

DISCUSSION

The Douglas River *Podocarpus* is the most easterly stand of the species known to date and, at 80 m, amongst the lowest in elevation in Tasmania. Other records for eastern Tasmania are uniformly on mountain summits and often in relatively exposed situations, e.g. at 1130 m on Mt Wellington and above 1380 m on the north-facing slopes of Ben Lomond (table 1).

TABLE 1

Plant Species	Altitudinal Range (metres above sea-level)	
	Douglas River	Ben Lomond (north-facing slopes of)*
Blechnum penna-marina	*ca* 60	1040-1560 (also at Lake Leake and in Fingal Valley)
Celmisia longofolia	*ca* 440	1100-1570
Cotula alpina	*ca* 440	1020-1565 (also Midlands)
Gnaphalium umbricola	*ca* 60	1100-1300
Podocarpus lawrencii	80-420	1380-1545

* M. Noble (pers. comm.)

Although *Podocarpus* occurs relatively close to sea level in western Tasmania and at about 240 m elevation in the Cubits Sugar Loaf - Long Ridge area behind Deloraine (W.D. Jackson pers. comm.), these occurrences are more obviously related to a downslope extension of cold, wet climates or (unlike the Douglas River stands) relatively close to highland vegetation containing the conifer. Nevertheless the species will grow well in cool, shaded garden situations near sea-level in Hobart.

These considerations suggest that relative freedom from plant competition as well as climate is important in determining the present distribution of *Podocarpus*. Significantly, the wiry habit of the plant enables it to withstand periodic extreme conditions such as flooding. The question is therefore not why *Podocarpus* can survive along the Douglas River but how (and when) the species came to be established there. Two possibilities exist:
(a) the stands are the result of a fortuitous but relatively recent arrival of seed from distant highland stands, or
(b) the stands have survived from an earlier, presumably colder, period during whith *Podocarpus* was more widely distributed than at present, i.e. are relict. The requisite cold conditions are known to have existed during the last glaciation, ending some 11,500 - 10,000 years ago (Colhoun 1978).

As with most podocarps, the fleshy bract supporting the female cone of *P. lawrencii* is likely to be attractive to birds and the seasonal migration of birds to and from the Central Highlands is a possible way podocarp seed has been carried to the Douglas River. This seed type may also be transported by water and the individual specimens growing downstream of the waterfalls on the Douglas River are probably spreading from the upstream stands in this way. Both *Celmisia* and *Gnaphalium* have florets with a pappus, making wind-dispersal of their seeds possible. In contrast *Cotula alpina* lacks a pappus and its seeds are unlikely to be dispersed far from the parent plant.

Accordingly it is possible that all 'highland' species except *Cotula alpina* have been independently and fortuitously established. Taken collectively, the evidence for fortuitous establishment becomes less likely and (circumstantially) five subalpine species in the one area supports a relict origin. A similar argument might be put forward for the presence of riparian rainforest scrub along the Douglas River. Testing this hypothesis will require a study of the vegetation history of the East Coast plateaux and gorges, e.g. via fossil pollen preserved in the river marshes. Pollen of *Podocarpus*, *Nothofagus cunninghamii* and *Atherosperma* is distinctive, making past *local* occurrences easy to detect via pollen analysis of cores taken from the river marsh deposits and dated by radiocarbon.

If *Popocarpus et al.* are in fact relict species on the Douglas River, then current theories on the distribution of some plant communities during the last glaciation and directions of spread in the postglacial will have to be revised. These propose that depressed temperatures and reduced effective precipitation had resulted in a substantial lowering of the treeline across Tasmania, leading to 'cold steppe' grasslands in inland

eastern Tasmania and restricting rainforest and conifer species mainly to western Tasmania in the latter part of the last glaciation (Macphail 1975, 1979; see also Ogden and Powell 1979).

Because conditions in eastern Tasmania were dry as well as cold, particularly during the "glacial maximum" some 18,000 years ago, any expansion of *Podocarpus et al.* to include the Douglas River is likely to have taken place somewhat earlier. Extremely wet, relatively cool conditions occurring earlier in the Last Glacial, at about 32,000 years ago, are one possibility. Survival of the relict community on the Douglas River, through the "glacial maximum" and subsequent postglacial period would only be possible in a deep gorge niche such as the Douglas River provides. As with the conifers and rainforest in "refugia" in western Tasmania, these relict communities would act as sources of seed enabling the plants to recolonize ice-influenced terrain during rapid rise in global temperatures between about 14,000 and 10,000 years old.

The discovery of *Podocarpus* and composites reported here illustrates the need for extensive plant collections in areas outside National Parks. Such information together with good habitat data assists in the understanding of the present-day ecology but is essential in the pollen-based study of past vegetation and climates. Here the modern altitudinal limits for important species are widely used to transform the fossil pollen data (reflecting changes in past vegetation) into palaeoclimatic values. Anomalies such as the Douglas River *Podocarpus* emphasise the dangers of an overly precise use of botanical data to deduce past environments, particularly by non-botanists. The New Zealand combination of modern plant distribution data (e.g. Burrows 1965) and fossil pollen data (Moar 1971, Dodson 1978), allowing patterns of postglacial plant migrations to be established, is a model of what might be achievable in Tasmania.

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