INDIGENOUS PLANTS IN THE EXOTIC PLANTATION FORESTS OF THE CANTERBURY PLAINS

David A. Norton[1]

Introduction

Exotic plantation forestss have often been described as 'biological deserts' and thought to be of little value for conservation. However, more and more of these biological deserts are being found to have a surprisingly rich indigenous flora (e.g., Ogle 1976, 1989, Rooney 1989), and in some cases provide a valuable refuge for some of our less common indigenous plants (e.g., the orchid *Chiloglottis gunnii* at Hanmer forest). In Iwatahi, central North Island, a 6 ha area of *Pinus nigra* has recently been given reserve status by the New Zealand Forestry Corporation, because of its rich indigenous orchid flora; about 30 species (Gibbs 1988). The prolific growth of tree ferns and other indigenous plants is a conspicuous feature of many North Island conifer plantations, as is easily observed driving along many central North Island roads. However, the conservation value of the drier eastern South Island plantations has perhaps not been as widely recognised, and is discussed in this article.

The Canterbury Plains is usually regarded as a poor place to look for indigenous plants. Outside the few scattered reserves, you may be lucky to find one or two silver tussocks (*Poa cita*) beside the main south road, or *Blechnum minus*, *Carex virgata*, and a very few *Typha orientalis* and *Phormium tenax* along drainage ditches. Other indigenous plants occasionally found include cabbage trees (*Cordyline australis*), pohuehue (*Muehlenbeckia australis*), and towards the main rivers, matagouri (*Discaria toumatu*), kowhai (*Sophora microphylla*), *Raoulia* species, *Rytidosperma* species and one or two other herbacious plants. However, the indigenous flora is not rich and is very sparsely distributed.

Across the Canterbury Plains are large areas of exotic plantations (mainly of conifers), those between the Waimakariri and Rakaia Rivers being controlled by the Selwyn Plantation Board. Close to Christchurch itself is Bottle Lake Forest run by the Christchurch City Council, and just north of the Waimakariri River is Eyrewell Forest owned by the New Zealand Forestry Corporation. The dominant tree in these plantations is *Pinus radiata*, but several other species can also be found, especially in the Selwyn Plantation Board forests (e.g., Douglas fir *Pseudotsuga menziesii*, European larch *Larix*

[1]School of Forestry, University of Canterbury, Private Bag, Christchurch.

decidua, *Pinus ponderosa* and species of *Eucalyptus*). These plantations have a surprisingly rich indigenous flora and, outside the reserves, are the major refuges for indigenous plants across the Canterbury Plains.

In this article I will discuss the flora of some of the Selwyn Plantation Board plantations and comment on some of the more interesting aspects of their botany. The information for this article comes from my own notes, a Canterbury Botanical Society field trip in June 1989, and articles by Bryony Macmillan (1973), Ross Elder (1986) and Derrick Rooney (1989). Other records of indigenous plants under plantations in this area are given by Thompson (1970) and Mason (1975).

During the Botanical Society field trip we visited four plantations, McHughes (Douglas fir and macrocarpa *Cupressus macrocarpa*), Keans (larch), Dormans (Douglas fir) and Murchisons (Douglas fir and eucalypts). McHughes and Murchisons are located near Darfield, while Keans and Dormans are on the upper plains near Springfield. Macmillan (1973) described Pages plantation (eucalypts) near Darfield and Rooney (1979) described Watsons and Centennial plantations (largely Douglas fir) near Coalgate. Elder (1986) provided further information on McHughes plantation.

Floristic composition

A total of 84 indigenous species have been recorded, comprising 21 fern, 46 dicot and 17 monocot species*. No indigenous conifers were recorded. A full vascular plant checklist is appended. The most striking feature of this flora is the high incidence of ferns, 25% compared with 8.5% in the total New Zealand indigenous flora. Eight species of *Asplenium* were recorded. In addition to the large fern flora, hybridisation within *Asplenium* is also very evident, with a wide range of different crosses apparent (see also Rooney 1989). Apart from the ferns, other prominent plant groups are Asteraceae (6 species), *Carex* (6 species), *Coprosma* (6 species) and *Clematis* (4 species). Some variation in species number occurs between the different plantations, although this may in-part reflect the time spent searching for plants; Watsons and Centennial (45 species), McHughes (45), Keans (38), Dormans (23), Murchisons (15) and Pages (6). The orchid flora listed is probably an underestimate, as several of the plantations were not visited during the likely flowering period (late November - early December; Thompson 1970).

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* One species recorded by Rooney (1989), *Blechnum minus*, has been excluded as it is a water-race species, not a forest floor species.

McHughes is typical of these plantations. The canopy is a mixture of Douglas fir and macrocarpa of variable cover. The forest understorey varies, and can in places be quite dense with regenerating thickets of conifers in canopy gaps. Blackberry is often abundant while the forest floor is usually covered in a deep litter of conifer leaves. *Pittosporum tenuifolium* is the dominant indigenous shrub occurring throughout the forest and growing up to 2-3 m tall. It grows as either scattered individuals and in patches. However, the majority of native plants occur on the forest floor, where often large patches (2-3 m diameter) of *Asplenium* ferns occur, while *Dichondra repens* is scattered throughout the forest. The ferns are generally on raised sites (e.g., old root plates). Most other native plants occur as scattered individuals, with many only occurring once or twice.

The indigenous flora of these plantations is essentially a forest flora, although some of the species also grow in the open. However, many of the plants do not occur outside forest on the Canterbury Plains. Several of the species recorded are of some interest. *Asplenium lyallii* is usually a plant of limestone areas in Canterbury, but is also clearly capable of growing on the more acid soils of the conifer plantations. *Acaena juvenca*, closely related to *Acaena anserinifolia,* has only recently been described (Macmillan 1989) and normally grows under indigenous forest and shrubland. *Gnaphalium gymnocephalum* reaches its known southern limit at Redcliffs, Banks Peninsula, so the present record is clearly close to its limit. *Melicytus angustifolius* is given an IUCN rating of 'Local' by Given (1981) and is restricted to forest margins in Taranaki and northern and eastern South Island.

Discussion

These data raise a number of interesting questions: Why are these plantations so rich in indigenous plants?; How did the indigenous plants arrive there, given that the plantations are often very isolated?; Why is the fern flora so diverse and hybridisation so evident? I will attempt to answer these questions in the rest of this article.

The Canterbury Plains experiences hot and often droughty summers, and cold winters. Strong winds are common, especially in summer. This would at first seem an inhospitable place for indigenous forests plants to grow. Certainly, the more widespread indigenous plants on the plains grow alongside water races or are plants typical of shallow dry soils. However, the Canterbury Plains has supported forest in the past (Molloy 1969) and many of the

plants recorded from the plantations today probably grew in these earlier forests too. These plantations are essentially providing the microclimates suitable for the growth of forest plants not otherwise available on the plains. Forests have a very marked effect on microclimates, decreasing temperature and radiation, increasing humidity and slowing down soil water loss. The accumulation of litter on the forest floor also helps maintain soil moisture. All these factors are essential for the survival of forest plants like *Asplenium*.

Some differences in the indigenous flora are also apparent between the different types of plantation. The two eucalypt dominated plantations are the poorest floristically (6 and 15 species), while the Douglas fir and larch plantations are considerably richer (23-45 species). This is likely to reflect differences in the forest microclimates; the eucalypt plantations are generally a lot more open with presumably higher light levels and temperatures, and lower humidity. Some differences were also noted between the young Dormans plantation and the older McHughes plantation; both dominated by Douglas fir. Dormans had a higher density of trees per hectare and was very dark under the canopy. The forest interior flora (indigenous and adventive) was sparse, and is reflected in total species number (23 compared with 45 species at McHughes).

How then did the indigenous plants actually reached these plantations? Perhaps the best way to answer this question is to look at the dispersal mechanisms of the plants present. The ferns have tiny spores which are easily blown in the wind and capable of travelling long distances, so their presence is not that surprising. Amongst the Angiosperms present we find a predominance of either fleshy fruit (e.g., *Coprosma* and *Pseudopanax*) or wind dispersed seeds (e.g., Asteraceae, Poaceae and *Clematis*), both well adapted for dispersal. In fact, of the 63 Angiosperm species recorded, 39 (62%) have one of these two dispersal mechanisms. Other mechanisms that favour good dispersal include small seeds (orchids), sticky seeds (*Pittosporum tenuifolium*) and hooked seeds (*Acaena* and *Uncinia*). The abundance of *Carex* (6 species) is harder to explain as it has no obvious dispersal mechanisms. In fact its widespread distribution around the world compared with the limited distribution of the related *Uncinia* has long been a puzzle to biogeographers. Then of course there is always chance; some plants just happen to reach a site through pure luck!

Not only is dispersal mechanism important, but also proximity of a seed source. Some species (e.g., *Carpodetus serratus*, *Melicytus*

ramiflorus and *Pseudowintera colorata*) were only found in plantations close to the Canterbury foothills (e.g., Keans and Dormans), with their pockets of intact native forest. It may be that dispersal of these species is not as good, and proximity of a seed source is more important than for some of the others. *Sophora microphylla* was only recorded from Keans, which occurs within a few kilometers of the Waimakariri riverbed, again a close seed source. The abundance of *Pittosporum tenuifolium* at McHughes may well reflect the close proximity of Darfield, an abundant source of seeds. Mason (1975) noted a similar relationship with this species in a plantation near Ashburton. In this case *Pittosporum tenuifolium* appeared to be spreading from a hedge in an adjacent farm homestead.

When you walk through many of these plantations, you are immediately confronted by the diversity in the forms of *Asplenium* present. Plants easily referable to the individual species are clearly present, but there are also a large number of intermediate forms. Why are these apparent hybrids so common? My suggestion relates to the nature of a plantation. In intact indigenous forest, these ferns occur in a range of sites, but usually there is some degree of site separation between the different species (e.g., *Asplenium flaccidum* is usually an epiphyte while *Asplenium gracillimum* is ground dwelling). However, a plantation represents a totally different environment with probably a quite different set of microsites available for fern colonsiation. It would appear that all the species are able to use these new microsites, with consequently several different species growing in close proximity. The end result of this is the extensive hybridisation we see today. Perhaps in time the species will sort themselves out in terms of different microsites, or perhaps new species will evolve?

In conclusion it is clear that these plantations are not biological deserts, but have a large number of indigenous plant species present. Although obviously not preferable to indigenous forest in parts of New Zealand like Westland, plantations do serve an important role for plant conservation in areas lacking indigenous forests (see also Molloy 1989); Canterbury is a prime example. Although the flora present is clearly not typical of that that would have occurred prior to deforestation, these plantations do provide a valuable refuge for some of our indigenous plants in what is otherwise an ocean of agricultural plants.

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Checklist to vascular plants recorded from Selwyn Plantation Board plantations

Ferns

Asplenium flabellifolium MKTC
Asplenium flaccidum MKDTC
Asplenium gracillimum MC
Asplenium hookerianum MKTC
Asplenium lyallii MC
Asplenium richardii MKTC
Asplenium terrestre MKDTC
Asplenium trichcomanes C
Blechnum fluviatile C
Blechnum penna-marina MDC
Histiopteris incisa MKC
Hypolepis ambigua MKDC
Hypolepis millifolium C
Hypolepis rufobarbarta MC
Paesia scaberula C
Pellaea rotundifolia MTC
Phymatosorus diversifolius MKTC
Polystichum richardii MKDTC
Polystichum vestitum MKDTC
Pteridium esculentum MKC
Pyrrosia serpens MKC

Dicots

Acaena juvenca MK
Acaena novae-zelandiae MK
Calystegia tuguriorum KD
Cardamine debilis agg. MKT
Carpodetus serratus D
Clematis cf. marata K
Clematis forsteri CP
Clematis paniculata MKP
Clematis quadribacteolata K
Coprosma crassifolia MKD
Coprosma propinqua MKDC
Coprosma rhamnoides KDC
Coprosma rotundifolia MC
Coprosma rigida M
Coprosma sp. (aff. parviflora) C
Corokia cotoneaster K
Dichondra repens MKTP
Gnaphalium gymnocephalum M
Griselinia littoralis KD
Hebe salicifolia D
Helichrysum aggregatum MK
Hydrocotyle novae-zeelandiae M
Lagenifera strangulata MK
Melicytus angustifolius KD
Melicytus crassifolius C
Melicytus ramiflorus K
Muehlenbeckia australis MKDC
Muehlenberckia complexa MC
Myrsine australis K
Oxalis exilis M
Parsonsia capsularis MC
Parsonsia heterophylla C
Pittosporum tenuifolium MKDTCO
Pseudopanax arboreus MKD
Pseudopanax crassifolius KD
Pseudowintera colorata D
Rubus cissoides C
Rubus schmidelioides C
Senecio glomeratus P
Senecio minimus M
Senecio quadridentatus P
Solanum laciniatum MTC
Sophora microphylla K
Stellaria parviflora KD
Wahlenbergia gracilis M
Viola cunninghamii K

Monocots

Arthropodium candidum C
Carex acicularis MDT
Carex breviculmis C
Carex comans C
Carex forsteri MC
Carex testacea M
Carex virgata MC
Chiloglottis cornuta C
Cordyline australis MKDTC
Corybas triloba C
Elymus rectisetus O
Gastrodia cunninghamii C
Libertia ixioides C
Poa cita P
Rytidosperma gracile MD
Thelymitra pauciflora O
Uncinia scabra K

M, McHughes (this study, Elder 1986); K, Keans (this study); D, Dormans (this study); T, Murchisons (this study); P, Pages (Macmillan 1973); C, Coalgate (Rooney 1989); O, others (Thompson 1970, Mason 1975).