

Natural Seedling Establishment in an Area Planted with Native Trees

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IN 1954 a start was made in planting with native species somewhat under half an acre of terrace land just south of the Manawatu River at Palmerston North. The area was on a slope facing south-west and was initially in rough pasture containing scattered young gorse up to 4 ft. high, but nowhere dense enough to shade out the grass.

Lack of shelter and strong grass growth were the main problems to begin with, and some plants were cut back by frost—even totaras slightly in the first year—and some suffered from drought. However maximum use was made of the increasing shelter provided by gorse and tree lucerne (*Cytisus proliferus*) as well as several of the faster growing native species such as *Pittosporum* spp. and makomako which were planted in open patches among the gorse. With the growth of these trees shelter has improved greatly; over the last few years no watering has been necessary, and frost-tender species such as puriri have come through several winters without losing their leading shoots.

As the grass was shaded out, seedlings of native species began to appear. Some arose from seeds of planted species which were already fruiting but many seeds, at least initially, came from outside the area. Mostly these were bird-carried, but a few non-fleshy winged fruits were presumably wind-carried. The most likely source of seed was Bledisloe Park, a remnant area of native bush a quarter of a mile away to the west over the brow of a hill, with pasture land between. Seedlings first appeared in appreciable numbers in 1959-60, and by 1967 33 species of trees and shrubs and five climbers had been noted as well as 26 fern species.

A list of the species that have appeared in the area is given in the table. The species present in Bledisloe Park are taken with slight corrections from a list given by Esler (1962). Both the number of species and the number of individual seedlings that appeared were considerably greater than expected. *Pittosporum ralphii* is probably not native to the district, but several fruiting plants occur on a nearby roadbank and young plants collected from here in 1955-56 are now fruiting in the area. *Coprosma rhamnoides*, though not recorded from Bledisloe Park, occurs in nearby scrub and the seed of taupata probably came from garden plants not far away. Several of the ferns have not been observed in Bledisloe Park. Most of these are common in the hills south and east of Palmerston North, but *Asplenium flabellifolium* has not been observed in the surrounding Kairanga

County (A. E. Esler, pers. comm.). It is present in Totara Reserve, over 20 miles to the north, and may also occur in the coastal sand country.

Initially karamu, which was fruiting in the area, was the commonest species among the seedlings, but with the death of most of the adult plants from disease its relative importance has declined. Mahoe is now by far the most abundant seedling species and also generally the most successful in growing past the seedling stage. It has not completely excluded other species however. In one place a green carpet of mahoe seedlings (several per sq. in.) came up under a fruiting tree in 1965-66. The growth of these seedlings was later severely checked and many were killed by leaf-eating insects and probably disease, as well as other factors of competition. By winter 1967 scattered seedlings of *Pittosporum ralphii* and fivefinger of the same age as the mahoe seedlings appeared likely to outgrow them.

Although two young manuka plants were present among the gorse in 1954 and the species is now fruiting in the area no further seedlings have appeared.

A few seedlings of ngaio have appeared but so far none has lived a full year, and only one rather weak plant of poroporo has been noted. This contrasts markedly with the situation on a steep hillside area adjoining Bledisloe Park from which mature *Pinus radiata* was cut in spring 1966. Ngaio, poroporo and gorse are all plentiful, and are the only shrub or tree species present in any quantity this first season.

Several species common in Bledisloe Park have not yet appeared in the planted area. These include tawa, karaka, hinau, supplejack, *Fuchsia perscandens*, rewarewa, kowhai, lowland ribbonwood, *Metrosideros robusta*, *M. colensoi*, *M. diffusa*, *M. perforata*, *Melicope simplex* and the ferns *Adiantum cunninghamii*, *A. formosum*, *Arthropteris tenella*, *Ctenitis velutina*, *Phymatodes scandens* and *Pyrrosia serpens*. Either the seeds or spores of these species have not been transported to the area, or they have not found conditions suitable for establishment. One fruiting plant of *Melicope ternata* is present in the planted area and several seedlings have appeared, but all very close to the parent plant. By contrast, seedlings of hangehange are widely dispersed and not concentrated near the two fruiting plants.

Since seeds of tawa and karaka seemed unlikely to be transported naturally to the planted area they were introduced in 1960 and 1961. Both species germinated freely, and by winter 1967 most karakas were over 4 ft. high and two 11 ft., whereas the tallest tawa (though quite healthy) was only 16 ins.

Over most of the planted area the gorse was removed when no longer required, and remaining plants thinned to prevent their suppressing the slower growing species. By winter 1967, when most

of the gorse had gone, a number of native species (including red beech) were over 20 ft. high. One small area of fairly dense gorse has been left entirely alone so that the unaided entry and development of native species can be observed. Even in this small area some parts have developed differently from others. In one place several mahoe and karamu seedlings that established early reach up into the thinning gorse canopy at about 12 ft. Elsewhere the gorse remains fairly dense, and although ferns have established strongly seedlings of woody species have grown slowly and are still well below the gorse canopy. Their growth would undoubtedly have been hastened by judicious thinning of the gorse.

Individual gorse plants have died every year, apparently from unidentified root-rots, and as many as 10% of the plants sometimes died in a single season. Tree lucerne is also susceptible as well as some native species including putaputaweta, toro, koromiko, lacebark, whau, kaikawaka, makomako and especially karamu. The unexpected appearance of two flowering stems of *Gastrodia cunninghamii* in January 1966 may be a pointer to a possible cause of these deaths, since this orchid has been shown to be dependent upon the root-attaching fungus *Armillaria mellea* (Campbell, 1962). These deaths have caused temporary openings in the canopy but have had no appreciable effect on growth in the area as a whole.

Seedlings of some introduced woody plants have appeared from time to time, including *Solanum pseudocapsicum*, *Passiflora mollissima*, *Euonymus europaeus*, *Rubus phoenicolasius* as well as gorse and tree lucerne. All but the two last were removed immediately. Gorse seedlings have been plentiful but almost all died from shading. A few tree lucerne seedlings have established in open places and at the margins.

With the growth of the many planted species and the abundant establishment of seedlings and ferns the planted area is now beginning to take on the aspect of native bush. Many species native to the locality have not yet become established, and more of these will be introduced as opportunity offers. On the other hand a number of species not natural to the district have been planted and some are already reproducing themselves successfully. The community that is developing is certainly not a natural one, but it demonstrates that bush can return to many areas if there is a source of seeds and spores and suitable sites for their establishment.

REFERENCES

- CAMPBELL, E. O. 1962. The mycorrhiza of *Gastrodia cunninghamii* Hook.f. *Trans. Roy. Soc. N.Z. Bot. 1*: 289-96.
- ESLER, A. E. 1962. The Banks Lecture: Forest remnants of the Manawatu lowlands. *N.Z. Plants & Gardens 4*: 255-268.

SPECIES WHICH HAVE APPEARED IN THE PLANTED AREA

	Seedlings present 1959-60†	Seedlings present 1967†	Fruiting plants present when seedlings first noted	Fruiting plants present in 1967	Also present in Bledisloe Park
TREES AND SHRUBS					
<i>Alectryon excelsus</i> (titoki)	(first noted 1962)	3	—	—	*
<i>Aristolelia serrata</i> (mako-mako)	(first noted 1961)	4	*	*	*
<i>Brachyglottis repanda</i> (rangiora)		2	—	—	*
<i>Carpodetus serratus</i> (putaputa-weta)	—	4	*	*	—
<i>Coprosma australis</i>	3	4	—	*	*
<i>C. rhamnoides</i>	2	3	—	—	—
<i>C. repens</i> (taupata)	—	3	—	—	—
<i>C. rigida</i>	—	4	*	*	—
<i>C. robusta</i> (karamu)	4	4	*	*	*
<i>Cordyline australis</i> (cabbage tree)	—	3	—	—	*
<i>Coriaria arborea</i> (tree tutu)	—	1	—	—	*
<i>Geniostema ligustrifolium</i> (hangehange)		4	*	*	*
<i>Griselinia littoralis</i> (broad-leaf)		4	*	*	—
<i>Hebe stricta</i> (koromiko)	(first noted 1961)	4	*	*	*
<i>Hedycarya arborea</i> (pigeon-wood)	2	3	—	—	*
<i>Hoheria sexstylosa</i> (lacebark)	1	3	—	*	*
<i>Laurelia novae-zelandiae</i> (pukatea)	1 (died)	—	—	—	*
<i>Macropiper excelsum</i> (kawa-kawa)	3	4	—	*	*
<i>Melicope ternata</i> (wharangi)	—	—	*	*	—
<i>Melicytus ramiflorus</i> (mahoe)	4	6	—	*	*
<i>Myoporum laetum</i> (ngaio)	—	2 (died)	—	*	*
<i>Myrsine australis</i> (mapou)	2	3	—	*	*
<i>Paratrophis microphylla</i>	—	2	—	—	*
<i>Pennantia corymbosa</i> (kai-komako)	(first noted 1961)	2	—	—	*
<i>Pittosporum eugenioides</i> (tarata)	—	4	—	*	*
<i>P. ralphii</i>	—	5	—	*	—
<i>P. tenuifolium</i> (kohuhu)	2	5	—	*	*
<i>Podocarpus totara</i> (totara)	—	2	—	*	*

	Seedlings present 1959-60*	Seedlings present 1967*	Fruiting plants present when seedlings first noted	Fruiting plants present in 1967	Also present in Bledisloe Park
<i>Pseudopanax arboreum</i> (five- finger)	2	4	—	*	*
<i>Pseudopanax crassifolium</i> (lancewood)	—	3	—	—	*
<i>Pseudowintera colorata</i> (horo- pito)	—	4	*	*	—
<i>Schefflera digitata</i> (pate)	—	4	—	*	*
<i>Solanum aviculare</i> (poroporo)	—	1	—	—	*

CLIMBING PLANTS

<i>Clematis foetida</i>	—	2	—	—	*
<i>Muehlenbeckia australis</i>	3	5	—	—	*
<i>Parsonia</i> sp.	—	2	—	—	*
<i>Rubus schmidelioides</i>	2	3	—	—	*
<i>Tetrapathaea tetrandra</i>	1	3	—	—	*

FERNS

<i>Asplenium bulbiferum</i>	—	3	—	*	*
<i>A. falcatum</i>	—	3	—	—	*
<i>A. flabellifolium</i>	—	1 (group)	—	*	—
<i>A. flaccidum</i>	—	3	—	—	*
<i>A. hookerianum</i>	—	2	—	*	*
<i>A. lucidum</i>	—	4	—	*	*
<i>Blechnum capense</i>	2	2	—	—	*
<i>B. fluviatile</i>	2	3	—	—	*
<i>B. lanceolatum</i>	—	1	—	—	*
<i>B. penna-marina</i>	—	2	—	—	—
<i>Ctenitis glabella</i>	—	2	—	*	*
<i>Cyathea dealbata</i>	—	4	—	—	*
<i>C. medullaris</i>	1	1 (large)	—	—	*
<i>C. smithii</i>	—	3	—	—	—
<i>Histiopteris incisa</i>	3	4	—	*	—
<i>Hypolepis rugosula</i>	—	2	—	*	—
<i>H. tenuifolia</i>	3	5	—	*	*
<i>Paesia scaberula</i>	2	3	—	—	*
<i>Pellaea rotundifolia</i>	—	4	—	*	*
<i>Phymatodes diversifolium</i>	—	3	—	—	*
<i>Polystichum richardii</i>	3	4	—	*	*
<i>Polystichum vestitum</i>	—	4	—	*	—
<i>Pteridium aquilinum</i> var. <i>esculentum</i>	—	1	—	—	*
<i>Pteris macilenta</i>	—	4	*	*	—
<i>P. tremula</i>	—	4	—	*	*
<i>Thelypteris pennigera</i>	—	2	—	—	*

† The figures are subjective assessments of abundance, from 1 (one plant seen) to 6 (abundant).