Measured growth on Hinewai Reserve

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Hinewai Reserve is (currently) a 1250 ha conservation project in southeast Banks Peninsula. It is owned and managed by the Maurice White Native Forest Trust but open to the public and much-visited, as if it were a mini-National Park on the doorstep of Akaroa. The management philosophy is one of minimal interference with natural processes. Exotic gorse and broom, for example, are tolerated as temporary nurse canopies for native regeneration. Indeed, most of the 230 or so naturalised exotic vascular plant species are similarly tolerated; only a handful regarded as significantly deleterious to native species are actively deleted. Some 330 native vascular plant species, as well as a good diversity of bryophytes, lichens, fungi and algae, form the macroscopic component of the indigenous vegetation.

Artificial plantings are not part of the revegetation strategy on the reserve. However, plantings have been established in the vicinity of both homesteads. In particular, two arboreta (Fig. 1, p. 70) are maintained for display, educational and scientific purposes. Hinewai arboretum is near the Manager's house and Visitor Centre at 450 m altitude and 4 km from the nearest sea. Otanerito arboretum is near Otanerito Homestead, which is close to sea level and 1 km from the sea. All the specimens in the arboreta are of known local source and date, carefully documented, and re-measured each year in May at the end of the growing season. Some of the plantings have died over the years, but at present 56 trees and shrubs are measured in Hinewai arboretum, and 58 at Otanerito.

The climate differs significantly between the two locations. Species grown at Otanerito but not at the higher altitude Hinewai arboretum include nikau palm, titoki, shining broadleaf, akeake, pigeonwood, and lowland totara. Species in Hinewai arboretum but not at Otanerito include broadleaved cabbage tree, native cedar, thin-bark totara, *Dracophyllum acerosum*, and mountain holly. Two species of native beech are grown at both arboreta.

We use a standard diameter tape for measuring trunk girth, a measuring pole for specimens shorter than about 3 m, and for taller specimens a small electronic height measuring device. Growth rates are of course subject to huge variation. We have measured specimens from the same seed source and grown at the same site, that have differed greatly in vigour, height and bulk. Here I simply select 26 well grown specimens in our two arboreta and offer a simple summary of the growth they have achieved within 2 or 3 decades (Tables 1 – 3, pp. 71-73).

Good data on growth rates are relevant to better scientific understanding of different species, both for single species interest, and for their role in

ecosystems. The data may have practical application too, such as in planning some intensively managed forms of eco-restoration, in evaluating carbon sequestration, or perhaps even in growing native species for timber production. Much is known about growth rates and management of *Pinus radiata*, by far the most widely grown exotic timber species in New Zealand, but to know that native red beech, for example, can achieve heights in excess of 10 m, and diameters of half a metre in 24 years, might add impetus to growing native timbers in sustainably managed plantations for commercial production. It would be nice to think that for ecological and biodiversity reasons, such plantings could be sourced from the local Ecological District, or at least Region.

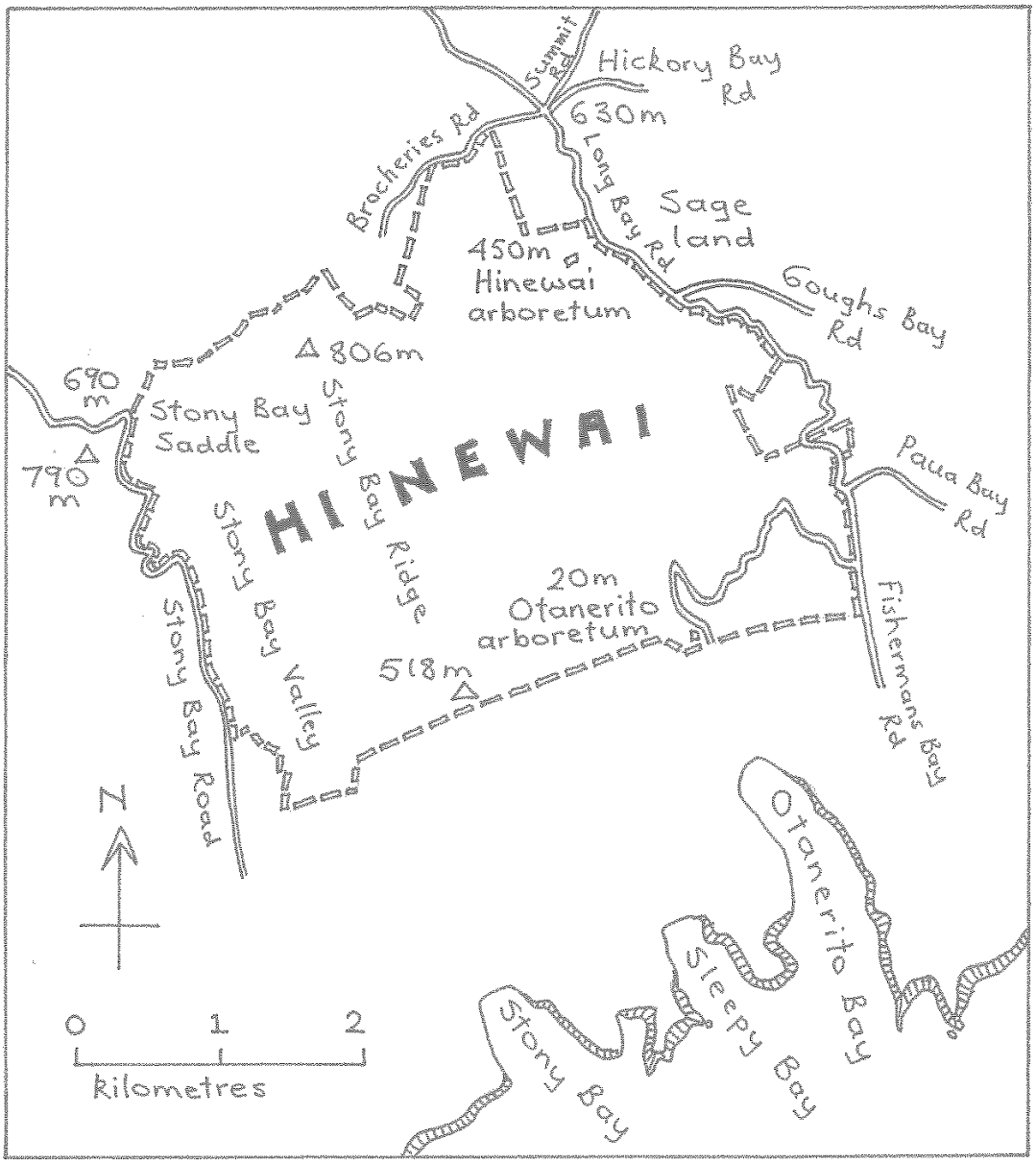

Figure 1 Map of Hinewai Reserve showing the locations of the two arboreta.

Table 1 Observations for selected specimens at Hinewai arboretum.

Arboretum number	Species	Year germinated	Age in 2014 (years)	Height in 2014 (cm)	Diameter at breast height in 2014 (cm)	Age when first flowered or coned (years)
9	*Cordyline australis*[1]	1988	26	560	-	10
19	*Sophora microphylla*	1988	26	520	multi-leadered	13
23	*Kunzea ericoides*	1989	25	555	-	5
25A	*Nothofagus fusca*	1987	27	1280	33	27
28	*Libocedrus bidwillii*[2]	1987	27	470	14	11
29	*Dacrycarpus dacrydioides*	1989	25	497	3.9	Not coned yet
35	*Nothofagus solandri*	1990	24	1060	33.5	24
36	*Nothofagus fusca x solandri*	1990	24	810	29.1	24
38	*Cordyline indivisa*	1991	23	433	15.1	Not flowered yet
41	*Plagianthus regius*	1991	23	650	18.2	Not flowered yet
43	*Prumnopitys taxifolia*[3]	1990	24	182	-	Not coned yet
52	*Podocarpus hallii*	1994	20	257	-	Not coned yet

[1] Diameter of *Cordyline australis* not measured yet because trunk still clad in old leaves.

[2] Specimen of *Libocedrus bidwillii* grown at Motukarara Nursery from a cutting from an adolescent tree at Armstrong Reserve, about 0.5 km to the south of Hinewai's southern boundary.

[3] *Prumnopitys taxifolia* still a tangled shrub with all juvenile brown foliage after 24 years.

Table 2 Observations for selected specimens at Otanerito arboretum.

Arboretum number	Species	Year germinated	Age in 2014 (years)	Height in 2014 (cm)	Diameter at breast height in 2014 (cm)	Age when first flowered or coned (years)
2	*Dacrycarpus dacrydioides*	1990	24	690	18.9	21
21	*Pseudopanax crassifolius*[1]	1989	25	549	12.7	16
26	*Nothofagus fusca*	1990	24	1030	51	18
30	*Cordyline australis*	1988	26	556	18	15
32	*Nothofagus solandri*	1990	24	770	15.8	Not flowered yet
33	*Nothofagus fusca x solandri*	1990	24	870	multi-leadered	23
47	*Prumnopitys taxifolia*[2]	1989	25	332	-	Not coned yet
48	*Plagianthus regius*	1989	25	830	22.3	Not flowered yet
50	*Kunzea ericoides*	1990	24	650	-	9
54	*Dodonaea viscosa*[3]	1993	21	664	60.4	8
57	*Griselinia littoralis*	1991	23	527	-	20
66	*Griselinia lucida*	1993	21	400	-	14
70	*Rhopalostylis sapida*[4]	1995	19	300	-	Not flowered yet
72	*Podocarpus totara*	1998	16	455	-	Not coned yet

[1] The change from all juvenile to all adult foliage in this plant of *Pseudopanax crassifolius* took place between age 9 and 13 years.

[2] *Prumnopitys taxifolia* all juvenile foliage for the first 21 years; at age 22 the top 30 cm was abruptly green and adolescent; by age 25 the top 122 cm was adolescent, with that juvenile and brown foliage below down to ground level. No clear cut leader to measure diameter.

[3] *Dodonaea viscosa* diameter measured at ground level because not far above the ground the trunk splits into several inclined branches.

[4] *Rhopalostylis sapida* still has no trunk after 19 years, but the characteristic green "bulb" of overlapping leaf bases is becoming obvious at ground level.

Table 3 Common names and some botanical synonyms for plants listed in the text and other tables.

Cordyline australis	cabbage tree, ti kouka
Cordyline indivisa	broadleaved cabbage tree, toi
Dacrycarpus dacrydioides	kahikatea, white pine
Dodonaea viscosa	akeake
Griselinia littoralis	broadleaf, kapuka, papauma
Griselinia lucida	shining broadleaf, puka
Kunzea ericoides	kanuka
Libocedrus bidwillii	pahautea, New Zealand cedar
Nothofagus fusca (*Fuscospora fusca*)	red beech, tawairaunui
Nothofagus fusca x solandri (*Fuscospora fusca x solandri*)	hybrid beech, tawai
Nothofagus solandri (*Fuscospora solandri*)	black beech, tawairauriki
Plagianthus regius	lowland ribbonwood, manatu
Podocarpus hallii (*Podocarpus cunninghamii*)	thin-bark totara
Podocarpus totara	lowland totara
Prumnopitys taxifolia	matai, black pine
Pseudopanax crassifolius	lancewood, horoeka
Rhopalostylis sapida	nikau palm
Sophora microphylla	kowhai