



The Nature of the Square
Lucas Associates

THE NATURE OF THE SQUARE

CONTEXT

The plains city of Otautahi Christchurch lies on a series of floodplain surfaces at the junction of volcanic hill, coastal, and Waimakariri river plains systems. Flood events have buried former land surfaces. On each fresh surface, biota gradually established - first low mat plants and grasses, then shrubs and woodlands. On deeper, wetter soils, kahikatea forests eventually developed. The Waimakariri would return, burying forest in fresh sands, gravels and silts. The vegetation cycle would begin again. This multi-layered sequence is a veritable "club sandwich" of buried forests, soils, silts and greywacke gravels over which the City is built.

The land surfaces of Christchurch have been mapped for their approximate age, soil development, and drainage. By analogy with surviving remnants and historic accounts, the natural mature vegetation for each surface has been reconstructed in theory and used as a guide to understand "what nature intended" for each part of the city. The mix of soils, plants, wildlife and microbes, and the processes that bind them together, is the ecosystem.

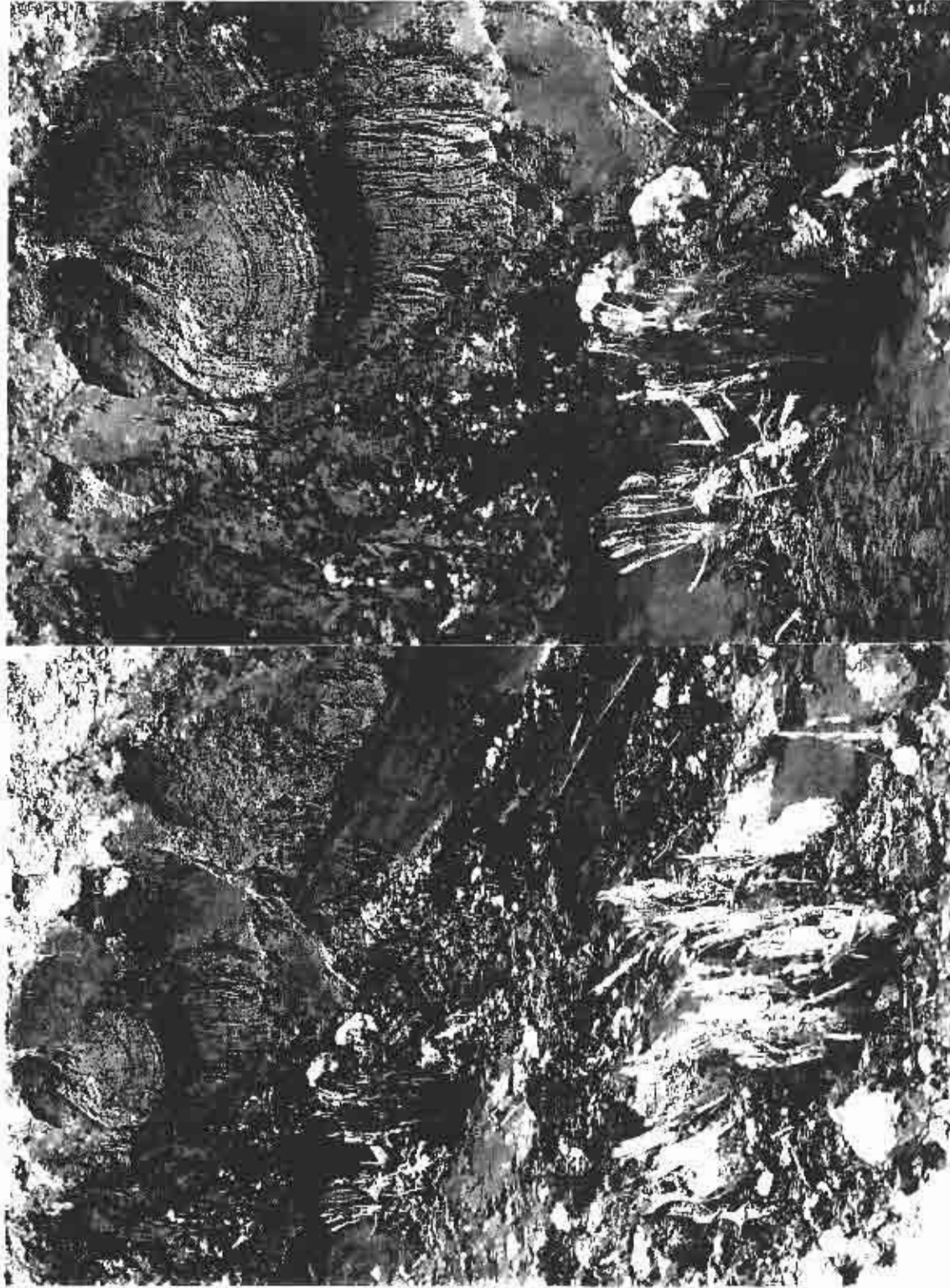
Each ecosystem is a physical-biological unit in terms of landforms, naturally or potentially dominant vegetation, and wildlife habitat. Each ecosystem supported the genepool of native plants and animals that gave character to this place. Together the ecosystems formed a mosaic related to the age and origins of each land surface, exposure to sun, salt, wind and rain, and effects of disturbance by fire, flood and settlement.

ECOSYSTEM MAPPING

The plains ecosystems of the City have been mapped and include the older, poorly drained *Taitapu* soils and imperfectly drained *Kaiapoi* soils, and, the mid-age but deep, well-drained *Waimakariri* soils. The older and wetter are at least 2 000 years old and naturally support surfaces a lush forest system. The mid-age surfaces are from 300 to 3 000 years old. Whereas, out to the west of the city, the youngest surfaces of the dry native grasslands are less than 300 years old.

As well as being mapped, ecosystems have been given a "signature" name and graphic, an icon (Lucas associates, 1996). The species of each "signature" define, but are not necessarily confined to, that ecosystem. Some plants, like ti kouka, kowhai and kanuka, are wide ranging. The species, landform and underlayer names distinguish each ecosystem. The texture of the underlayers of each ecosystem is shown - stones, logs, peat. The presence, size and shape of greywacke stones underpins the character of some ecosystems.

The underlayers contain magnificent aquifers, from which Christchurch obtains its high quality water. These waters travel slowly for centuries from the mountains



Totara Stumps 1m Below Centre City Ground Surface

under the plains toward the sea. From these, artesian flow is a natural characteristic of the city centre.

Much of the central city lies on the lush older surfaces that naturally support native forest (refer map and city cross section).

KAHIKATEA

kereru, manatu,

lush, older plains ecosystem

of the wet Taitapu soils

TOTARA

bellbird, matai,

older plains ecosystem

of the moist and deep Kaiapoi soils

HOUHERE

piwakawaka, kohuhu,

mid-age plains ecosystem

of the moist and deep Waimakariri soils.

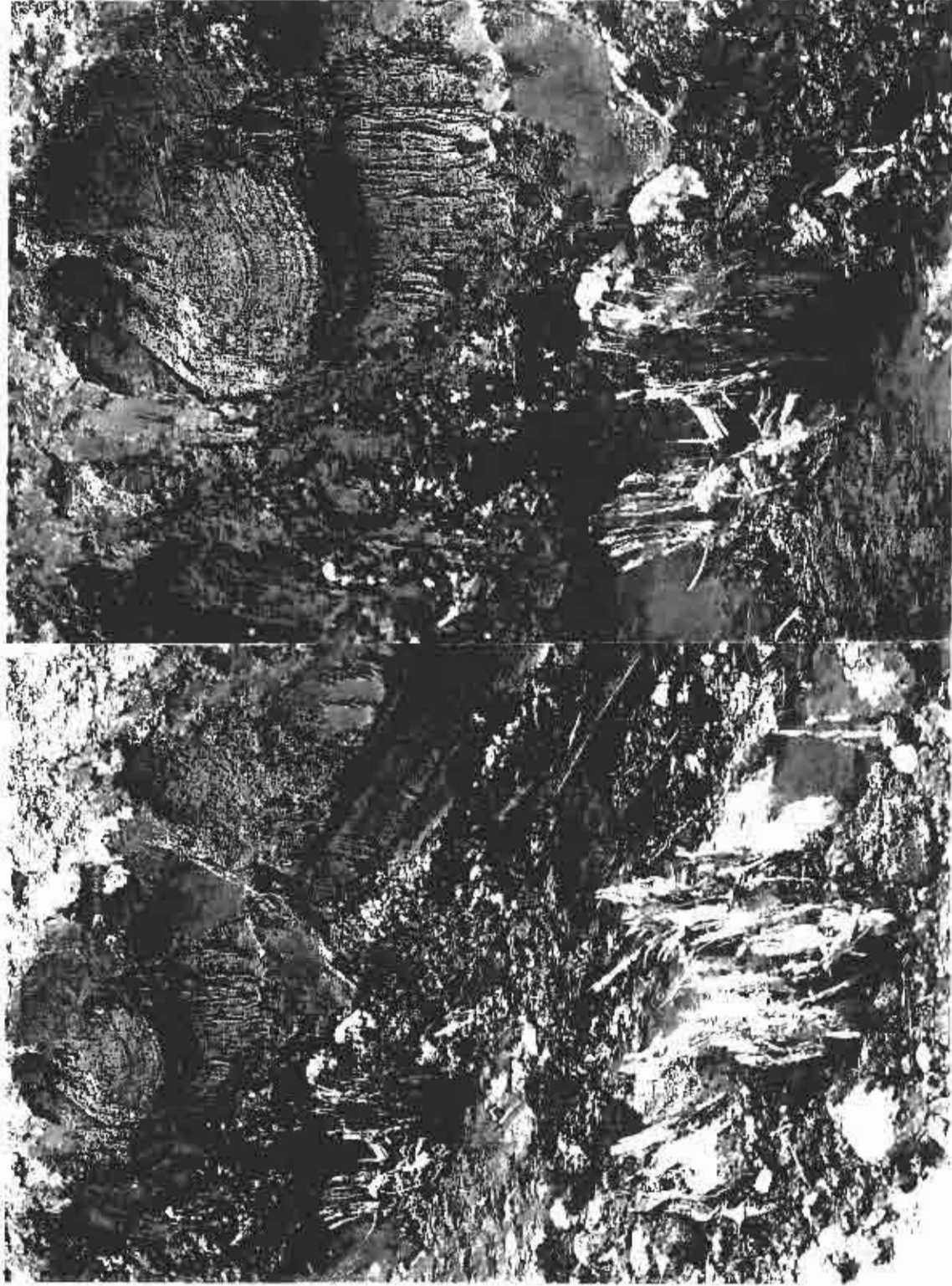
Cathedral Square lies across the latter two surfaces, the TOTARA and the HOUHERE ecosystems. Totara stumps continue to be exposed just below the surface during excavations in the central city. This symbolises the forest ecosystem that underlies this place, but is largely unknown to the public.

The ecosystem names hint at the interdependence of the plants and animals of these forests – the nectar-feeding bellbird (korimako), the insect-feeding piwakawaka or fantail. The birds, the lizards, the insects, they are all crucial dimensions of the nature of the place. Nearby the Avon supports native fishes, such as inanga (whitebait) fished and enjoyed in the city centre by people and the kotare (kingfisher).

PLANT DATA

Plant lists for trees, shrubs and groundcovers have been compiled for each of the indigenous ecosystems. The plants of the TOTARA and HOUHERE ecosystems are listed on coloured sheets. They show that some 62 different native plant species belong in the nature of the Square. For most of these species, a page of data follows that shows leaf shapes, etc. for each species.

The plant lists show that these are forests of tall podocarps, particularly totara, plus matai. The majority of species are flowering plants, with many trees and shrubs. There is also a range of ground ferns. Although several are natural to the wetter KAHIKATEA ecosystem (including the ponga or silver fern), no tree fern species belong in the drier ecosystems that underlie the Square.



Totara Stumps 1m Below Centre City Ground Surface

Being a flora that has evolved with a large bird population, many species abound with berries. For many species, the berries sit on sturdy branches (rather than out on fine branchlet tips as is typical of many showy flowering plants) and thus provide for sheltered bird feasts. Their flowers are thus also branch-based - such as on the tree fuchsia, whose nectar is obviously enjoyed by the bellbird emerging with a blue pollen-covered face!

For the flowering plants, the thickness and even-ness of leaves is often an important feature for recognition. Some species are distinguished by their wavy surface, such as *Pittosporum* spp., *Myrsine* sp. and *Olearia paniculata*. Others are particularly thick and glossy, or textured. Some are particularly thin and translucent, particularly *Aristotelia serrata* the makomako, so that when leaves overlap there is a shadow pattern through the leaves. Another tree species, the ngaio, is distinguished by its gland-dotted leaves allowing pin-hole light spots. *Meliccytus ramiflorus* has simple smooth living leaves, but these are distinctive when they fall in surviving long as a leaf skeleton.

There are some 9 species of *Coprosma* natural to the Square, with a large range of leaf size and stature. *Coprosma* spp. are distinguished by rows of pits along the petiole on the underside of the leaf, and stipules at the leaf base. The *Coprosma* genus is very important in the New Zealand flora generally, and their distinguishing characteristics could be highlighted.

DIVARICATING FORMS

A curious feature of Canterbury vegetation is the very large range of divaricating plants. The abundance of shrubs with tiny leaves and twiggy, flexible, interlacing and angled branchlets. The mesh-like form that results is a major feature of local vegetation, whether forest, shrubland, marshland or grassland. (There is even one species traditionally known as the "wire-netting bush".)

In recognising or depicting these distinctive divaricating plants, not the individual leaf, but the branchlets with their leaves, are the distinguishing features - their combination into a mesh-like pattern. Although of international note and fascination, locally, these divaricating species are often overlooked.

Many of the divaricating shrub species are insect- or wind-pollinated, and thus don't have showy flowers, but have abundant, often colourful berries. Not just the birds, but lizards are also attracted (reputedly with a particular penchant for blue berries)

Botanists have put forward two main suggestions as to why so many unrelated plants have evolved this small-leaved, interlacing form. One line of thought sees it as a defensive mechanism against browsing by various moa (the major browsers of this land prior to sheep, cattle, rabbits, deer and possums). The other is that

the divaricating form is due to climate, with the mass of fine branchlets and small leaves providing a very resilient form and micro-climate. A vigorous debate has long occurred.

Many of the small-leaved, tangle-branched shrubs are juvenile stages of adult trees which develop larger leaves when well above moa height. There can be a huge contrast between the juvenile and the adult leaf forms. The lancewood is an exception which has larger leaves when juvenile and smaller ones when adult. As with other large-leafed *Pseudopanax* spp., their lance-shaped leaves are publicly well-recognised and distinctive of New Zealand.

Whilst the divaricating plants may appear rather dry, some 8 species of ferns also belong in the Square. About 75 species of ferns occur naturally throughout greater Christchurch. The form, texture and size of the different fern species varies greatly from flat, undulating, leathery, slick or powdery, smooth edged or divided into hundreds of leaflets. The contrast between lush and leafy ferns with the dry-style divaricating plants is a local feature.

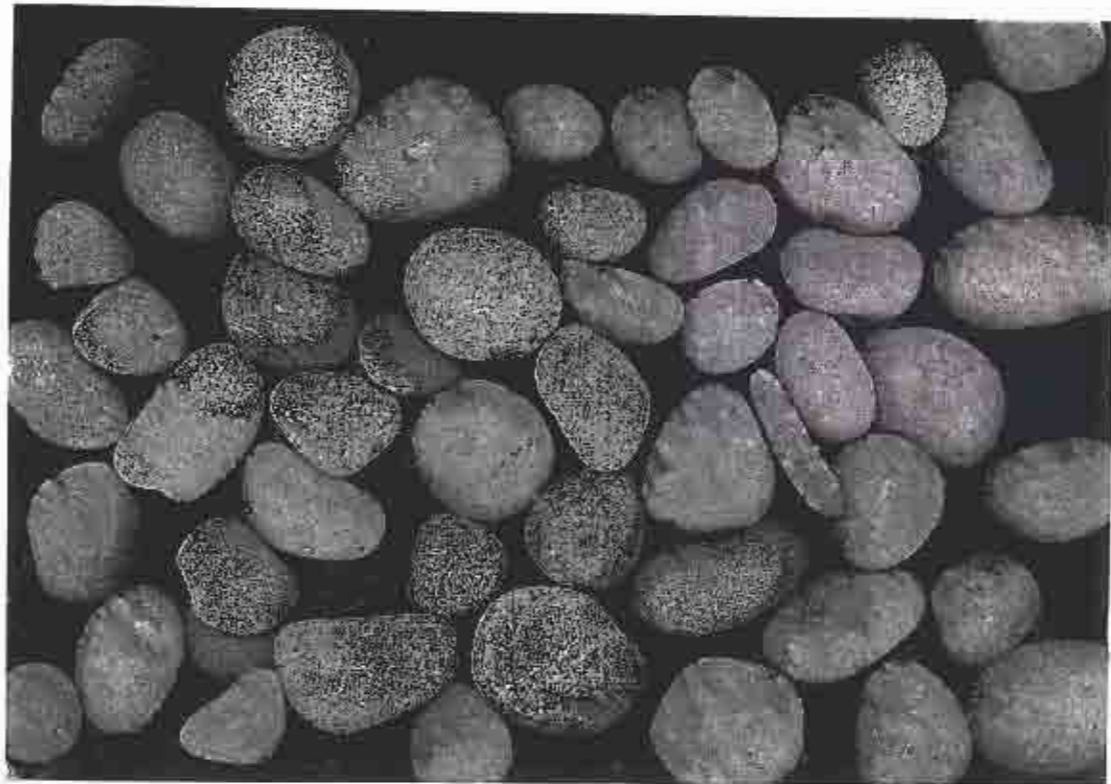
DISTINCTIVE FEATURES OF PLANTS BELONGING IN THE SQUARE:

- Diverse range of species from ground level to tall trees - it is a much richer flora than people imagine.
- Predominantly flowering plants, rather than ferns, podocarps or conifers, displaying a wealth of small flowers and berries.
- Enormous diversity in leaf size and texture, from large and lush to very fine and almost leafless; from thick and leathery to thin and translucent.
- The mesh-like pattern from the many divaricating species, both shrubs and juvenile trees.

The pages on each species include photocopies of drawings, photos and actual plants. Adult and juvenile foliage is often included. Because of the importance of flowering plants, not just foliage, but images of their flowers and fruits are also included. Details have not been included on all species. More information, including fresh specimens, can be provided on any species, if and when required. Also information can be provided on combinations and relationships between species.

REFERENCE

Lucas Associates. 1996. *Indigenous Ecosystems of Otautahi Christchurch. Set 2. The Coastal Plains of Hagley, Ferrymead & Burwood-Pegasus* for Christchurch-Otautahi Agenda 21 Forum and the Hagley-Ferrymead and Burwood-Pegasus Community Boards. Christchurch.



GRAPPLING with GREYWACKE

Greywacke, the basis and signature of Canterbury
From the sharp fragments shattered from the Waimakariri mountainlands,
tumbled and worn rounded to build the plains that meet the volcano
at Ōtautahi Christchurch.

Outwash plains.

Overall a vast horizontal surface. Flat.

In detail, a complex of terraces, humps and hollows.

Overall a complex of varying massing of greywacke units.

Coarse to fine, as laid down by the waterways. Rich soils to bony.

Greywacke from boulder to silt. Transported, sifted and sorted.

Streams meandering, cutting a step here, building a beach there.

Cut matched with fill. Cut slopes through layers, striations of stones.

Vertical greywacke cuts. Steep. Layered. A lip. Capped with vegetation.

Grey on grey. Uniform yet varied.

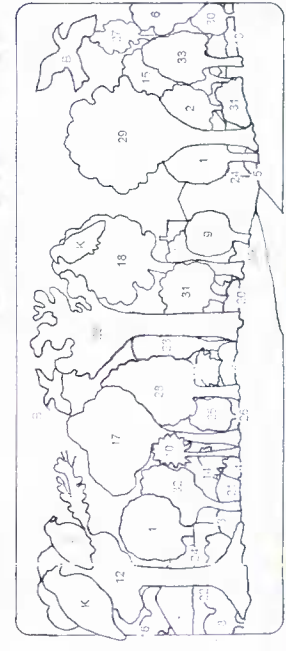
Roundness expressing the journey from the hills.

Mobile. Dynamic. Telling a story of travels.

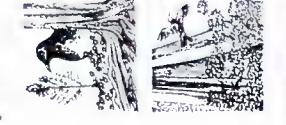


OTAUTAHI CHRISTCHURCH PLANTS of the...

No	Botanical Name	Common Name	No	Botanical Name	Common Name
1	<i>Alecisyon asperifolius</i>	tikok	20	<i>Hydrocotyle ambigua</i>	rough pig fern
2	<i>Azorella saxatilis</i>	matua, wetweary	21	<i>L. microdon</i>	pisang
3	<i>Azolla (var.)</i>	bush lily, kakaha	22	<i>Melicope simplicis</i>	mahehe, whitewood
4	<i>Blechnum minus</i>	swamp noddy	23	<i>Myrsine australis</i>	maoau, red mapou
5	<i>Carex lambertiana</i>	pipipiwaweta, maribaleai	24	<i>Myrsine divaricata</i>	weeping mapou
6	<i>Carex serratula</i>	bush clematis, puia wananga	25	<i>Myrsine divaricata</i>	hounds tongue fern, maratahi
7	<i>Clematis paniculata</i>	thin-leaved coprosma	26	<i>Phytolacca rugosa</i>	manuka, lowland ribbonwood
8	<i>Coprosma acroclada</i>	round-leaved coprosma	27	<i>Phytolacca rugosa</i>	totara
9	<i>Coprosma acroclada</i>	ti kouta, cabbage tree	28	<i>Podocarpus totara</i>	matua, black pine
10	<i>Cyathochaeta</i>	pinga, silver fern, a tree fern	29	<i>Phymatopteris lyallii</i>	arua, paeopaearak
11	<i>Cyathochaeta</i>	pinga, silver fern, a tree fern	30	<i>Phymatopteris lyallii</i>	arua, paeopaearak
12	<i>Dacrydium cupressinum</i>	totara	31	<i>Phymatopteris lyallii</i>	arua, paeopaearak
13	<i>Dicentra fibrosa</i>	lumpaka, whei oonga, a tree fern	32	<i>Sporobolus micranthus</i>	South Island tussock
14	<i>Dicentra fibrosa</i>	lumpaka, whei oonga, a tree fern	33	<i>Streblus heterophyllus</i>	turoso, small-leaved milk tree
15	<i>Elaeocarpus demissus</i>	hinau			
16	<i>Elaeocarpus hookeri</i>	hinau			
17	<i>Fuchsia excorticata</i>	totokutuku, titea fuchsia			
18	<i>Hebe xanthophylla</i>	porokawhiri, pigeonwood			
19	<i>Hesperis matronalis</i>	matua, water fern			



KAHIKATEA kereru, manatu, lush, older plains ecosystem & TOTARA bellbird, matai, older plains ecosystem



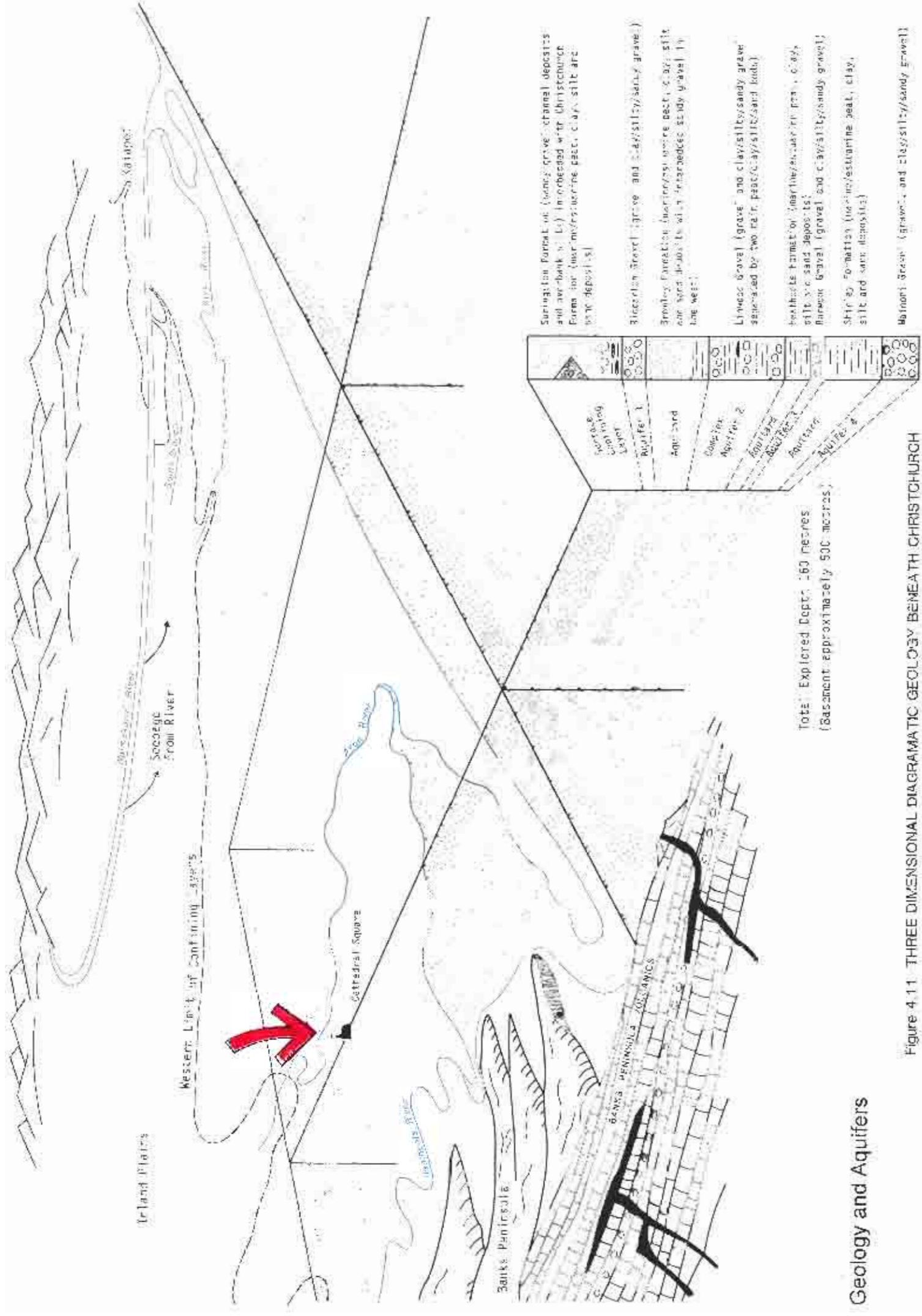
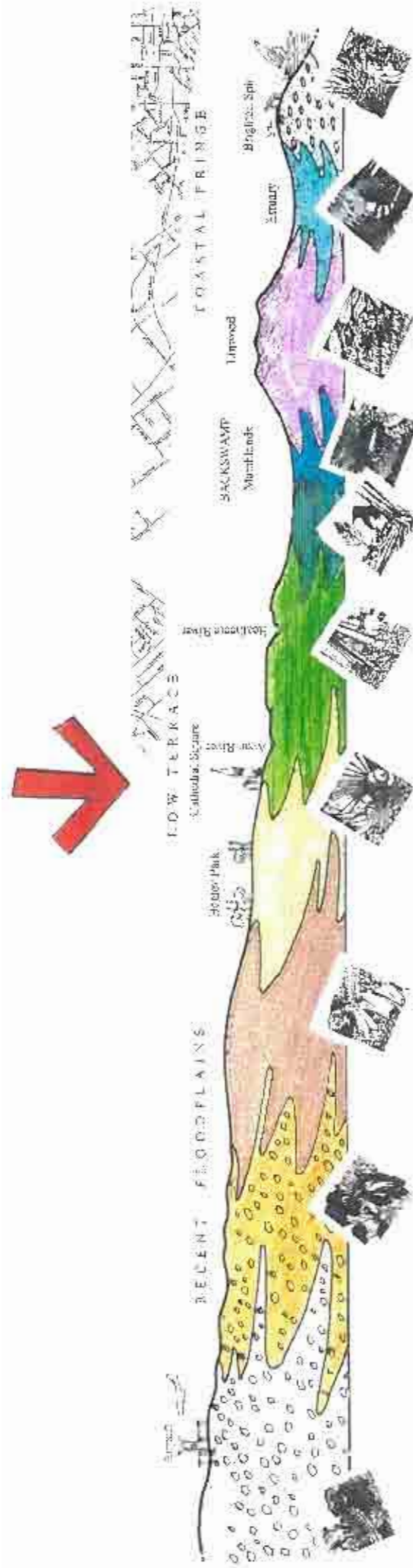


Figure 4.11 THREE DIMENSIONAL DIAGRAMATIC GEOLOGY BENEATH CHRISTCHURCH

Geology and Aquifers



Ecosystems of Plains Christchurch

Lucas Associates

OTAUTAHU CHRISTCHURCH

Indigenous Coastal Plains Ecosystems

KEY

		KAHIKATEA kereru, manatu, lush, older plains ecosystem
		TOTARA bellbird, matai, older plains ecosystem
		HOUHERE piwakawaka, kohuhu, mid-age plains ecosystem
		TI KOUKA kotare, kanuka, mid-age plains ecosystem
		KOWHAI pipit, mikimiki, young plains ecosystem
		TUSSOCK green skink, ti kouka, young plains ecosystem
		PUKIO pukeko, karama, coastal peat plains ecosystem
		AKEAKE riroriro, ngaio, old dune ecosystem
		PINGAO kuaka, tauhinu, young dune ecosystem
		OIOI tuturiwhatu, marsh ribbonwood, estuarine ecosystem.

KEY

KAHIKATEA
kereru, manatu,
lush older plains ecosystem



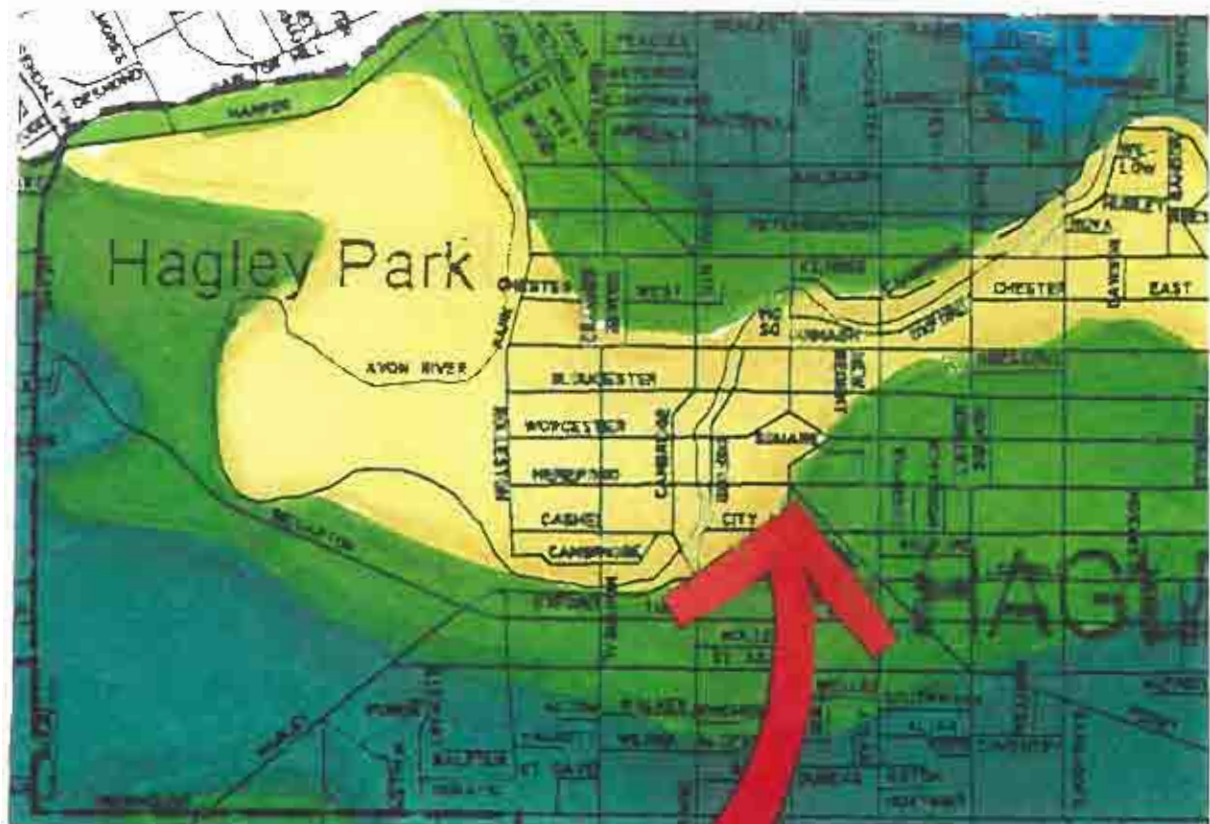
TOTARA
bellbird, matai, broadleaf,
older plains ecosystem



HOUHERE
piwakawaka, kotuhu,
mid-age plains ecosystem



PUKIO
pukeko, karamu,
peatland plains ecosystem





TOTARA, bellbird, matai, older plains ecosystem

FOOD: for native birds shown as:

- F - Fruit/seed
- N - Nectar
- B - Bud/foliage and
- I - Insects
- L - Fruit for *Ligaria*

PLANT TOLERANCES:
for sunny, shady, moist, dry and
windy conditions shown as:

- = tolerates or needs
- = intolerant
- ½ = tolerant of some
- † = toxic for toddlers

PLANT LISTS Selected from vegetation natural to these moist & deep Kaiapoi soils

LARGE TREES

F) <i>Elaeocarpus dematus</i>	hinau
P) <i>Podocarpus totara</i>	totara
P) <i>Prumnopitys taxifolia</i>	matai, black pine

TREES & TALL SHRUBS

F) <i>Coprosma lucida</i>	shining karamu	F	■ ■ ■ ■ ■ ■
F) <i>Coprosma robusta</i>	karamu	F	■ ■ ■ ■ ■ ■
F) <i>Cordyline australis</i>	ti kouka, cabbage tree	F,N,I	■ ½ ■ ■ ■ ■
F) <i>Fuchsia excorticata</i>	kotukutuku, tree fuchsia (deciduous)	F,N,B,I	½ ■ ■ ■ □ □
F) <i>Griselinia littoralis</i>	kapuka, broadleaf	F,N,B,I	■ ■ ■ ■ ■ ■
F) <i>Hoheria angustifolia</i>	houhere, narrow-leaved lacebark	F,I	■ □ ■ ■ ■ ■
F) <i>Kunzea ericoides</i>	kanuka	N,I	■ □ ½ ■ ■ ■
F) <i>Leptospermum scoparium</i>	manuka, tea tree	N,I	■ □ ■ ■ ■ ■
F) <i>Lophomyrtus obcordata</i>	rohutu, NZ myrtle	F	■ ■ ■ ■ ■ ■
F) <i>Pittosporum eugenoides</i>	tarata, lemonwood	F	■ ■ ■ ■ ■ □
F) <i>Pittosporum tenuifolium</i>	kohuhu, black matipo	F,I	■ ■ ■ ■ ■ ■
F) <i>Plagianthus regius</i>	manatu, lowland ribbonwood (deciduous)	F,I	■ ½ ■ ½ ■ ■
F) <i>Pseudopanax crassifolius</i>	lancewood, horoeka	F,N,H,I	■ ½ ■ ■ ■ ■
F) <i>Sophora microphylla</i>	South Island kowhai	F,I	■ ½ ½ ■ ■ ■ †

SHRUBS

F) <i>Coprosma propinqua</i>	mikimiki, mingimingi	F,L,L	■ ■ ■ ■ ■ ■
F) <i>Coprosma virescens</i>	pale green coprosma	F,L	■ ■ ■ ■ ■ ■
F) <i>Hebe salicifolia</i>	koromiko	I	■ ½ ■ ½ ■ ■
F) <i>Leucopogon fasciculatus</i>	mikimiki	F,I	■ ½ ½ ½ ■ ■

GROUNDCOVERS, etc.

F) <i>Acaena novae-zelandiae</i>	bidibidi, piripiri		■ □ ½ ■ ■ ■
F) <i>Anemanthele lessoniana</i>	bamboo grass, wind grass		■ ■ ■ ■ ■ ■
F) <i>Cortaderia richardii</i>	toetoe		■ □ ■ ■ ■ ■
F) <i>Phormium tenax</i>	harakeke, NZ flax	N,L	■ □ ■ ½ ■ ■
f) <i>Phymatosorus pustulatus</i>	hounds tongue fern, maratata		½ ■ ■ ■ ½ □
f) <i>Pteridium esculentum</i>	bracken fern, rahurahu		■ ½ ½ ■ ■ ■

Key

- P podocarpus
- F flowering plants
- f ferns

FOOD: for native birds shown as:

F = Fruit/seed;

N = Nectar;

B = Bud/foilage and

I = Insects.

L = Fruit for Lizards

PLANT TOLERANCES:

for sunny, shady, moist, dry and windy conditions shown as:

■ = tolerates or needs

□ = intolerant

½ = tolerant of some

ADDITIONAL PLANTS FOR SHELTERED SITES: TREES & TALL SHRUBS

F) <i>Alectryon excelsus</i>	titoki
F) <i>Aristotelia serrata</i>	makomako, wineberry (semi-deciduous)
F) <i>Coprosma areolata</i>	thin-leaved coprosma
F) <i>Coprosma linearifolia</i>	narrow-leaved coprosma, yellow-wood
F) <i>Coprosma rhamnoides</i>	red-fruited mikimiki
F) <i>Coprosma rubra</i>	red-stemmed karamu
F) <i>Cyathodes juniperina</i>	prickly mikimiki
F) <i>Melicope simplex</i>	poataniwha
F) <i>Melicope ramiflora</i>	mahoe, whiteywood
F) <i>Myoporum laetum</i>	ngaio
F) <i>Myrsine australis</i>	mapou, red mapou
F) <i>Pennantia corymbosa</i>	kaikomako (slow growing)
F) <i>Pseudopanax anomalus</i>	shrub pseudopanax
F) <i>Pseudopanax arboreus</i>	fivefinger, whauwhaupaku
F) <i>Streblus heterophyllus</i>	turepo, small-leaved milk tree (slow)

GROUNDCOVERS

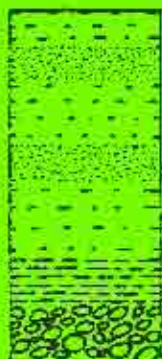
f) <i>Asplenium</i> aff. <i>trichomanes</i>	spleenwort
F) <i>Astelia fragrans</i>	bush flax, kakaha
f) <i>Blechnum penna-marina</i>	kiokio, small hardfern
f) <i>Hypolepis ambigua</i>	rough pig fern
F) <i>Libertia ixioides</i>	NZ iris, mikoikoi
F) <i>Microlaena polynoda</i>	a rice grass
F) <i>Microlaena stipoides</i>	a rice grass
f) <i>Pellaea rotundifolia</i>	button fern
f) <i>Polystichum richardii</i> ; <i>P. vestitum</i>	shield ferns; pikopiko; puniu
F) <i>Uncinia uncinata</i>	watau, hook sedge

Tolerances

Food	sun	shade	wet	dry	windy
F	■	■	■	□	□ *
F,I	½	½	■	½	□
F,L	½	■	■	½	□
F,N,L	½	■	■	½	½
F,B,I	■	■	½	■	■
F,N,L	■	½	■	½	■
F,N	■	½	½	■	■
F,I	½	■	■	□	■
N,B,I	■	■	□	□	□ *
F,N	■	½	■	■	■ t
F,I	■	■	□	■	■
F,N,I	½	½	■	□	½
F,N	½	½	■	½	■
F,N,I	■	■	½	½	½
F	½	■	■	□	□



Underlayers: Alternating silt, sand & clay on greywacke river stones (2-100mm rounded).



* = to establish, protect from frost; t = toxic for toddlers.



HOUHERE, piwakawaka, kohuhu, mid age plains system

FOOD: for native birds shown as:

- F - Fruit/seed;
- N - Nectar;
- B - Bud/foilage and
- I - Insects;
- L - Fruit for lizards

PLANT TOLERANCES:

for sunny, shady, moist, dry and windy conditions shown as:

- = tolerates or needs
- = intolerant
- ½ = tolerant of some
- t = toxic for toddlers

PLANT LISTS Selected from vegetation natural to these moist & deep Waimakariri soils Tolerances

FOR OPEN SITES:

LARGE TREES

- ♀ *Podocarpus totara*
- ♀ *Prumnopitys taxifolia*

- totara
- matai, black pine

Food	sun	shade	wet	dry	windy
F,N,B,I	■	■	■	■	■
F,B,I	■	■	■	□	□

TREES & SHRUBS

- F1 *Coprosma robusta*
- F1 *Cordyline australis*
- F1 *Griselinia littoralis*
- F1 *Hoheria angustifolia*
- F1 *Kunzea ericoides*
- F1 *Leptospermum scoparium*
- F1 *Olearia paniculata*
- F1 *Pittosporum tenuifolium*
- F1 *Pseudopanax crassifolius*
- F1 *Sophora microphylla*

- karamu
- ti kouka, cabbage tree
- kapuka, broadleaf
- houhere, narrow-leaved lacebark
- kanuka
- manuka, tea tree
- akiraho, golden akeake
- kohuhu, black matipo
- lancewood, horoeka
- South Island kowhai

F	■	■	■	■	■
F,N,I	■	½	■	■	■
F,N,B,I	■	■	■	½	■
F,I	■	□	■	■	■
N,I	■	□	■	■	■
N,I	■	□	■	■	■
I	■	□		■	■
F,I	■	■	■	■	■
F,N,B,I	■	½	■	■	■
F,I	■	½	½	■	■ t

SHRUBS

- F1 *Coprosma crassifolia*
- F1 *Coprosma propinqua*
- F1 *Coprosma rubra*
- F1 *Coprosma virescens*
- F1 *Cyathodes juniperina*
- F1 *Helichrysum lanceolatum*
- F1 *Leucopogon fasciculatus*
- F1 *Muehlenbeckia astonii*
- F1 *Teucrium parvifolium*

- thick-leaved mikimiki
- mikimiki, mingimingi
- red-stemmed coprosma
- pale green coprosma
- prickly mikimiki
- niniaio
- mikimiki
- shrub pohuehue
- NZ shrub verbena

F,N,L	■	½	½	■	■
F,L,L	■	■	■	■	■
N,I	■	½	■	½	■
N,L	■	■	■	■	■
F,I	■	½	½	■	■
	■	□	½	■	■
N	■	½	½	½	■
F,N,L	■	□	½	■	■
	■	□	½	½	□

Key

- F podocarps
- F1 flowering plants
- f ferns

FOOD: for native birds shown as:

F = Fruit/seed;

N = Nectar;

B = Bud/foilage and

I = Insects.

L = Fruit for *Lizards*

PLANT TOLERANCES:

for sunny, shady, moist, dry and windy conditions shown as:

■ = tolerates or needs

□ = intolerant

½ = tolerant of some

ADDITIONAL PLANTS FOR SHELTERED SITES: TREES & SHRUBS

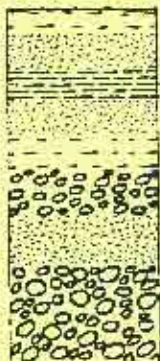
F1 <i>Dodonaea viscosa</i>	akeake (protect from frost)
F1 <i>Lophomyrtus obcordata</i>	rohutu, NZ myrtle
F1 <i>Pittosporum eugenioides</i>	tarata, lemonwood
F1 <i>Plagianthus regius</i>	manatu, lowland ribbonwood (deciduous)
F1 <i>Pseudopanax arboreus</i>	fivefinger, whauwhaupaku

Food	Tolerances				
	sun	shade	wet	dry	wind
	■	□	□	■	■
F	■	■	■	■	■
F	■	■	■	½	□
F,I	■	½	■	½	■
F,NI	■	■	½	½	½

GROUNDCOVERS

F1 <i>Anemanthele lessoniana</i>	bamboo grass, wind grass
F1 <i>Dichondra repens</i>	dichondra
F1 <i>Leucopogon fraseri</i>	patototara, a dwarf heath
F1 <i>Microlaena polynoda</i>	rice grass, native bamboo
F1 <i>Microlaena stipoides</i>	meadow rice grass

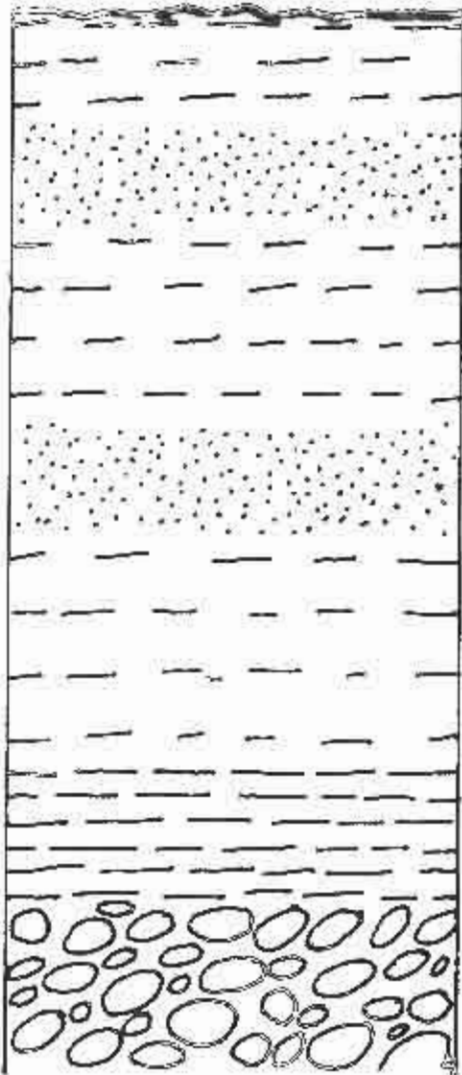
½	■	■	½	½
■	■	½	■	■
■	□	½	□	■
□	■	■	□	□
□	■	■	½	□



Underlayers: Alternating silt & sand (minor clay) on greywacke river stones (2-100mm rounded) on sand on more stones.

Totara

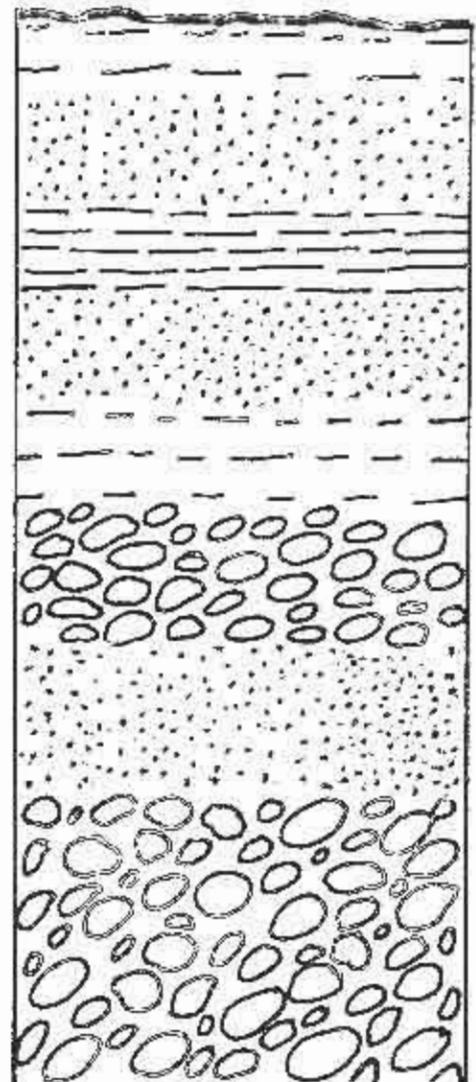
bellbird, matai, broadleaf,
older plains
ecosystem



Underlayers: Alternating silt, sand & clay on greywacke river stones (2-100mm rounded).

Houhere

piwakawaka, kohuhu
mid-age plains
ecosystem



Underlayers: Alternating silt & sand (minor clay) on greywacke river stones (2-100mm rounded) on sand on more stones.



hinau tree



Racemes of hinau flowers



hinau flowers



NMA

lower surface of the hinau leaf



the upper surface of a hinau leaf natural size

hinau *Elaeocarpus dentatus*



adult totara tree

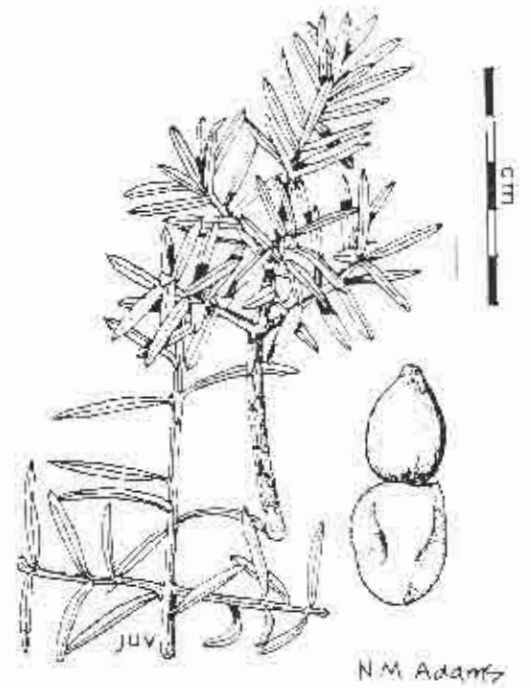


20

spray of totara



a ripening branchlet - female



totara
Podocarpus totara



adult Matali tree

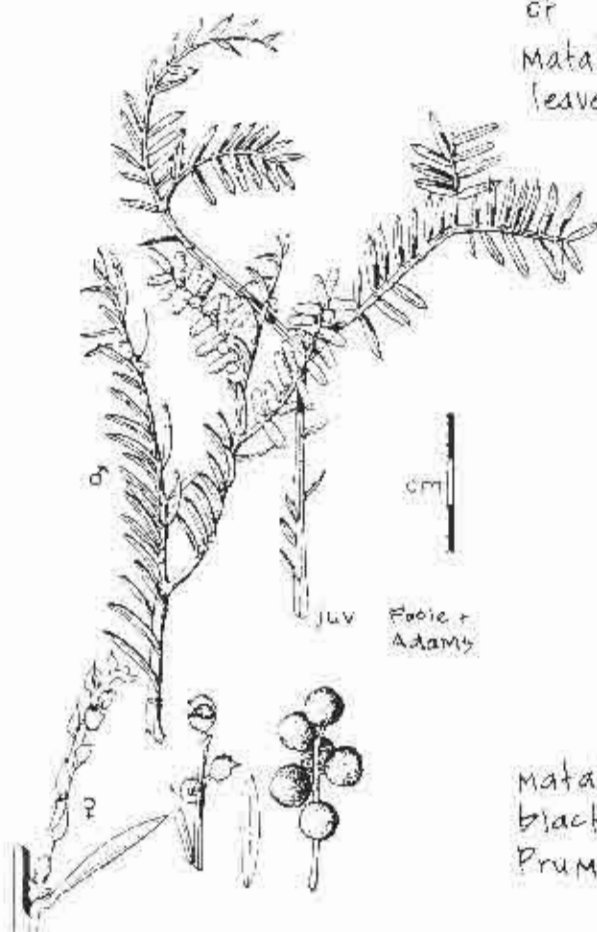


bark from young mature adult



spray of Matali leaves

new leaves developing along a sprouting branchlet



developing buds of new Matali leaves

Matali black pine
Prumnopitys taxifolia



underside of a Makomako leaf
showing prominent veins



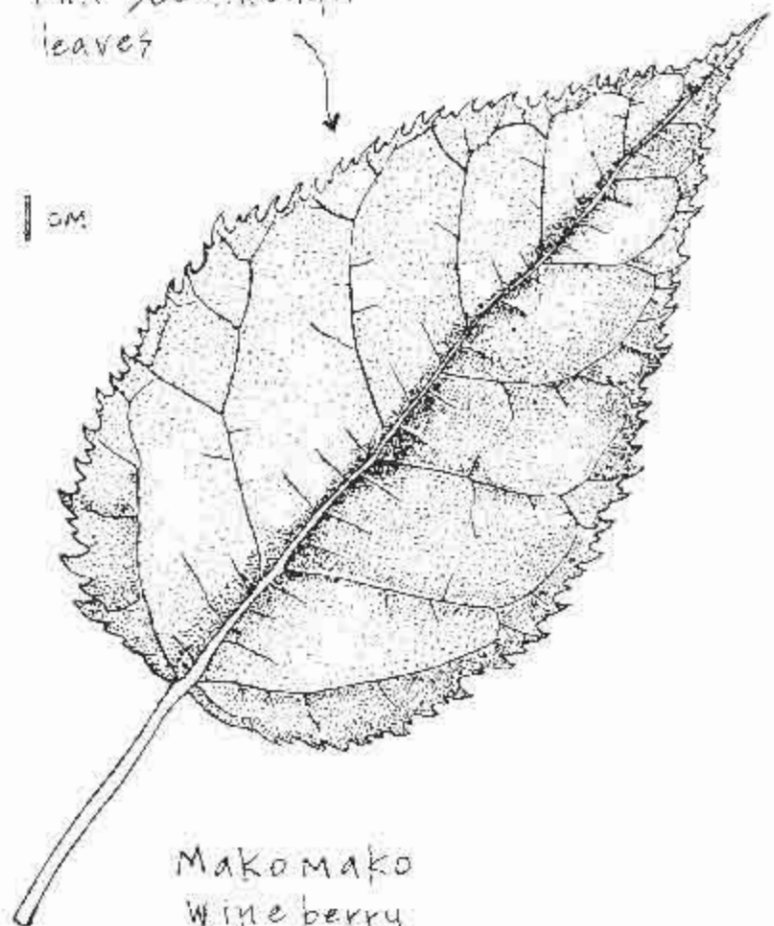
Makomako berries



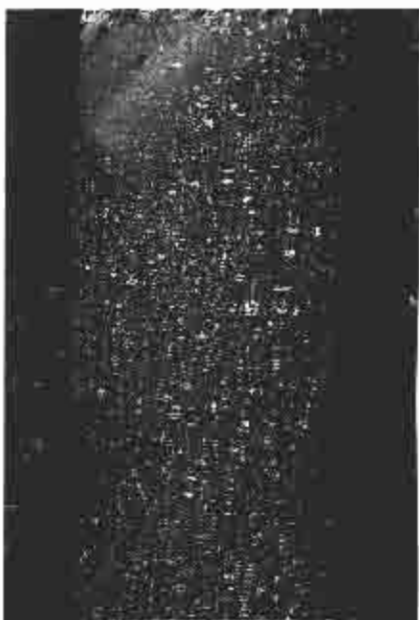
NMAadams

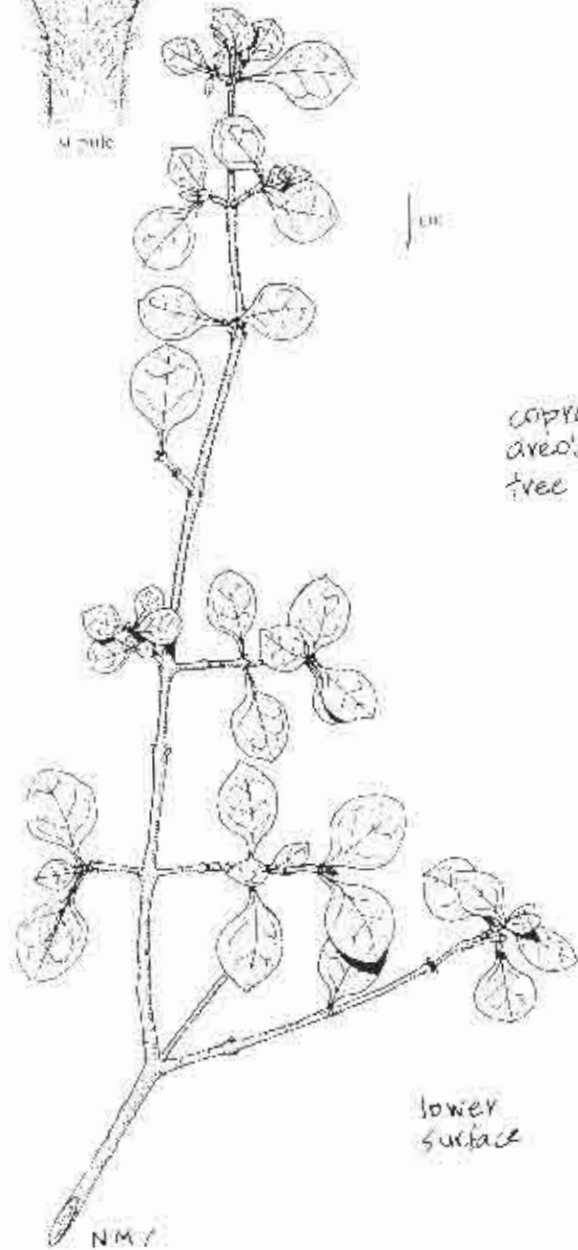
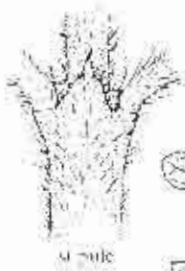
thin see-through
leaves

1 cm



Makomako
wine berry
Aristotelia serrata

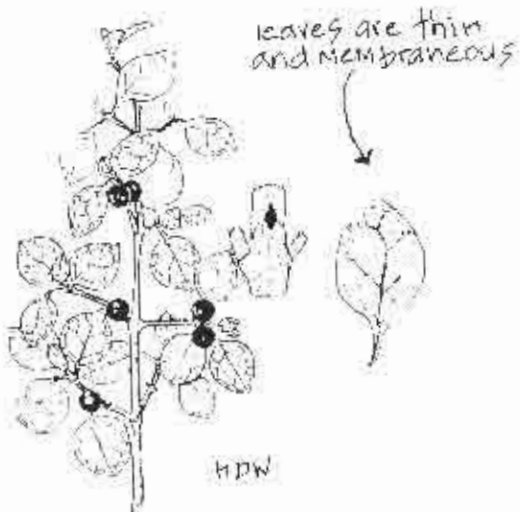




Coprosma areolata
tree



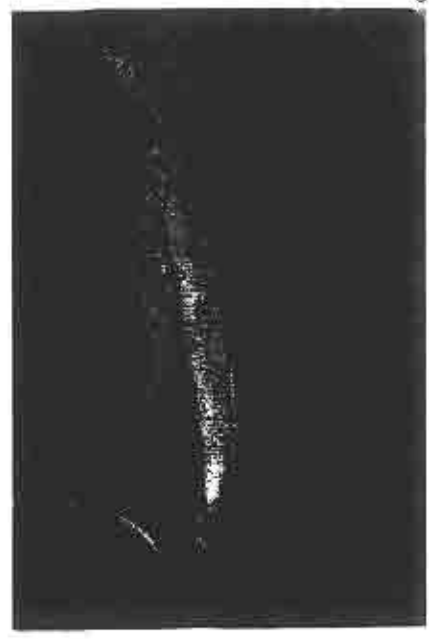
lower surface



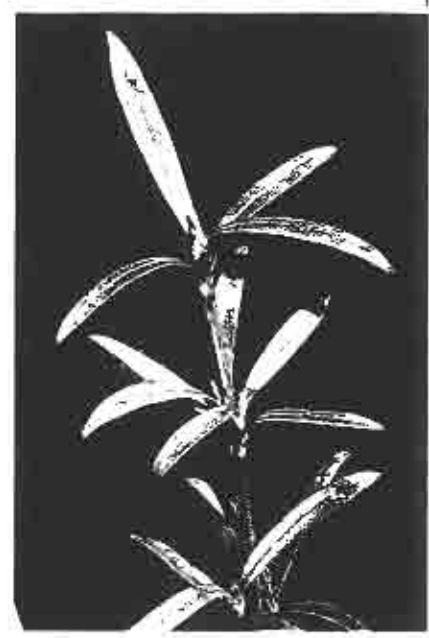
leaves are thin and membranous

upper surface

thin leaved *Coprosma areolata*



lower surface of a thick leathery leaf

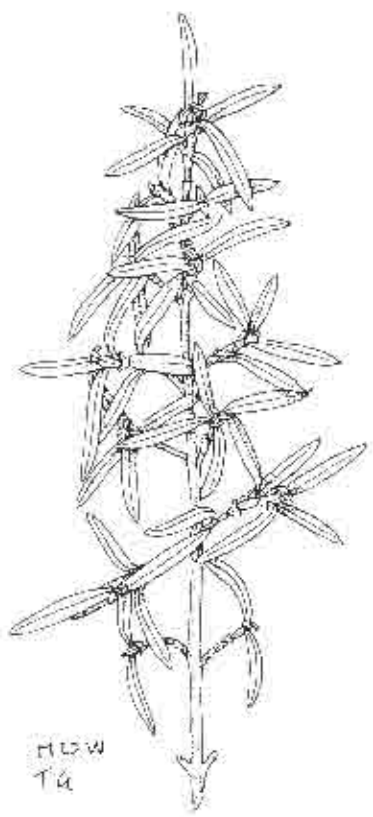


A branchlet of *C. linearifolia*



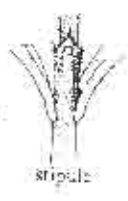
upper surface

narrow-leaved coprosma yellow wood
Coprosma linearifolia

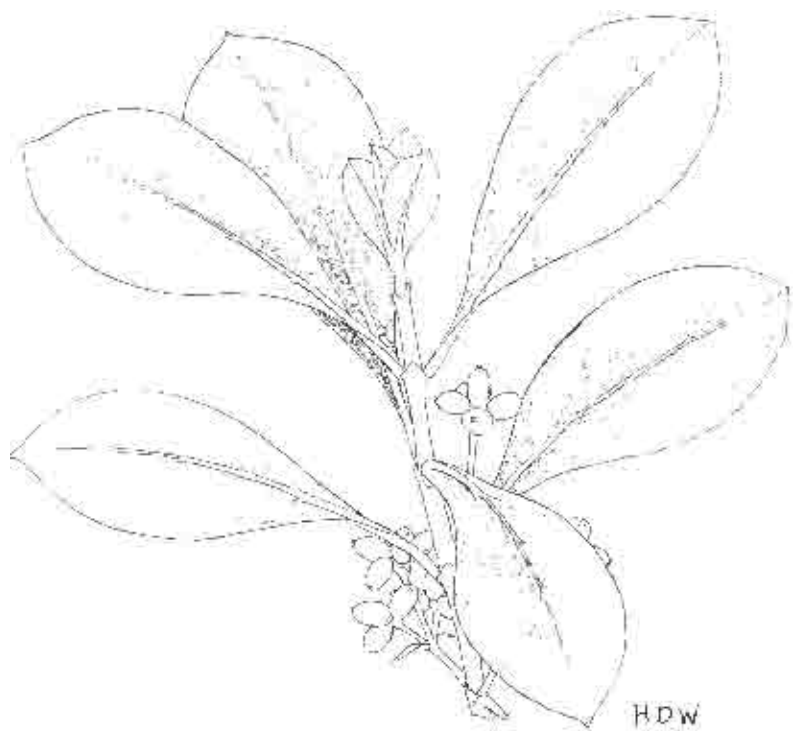


HLOW
Tā

1 cm



stipule



Shining Karamu
Coprosma lucida



Pooler + Adams

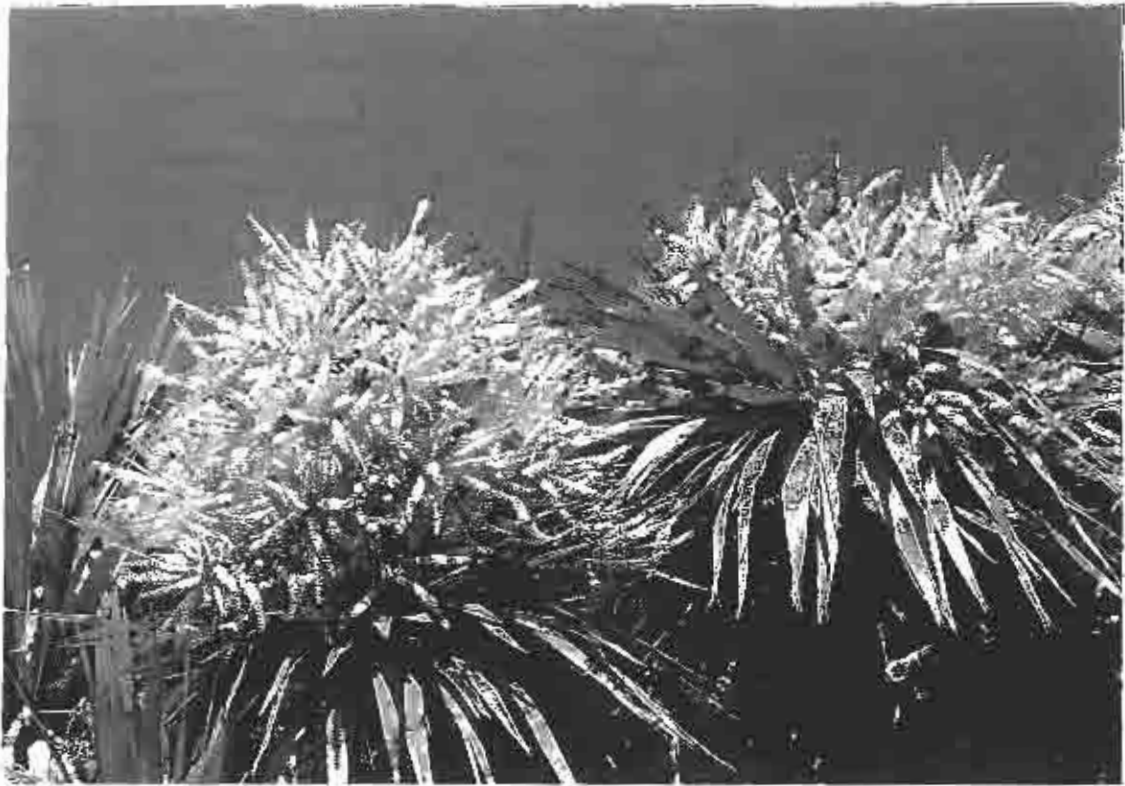


HDW



leaves are
leathery

Karamu
Coprosma robusta

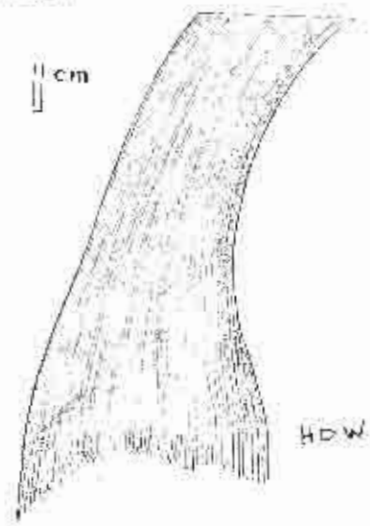


N.M. Adams



♂ Head

1 cm



H.W.

ti kouka
cabbage tree
Cordyline australis

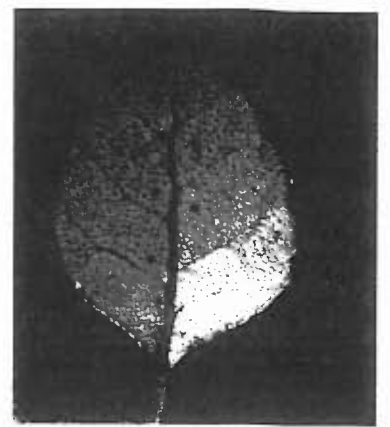
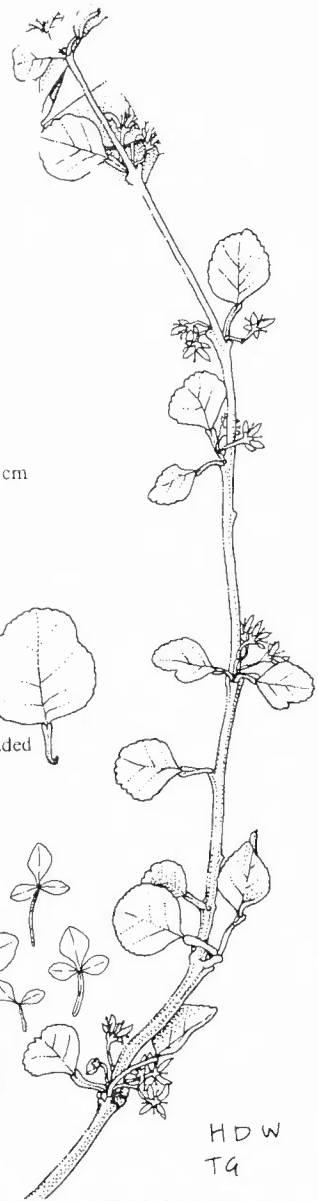
flat hinged petiole

shaded

juvenile

HDW
Tg

cm



leaf underside dotted with aromatic glands



male flower



female flowers



a small tree

poataniwha
Melicope simplex



a typical
akeake
tree

underside
of a leaf
showing
prominent
vein
network

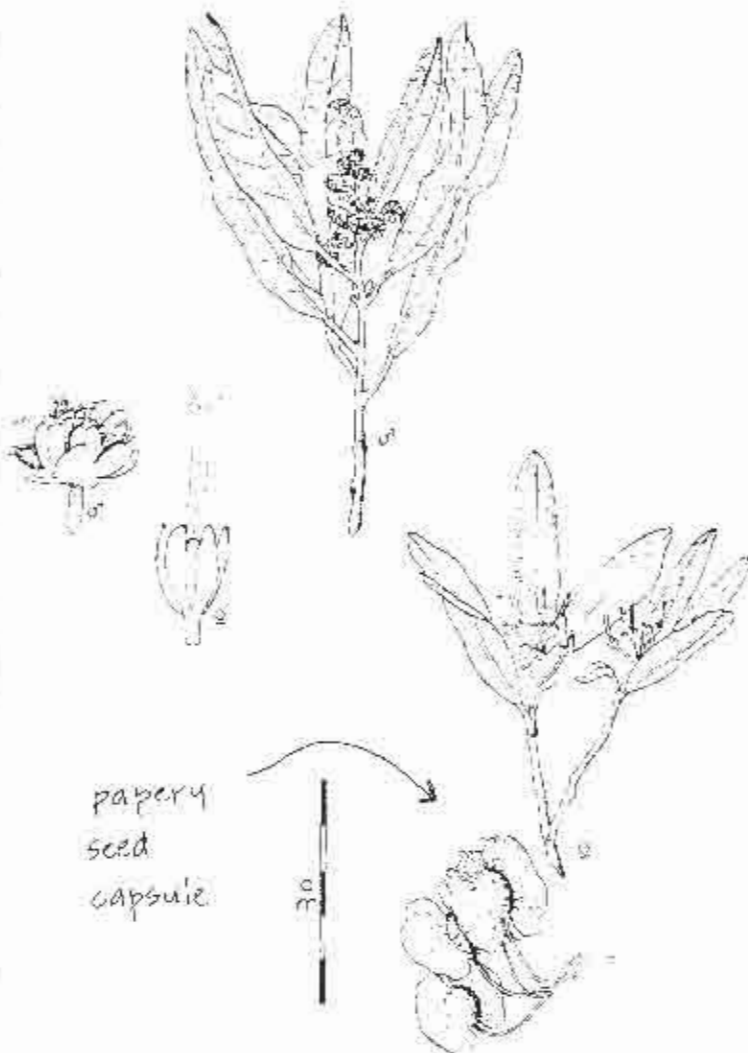


3



2

upper surface of an
akeake leaf



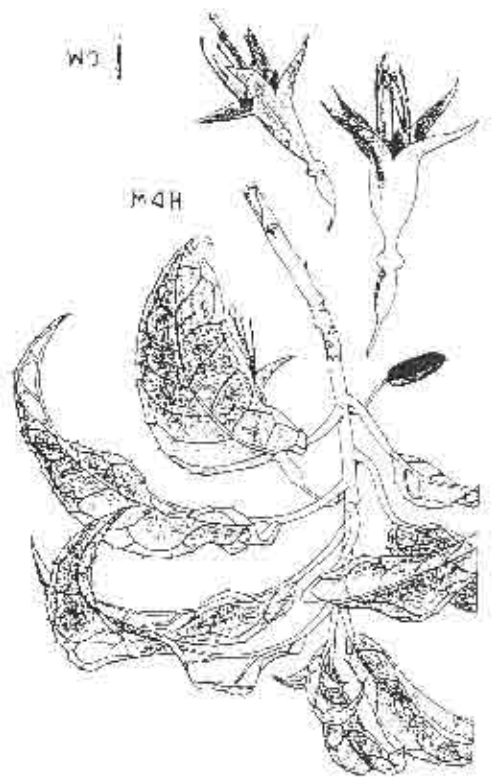
male
flower



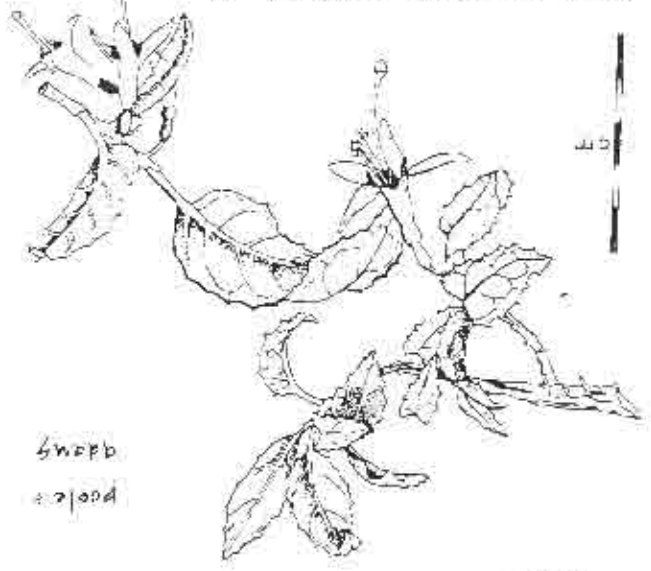
10

akeake
Dodonaea viscosa

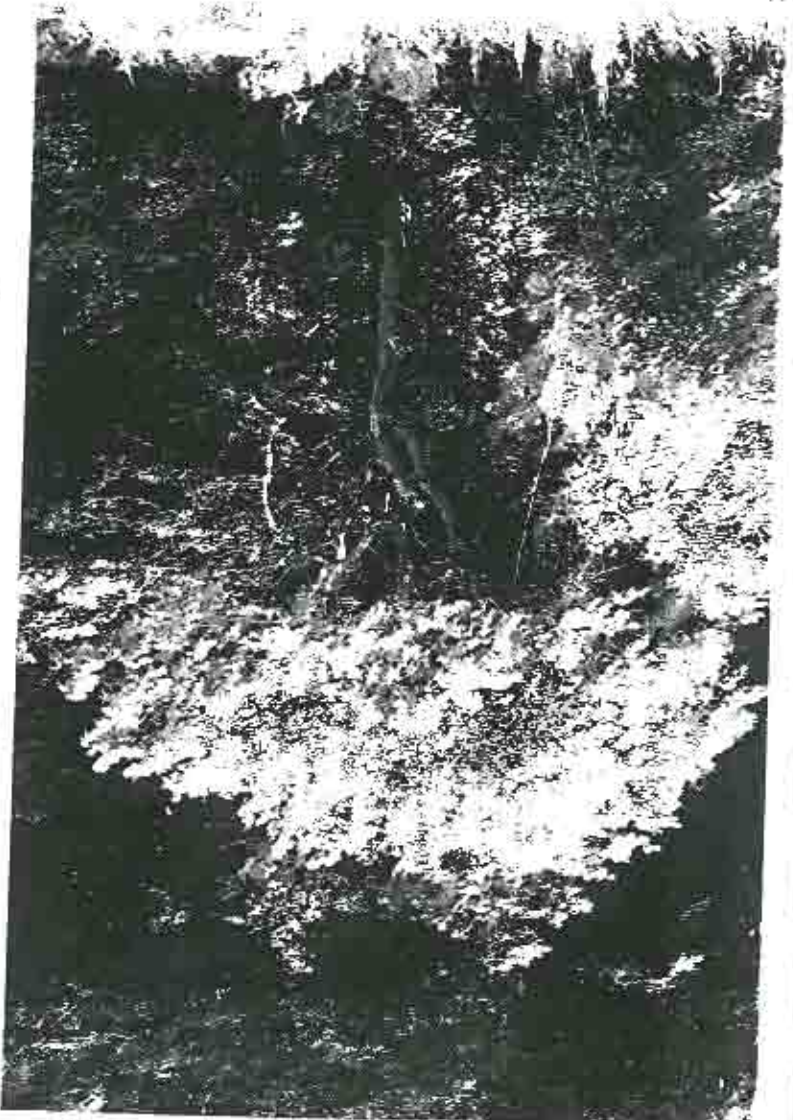
Kotukutuku
 tree fuchsia (deciduous)
 Fuchsia excorticata



the flowers have nectar which birds adore
 often coating their faces in blue pollen



Kotukutuku is the largest fuchsia in the world



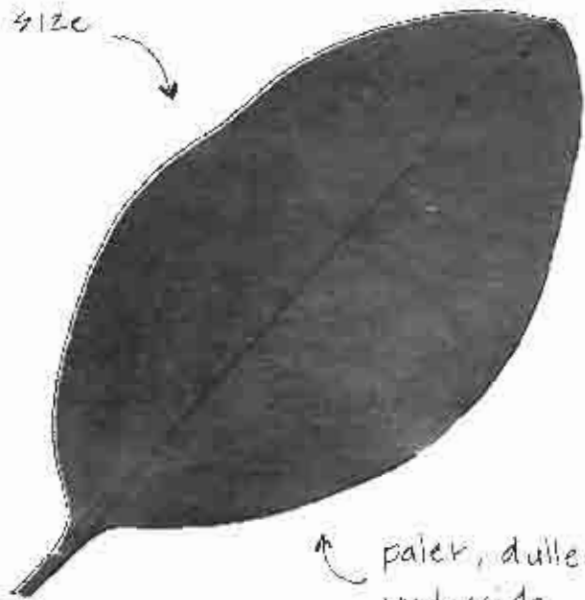
a gnarled
 and twisted
 tree trunk

pollen
 drops



shiny thick leaves →

natural size →

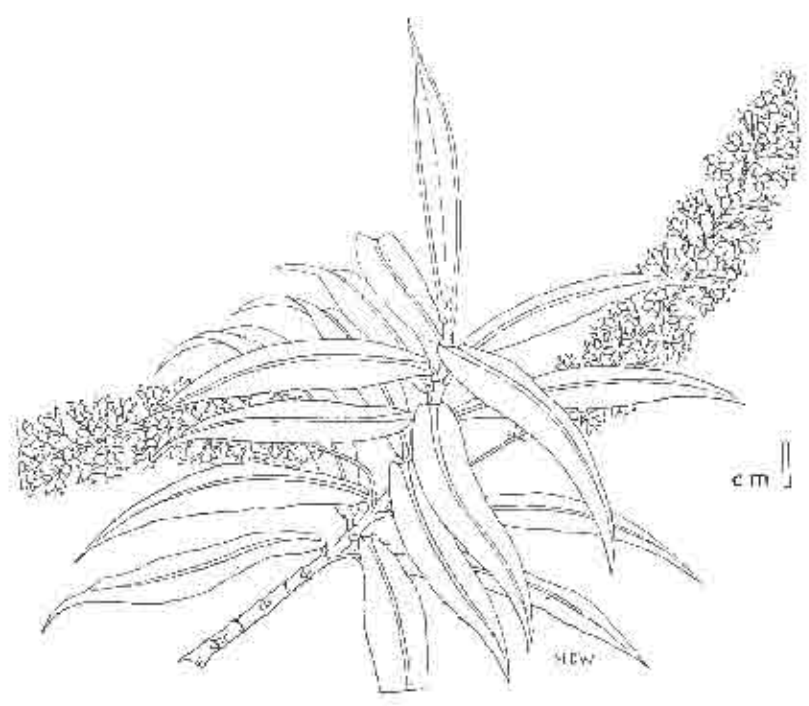
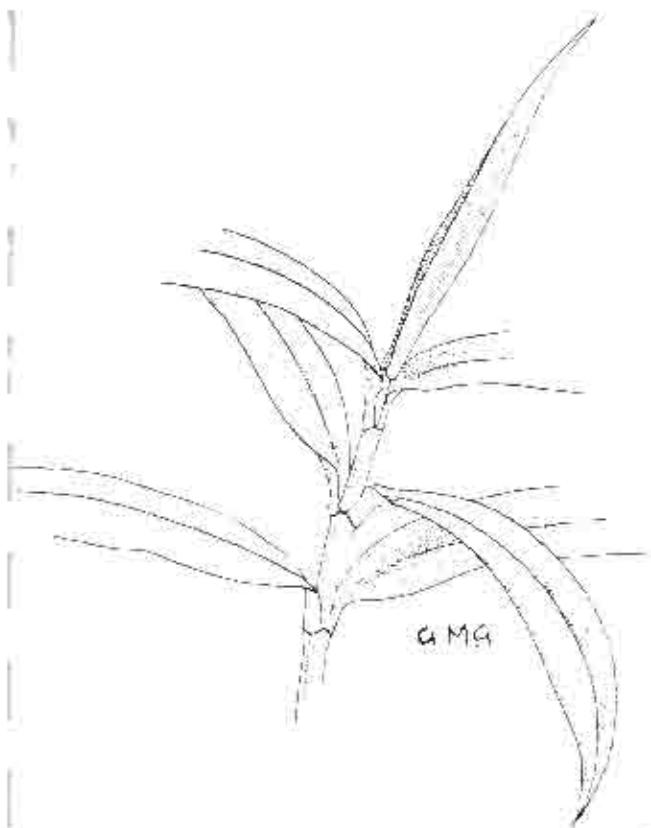


↑ paler, duller underside



in the open kapuka is a tight bushy tree, in the forest it is more open

Kapuka
broadleaf
Grisebinia littoralis



Koromiko
Hebe salicifolia



adult specimen houhere

leaf spray
showing the
paler leaf
lower surface

Notice the
prominent
serrations



fruits in early
formation



adult form



juvenile form



HDW
Tg

close view of flower



houhere
narrow-leaved lacebark
Honeria angustifolia



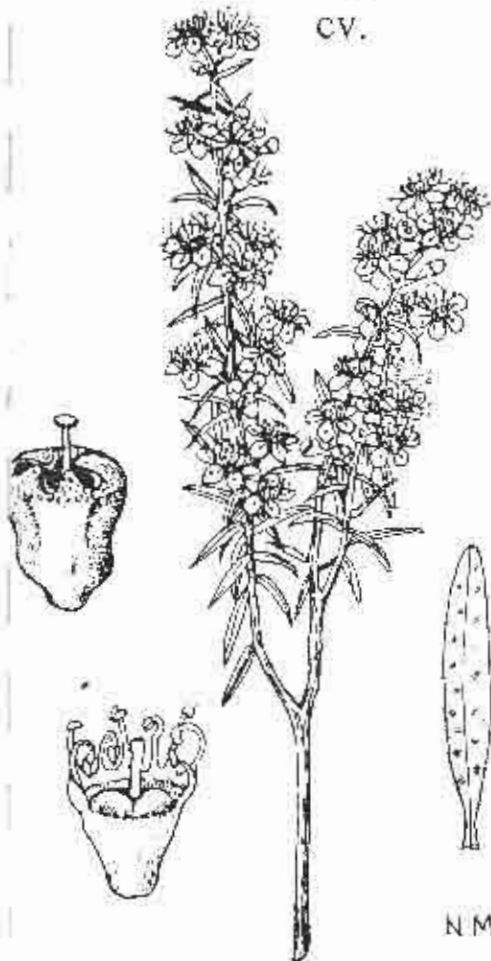
adult tree

close up
of flowers



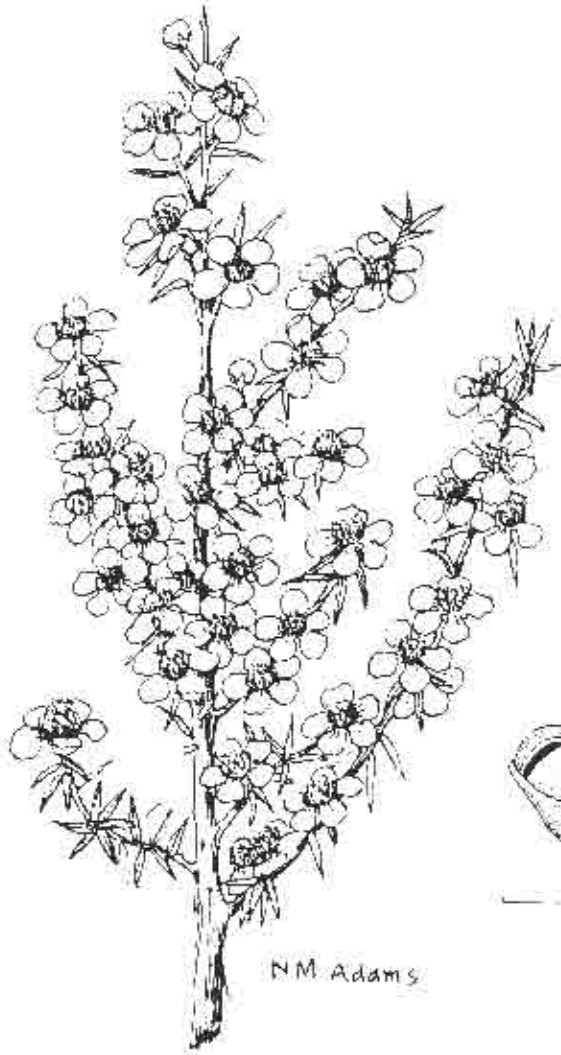
cv.

Kanuka
bark

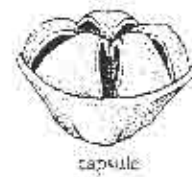


Kanuka
Kunzea ericoides

NM Adams



NM Adams



capsule

1 cm



How
TA

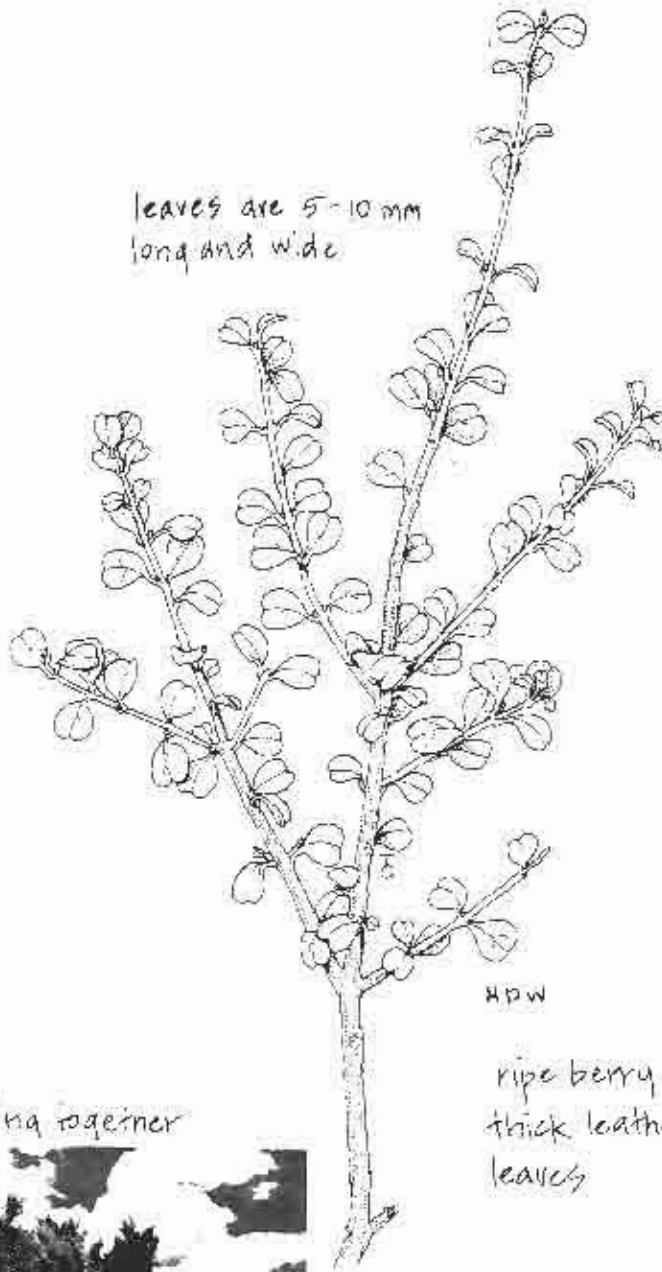


Manuka
Leptospermum scoparium

bark of
rohutu



leaves are 5-10 mm
long and wide

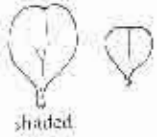


cm



HPW

ripe berry and
thick leathery
leaves



shaded

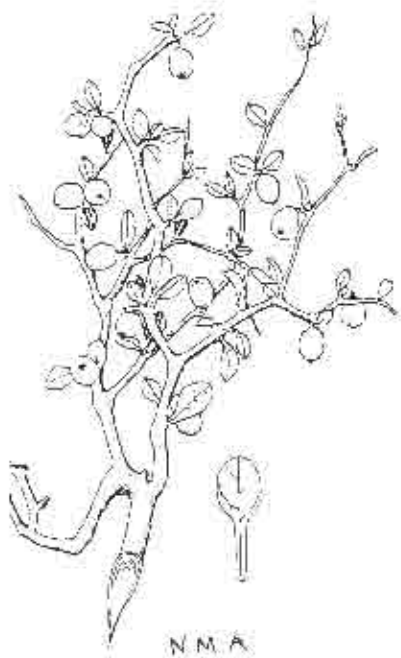
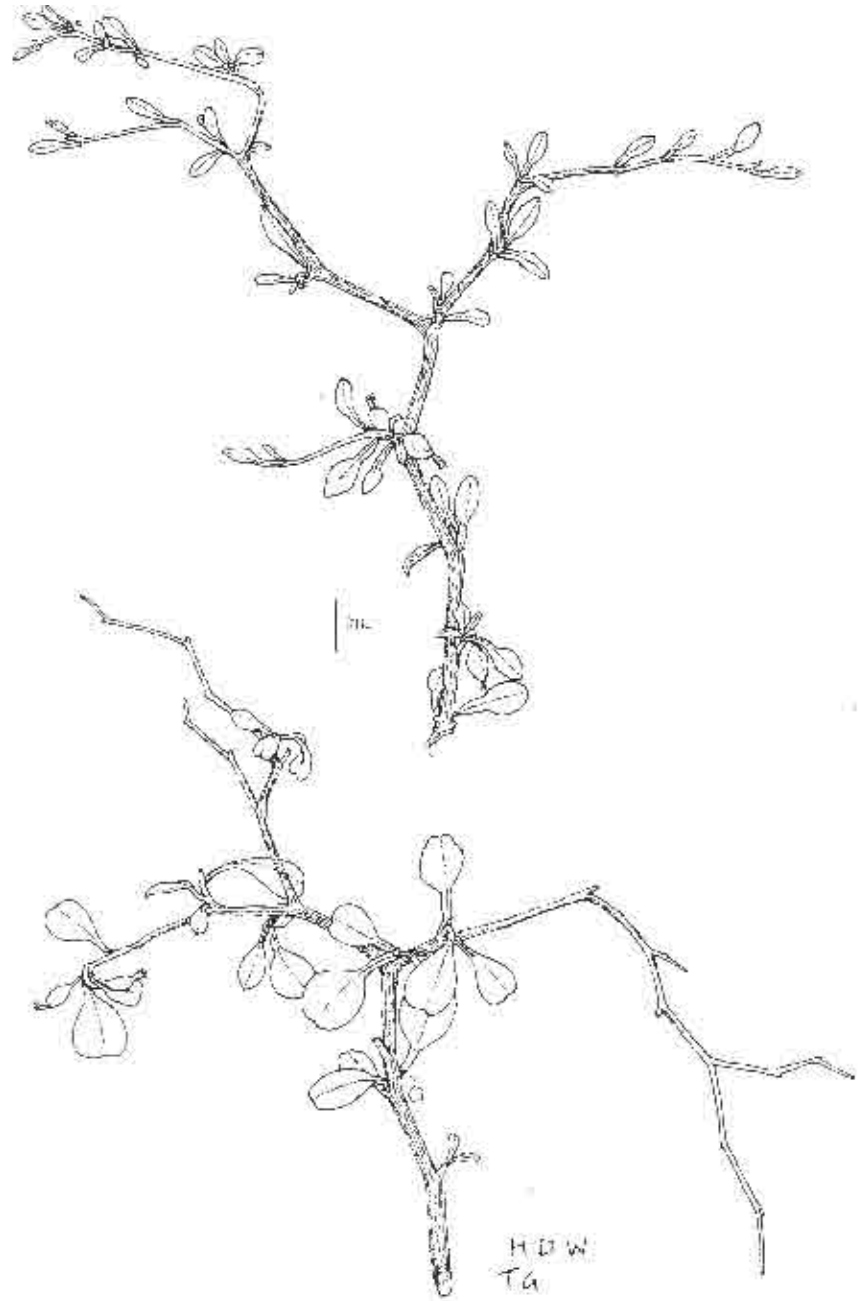
2 adult trees growing together



flowers 6 mm
across

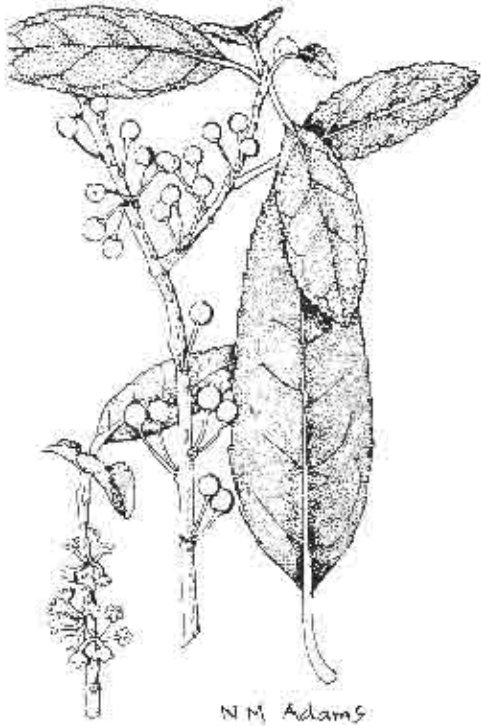


rohutu
New Zealand Myrtle
Lophomyrtus obovata



Corokia
Corokia coronaster

small hardy
tree growing
to 10 m high



an old gnarled mahoe

mahoe
leaf,
natural
size



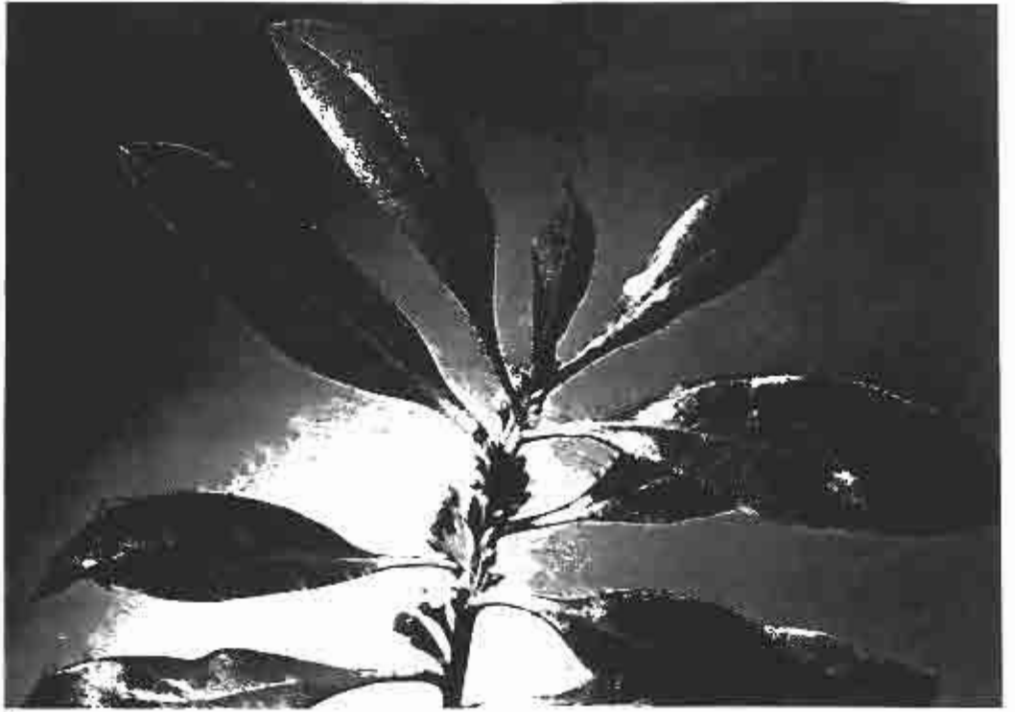
mesh-like Mahoe leaf skeletons
litter the forest floor



underside of
leaf

Mahoe
white wood
Melicope ramiflora

spray of ngaio leaves



7



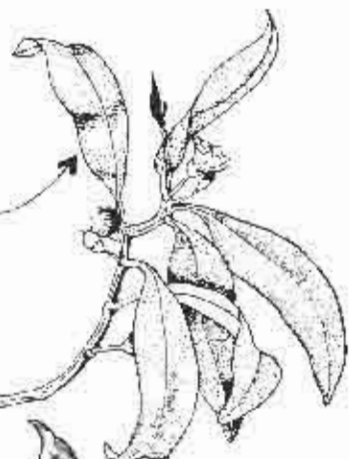
3

a single ngaio flower



5

translucent light comes through pellucid glands



NM Adams
A. v. Peck



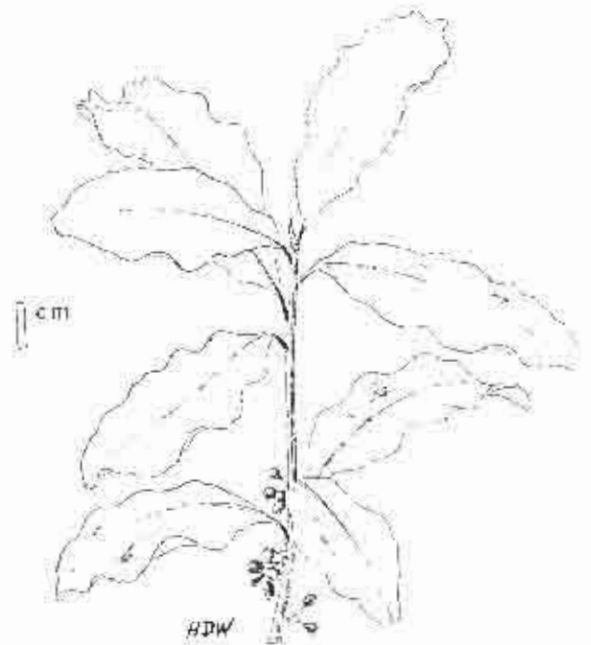
6

rough, wrinkled corky bark

ngaio
Myoporum laetum



Fully grown Mapou



leaf branchlet showing alternate leaf arrangement

Mapou has undulate margins and hairy midvein



leaf natural size



Mapou
red Mapou
Murgine australis



akiraho in full flower

leaves are
elliptic to
ovate-oblong
3-10 cm long
by 2-4 cm
wide



2

rough
deeply
furrowed
bark



life size
leaves



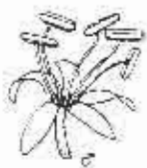
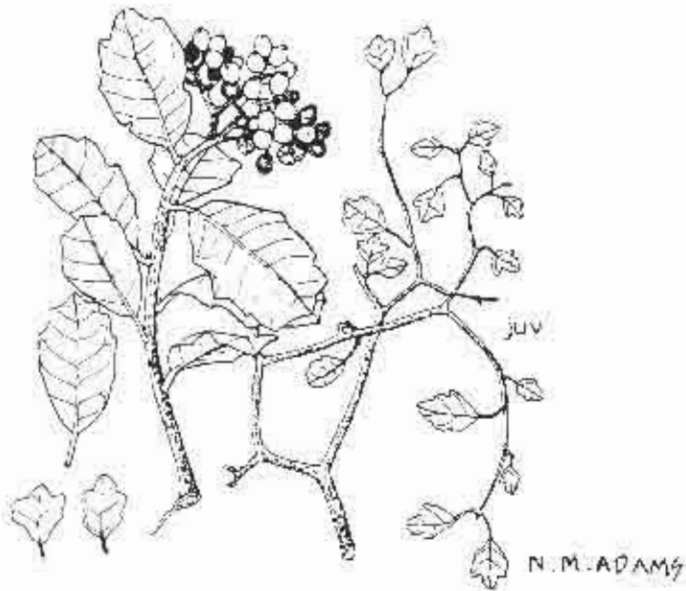
akiraho
golden akeake
Dicaria paniculata





Kaikomako drupes are black and shiny, they are the favourite food of bellbirds

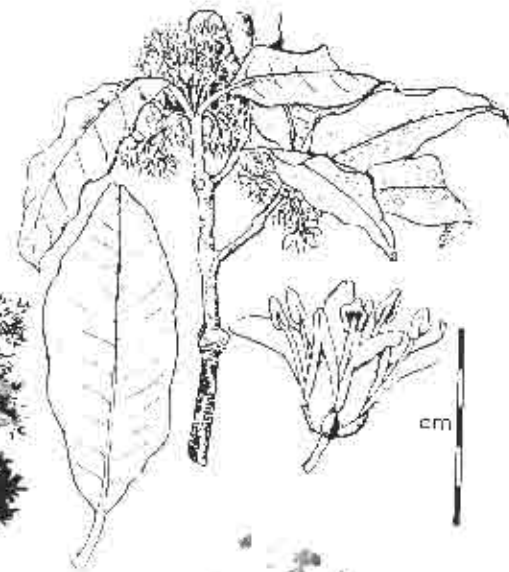
Kaikomako wood was used by Maori to make fire



Kaikomako
Pennantia wrymbosa



Mature tarata tree



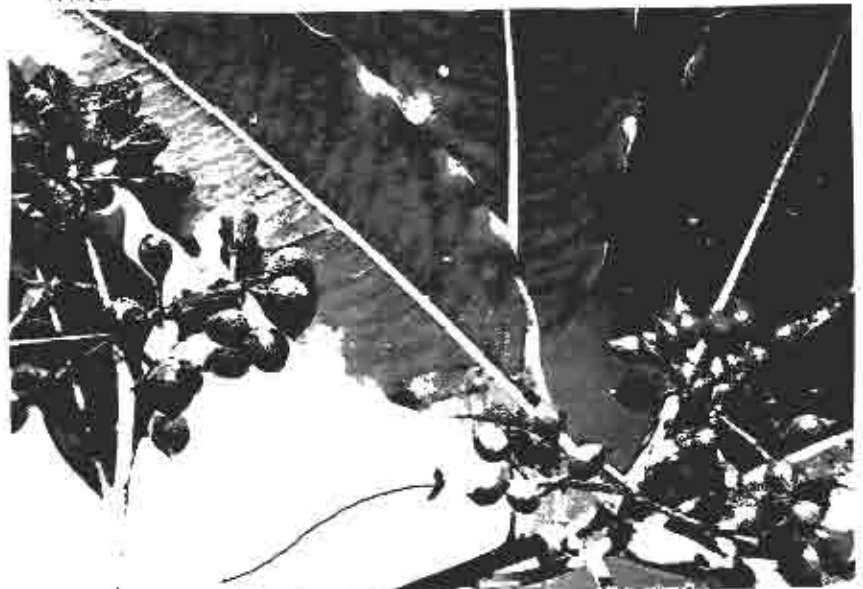
When
leaves
are crushed
they emit
a lemon
smell



leaves have undulating margins
and are 10-15 cm long, by 2-4cm
wide

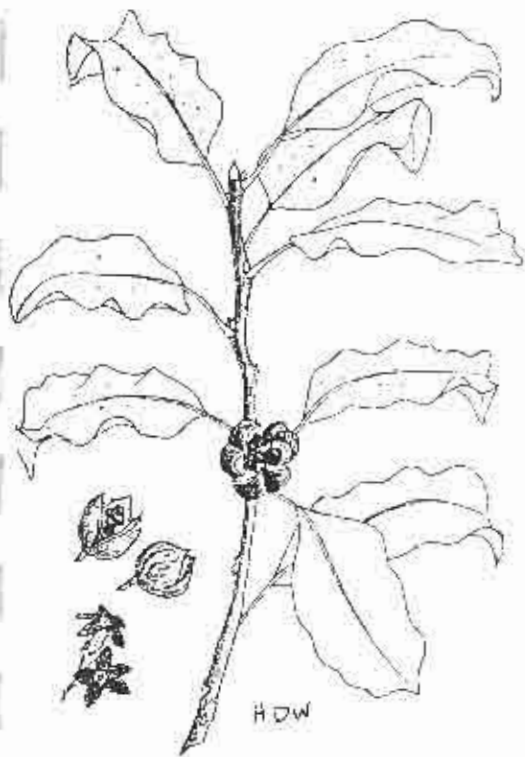


bark of a mature tree



new seasons
green fruit

tarata
lemonwood
Pitcairnia eugenioides



life size
leaves



leaves are
glossy,
wavy and
margined

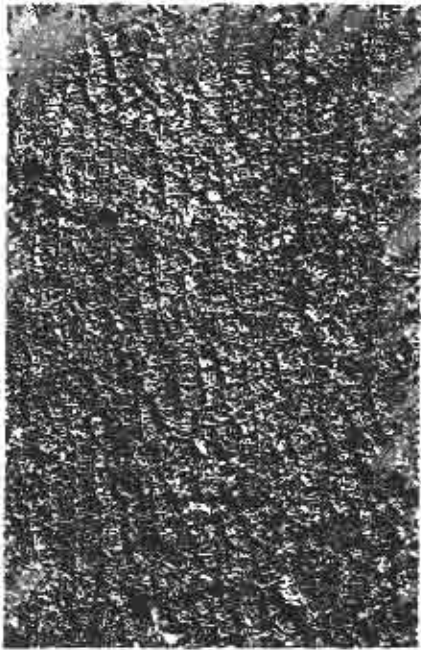
blistered bark
of an old tree



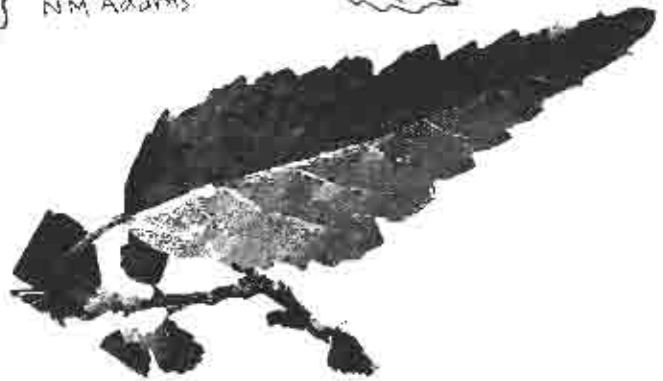
forest form of Kohuhu

Kohuhu
black matipo
Podocarpum tenuifolium





bark is very rough. The tough strong layers were used by Maori to make rope for fishing.

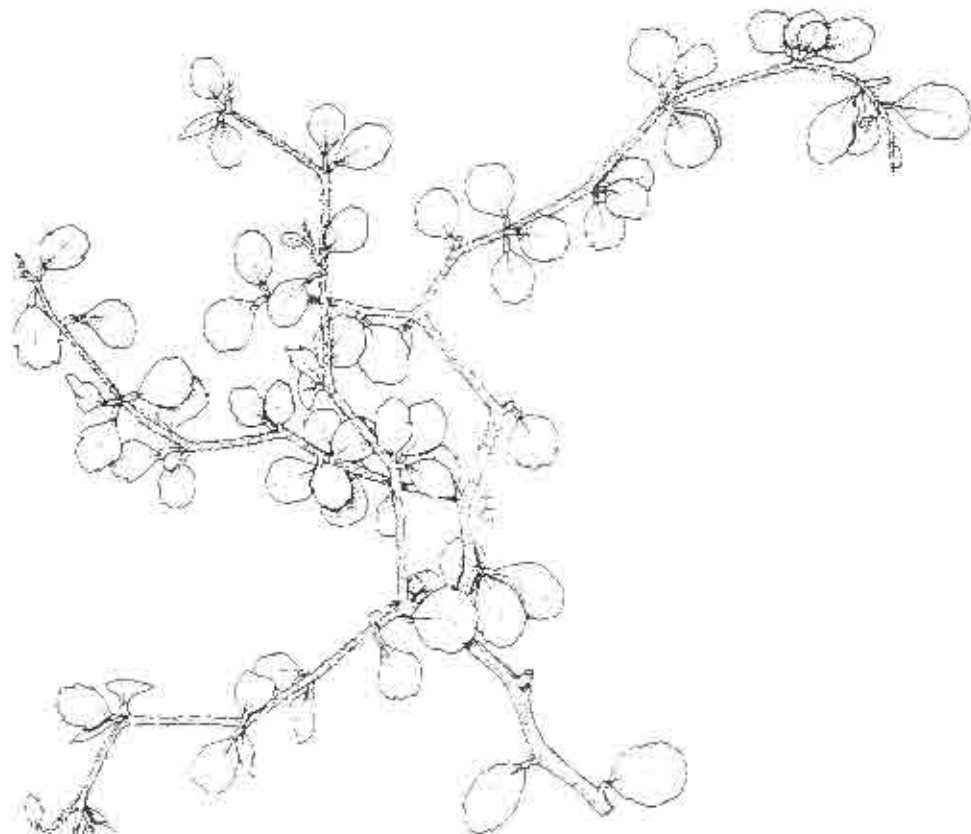


an adult tree - branch habit

a tree changing to adult form



Manatu
lowland ribbonwood (deciduous)
Plagianthus regius



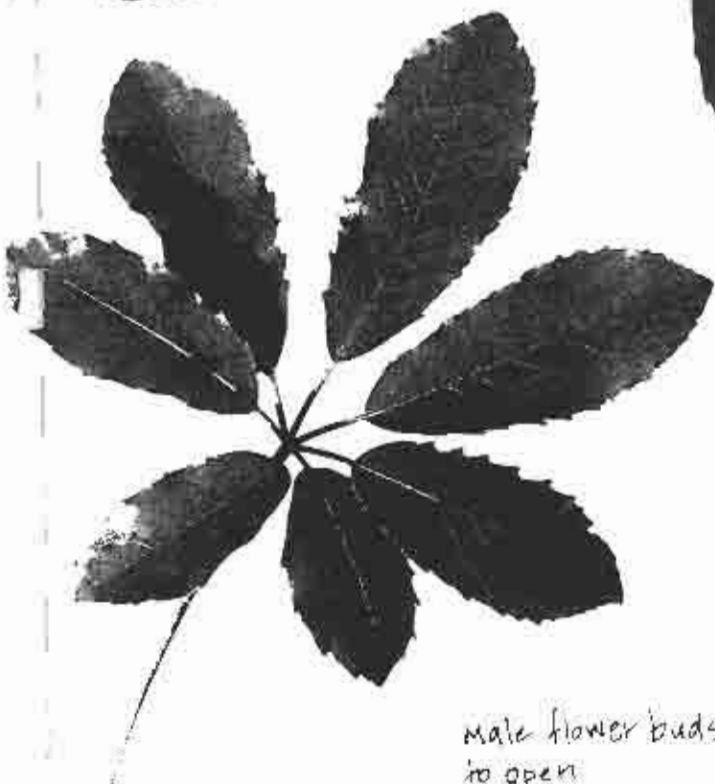
5x
*Pseudopanax
anomala*

H.D.W.
T.G.

shrub pseudopanax
Pseudopanax anomala

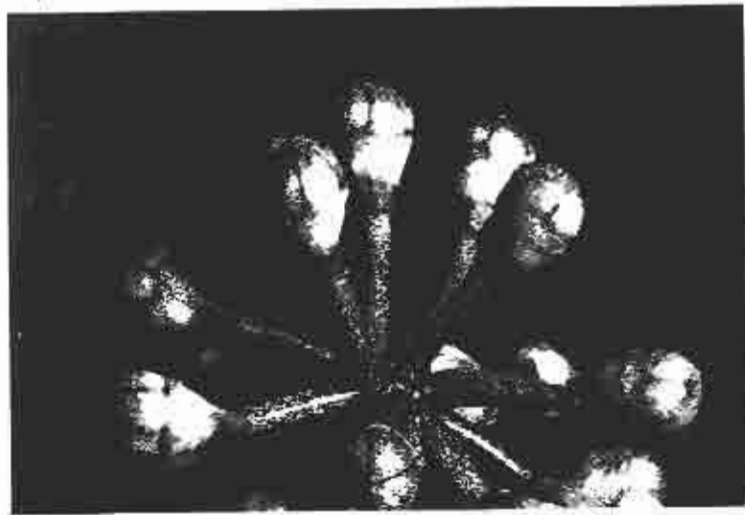


life size
whauwhaupaku
(new leaves)



male flower

male flower buds ready
to open



Whauwhaupaku
fivefinger
Pseudopanax arboreus

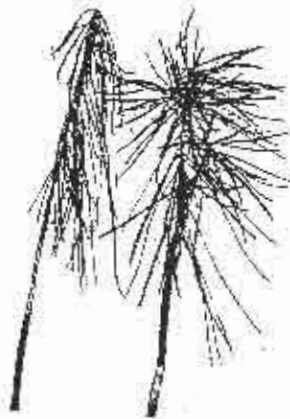


lancewood juveniles



N.M. ADAMS

bark of adult tree

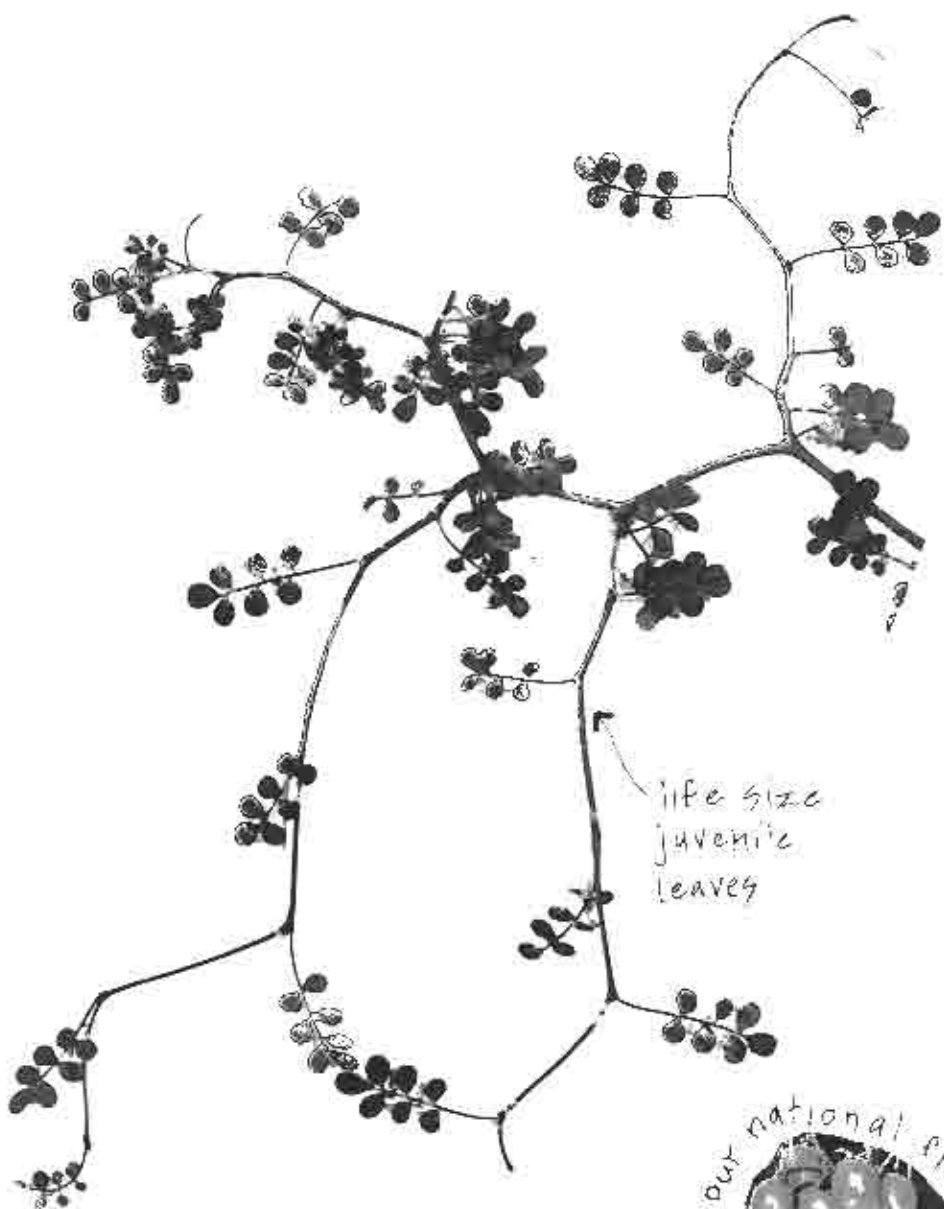


juvenile and adult forms of lancewood

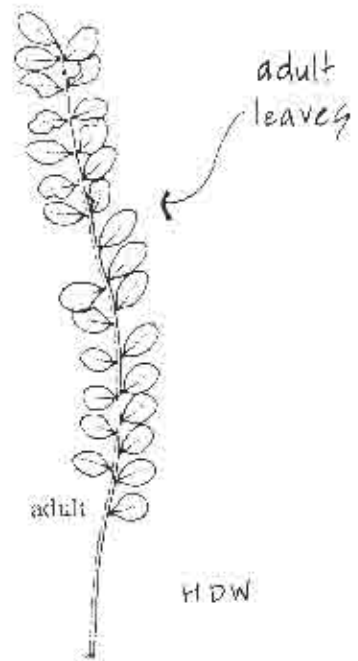
life size
juvenile
leaf



horoeka
lancewood
Pseudopanax crassifolius



life size
juvenile
leaves

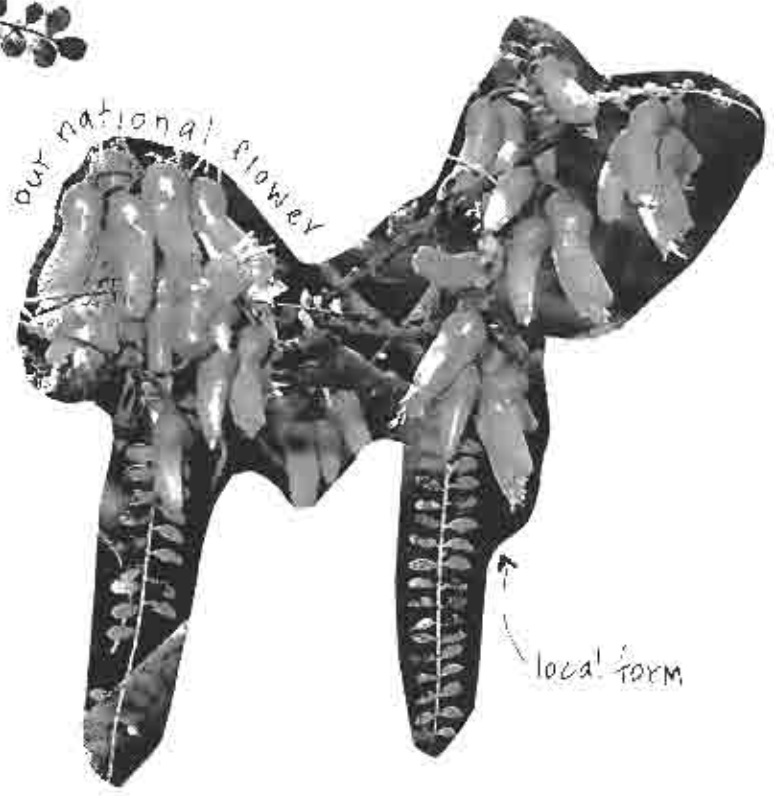


adult
leaves

adult

HDW

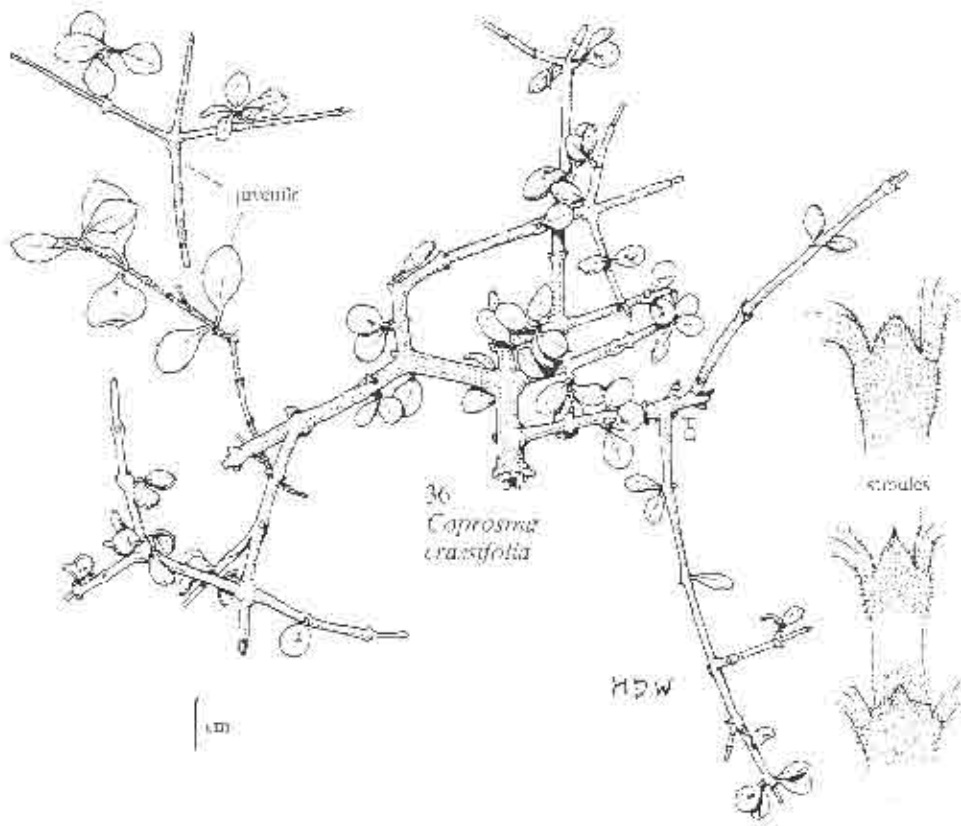
our national flower



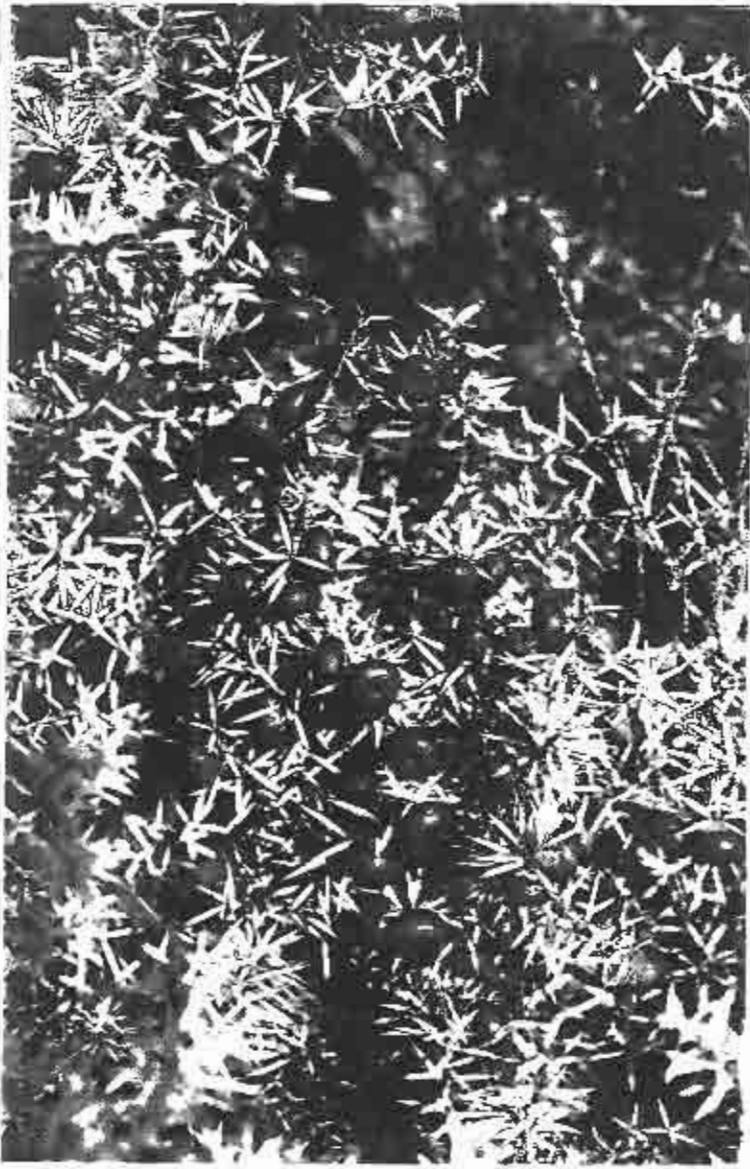
local form



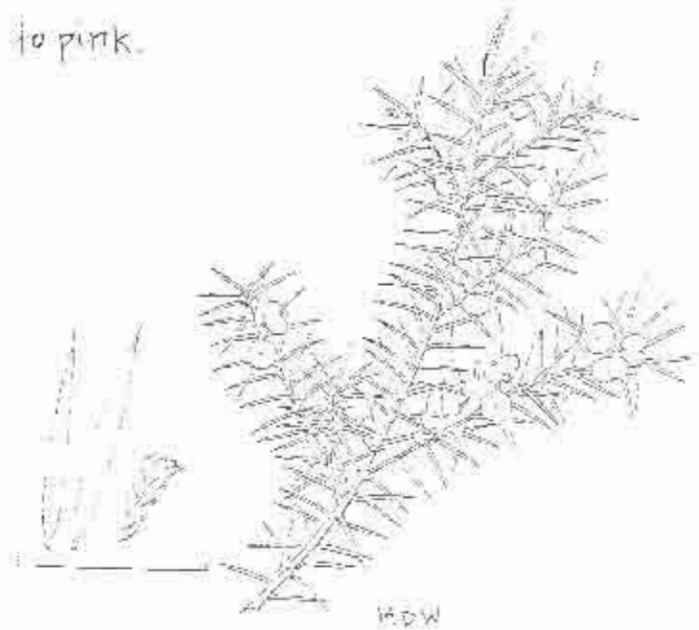
South Island Kowhai
Sophora microphylla



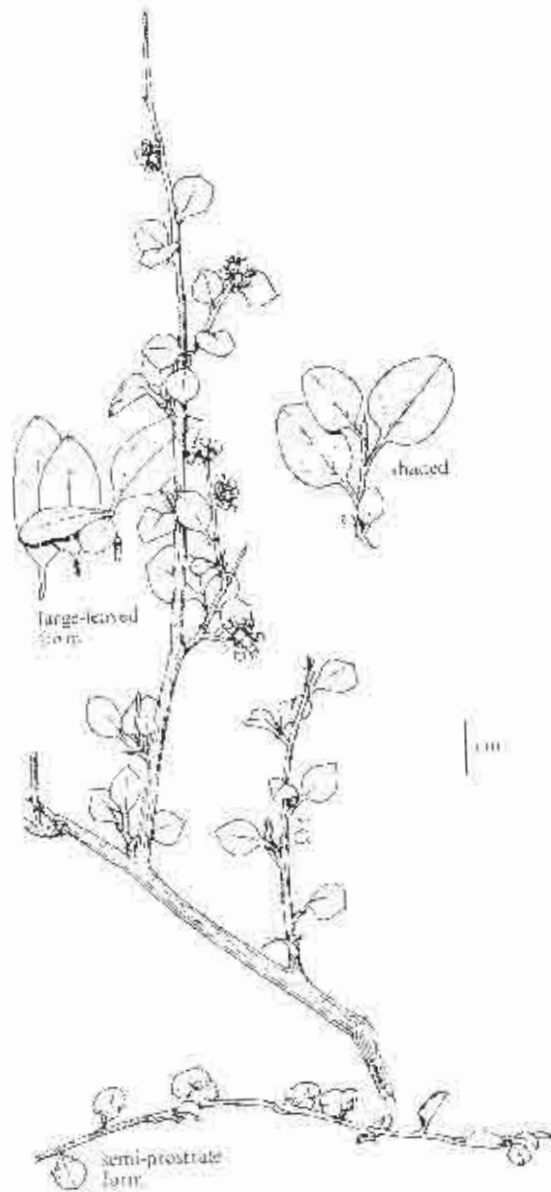
thick-leaved mikimiki
Coprosma crassifolia



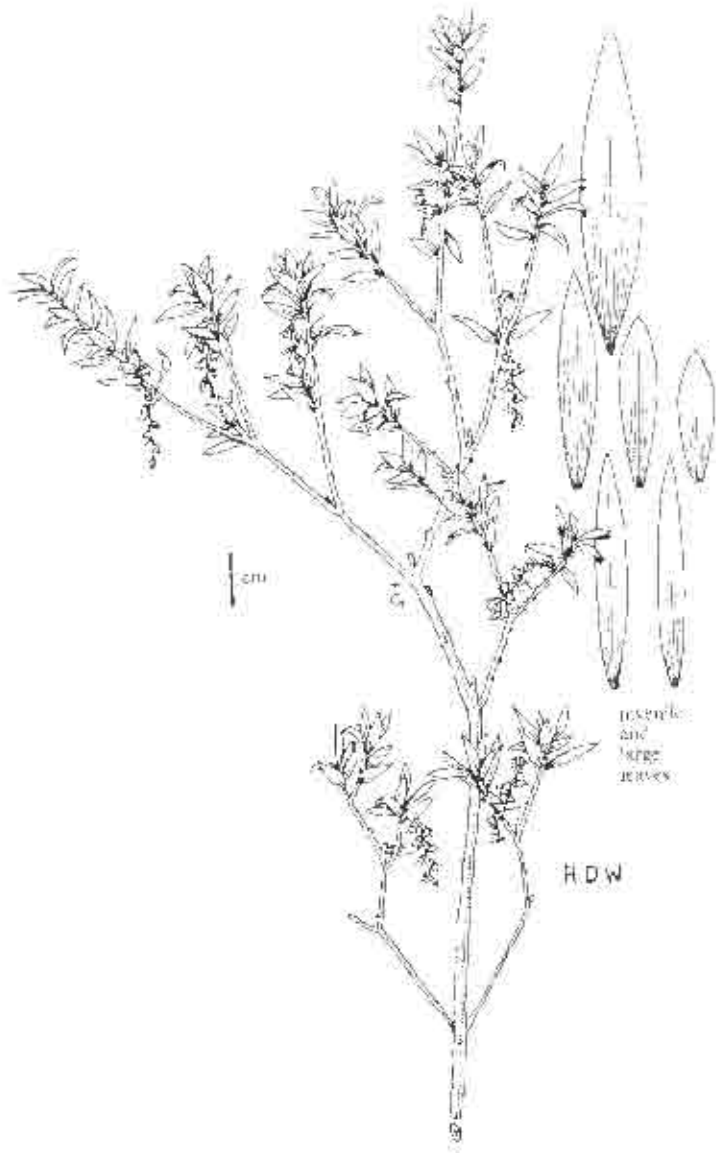
Berries vary in colour from white to pink, red to purplish red.



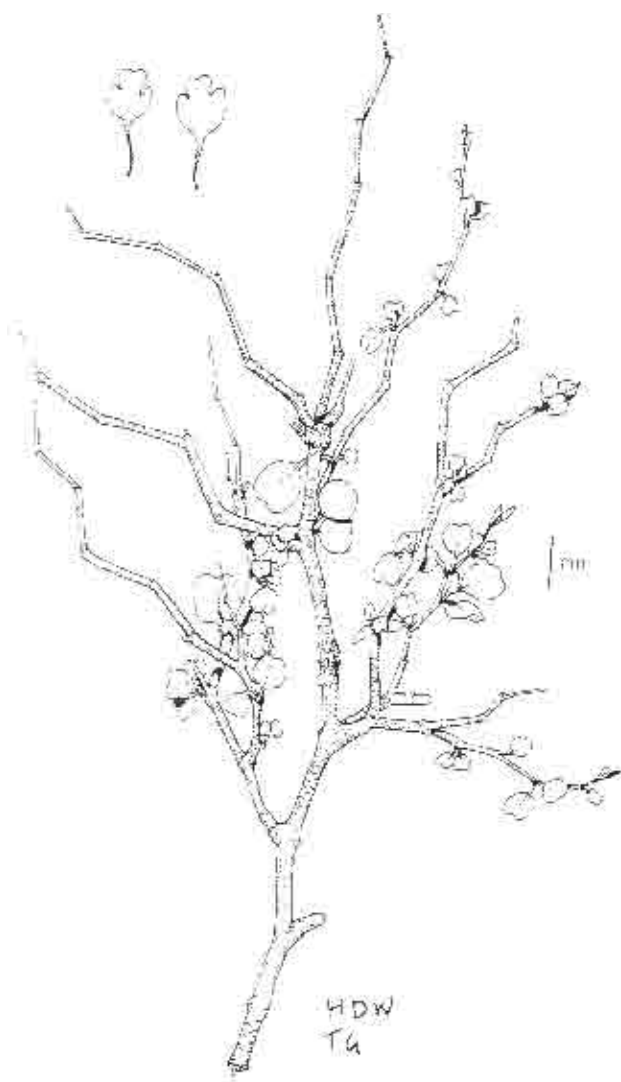
prickly mikimiki
Cyathodes juniperina



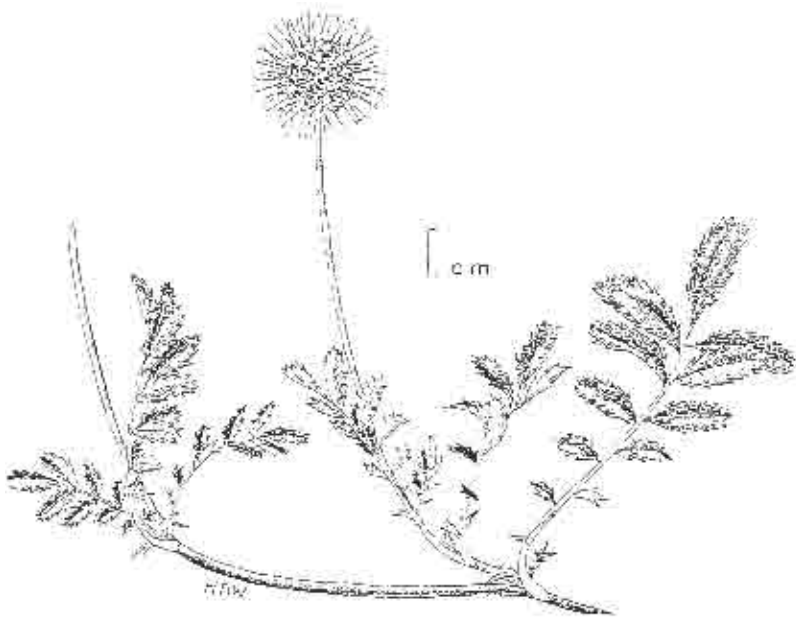
niniad
Helichrysum lanceolatum



Mikimiki
Leucopogon fasciculatus



A rare peniculate shrub
Muchlenbeckia astonii

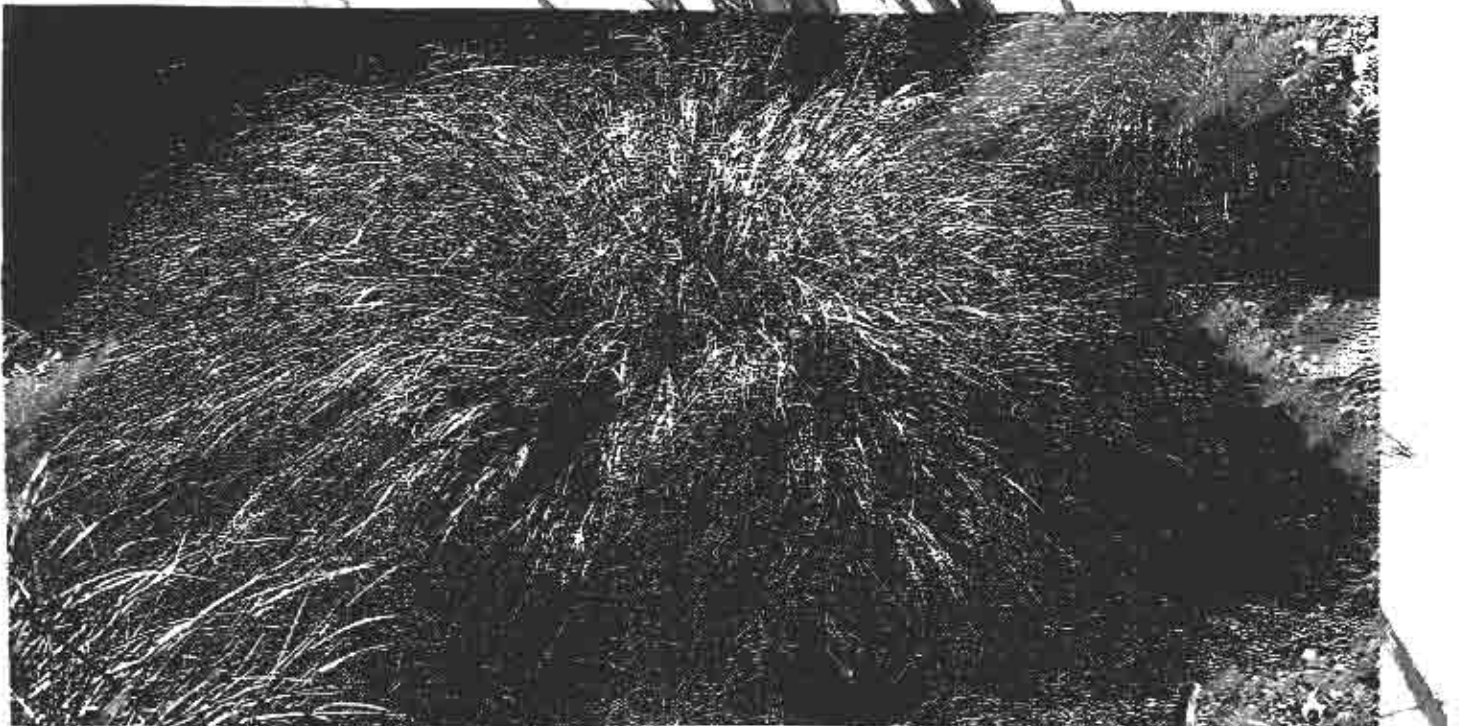


bidibidi, piripiri
Acaena novae-zelandiae

wind grass, bamboo grass
Anemathes lessoniana

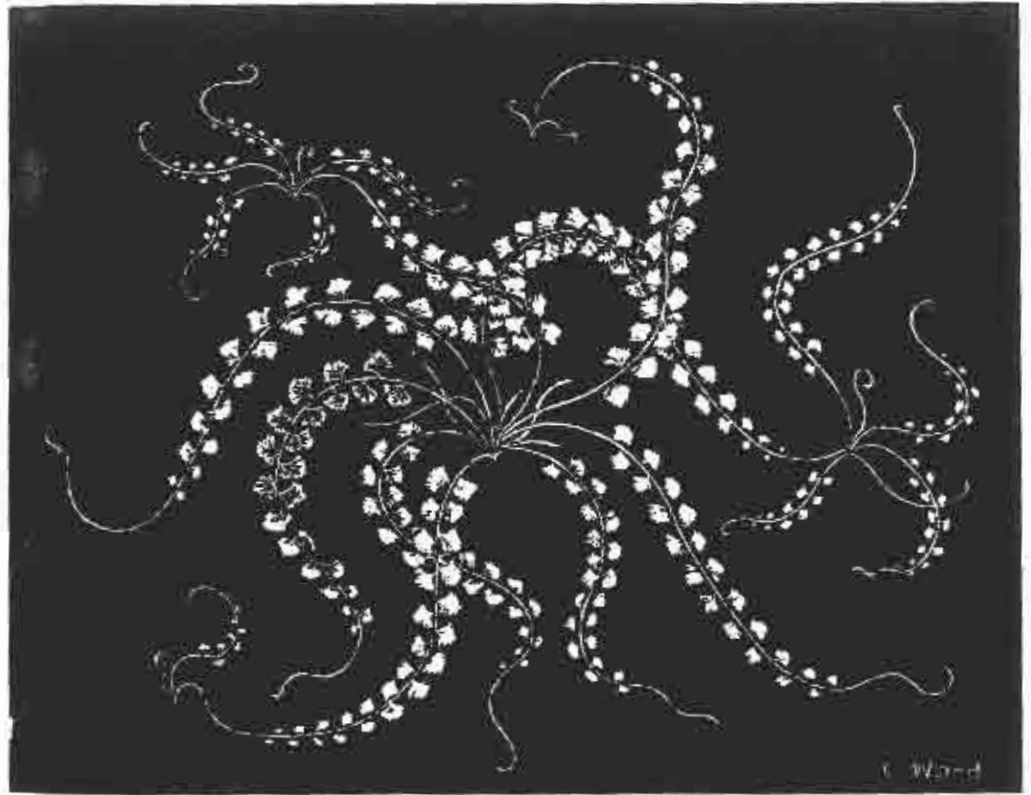
seed head

life size



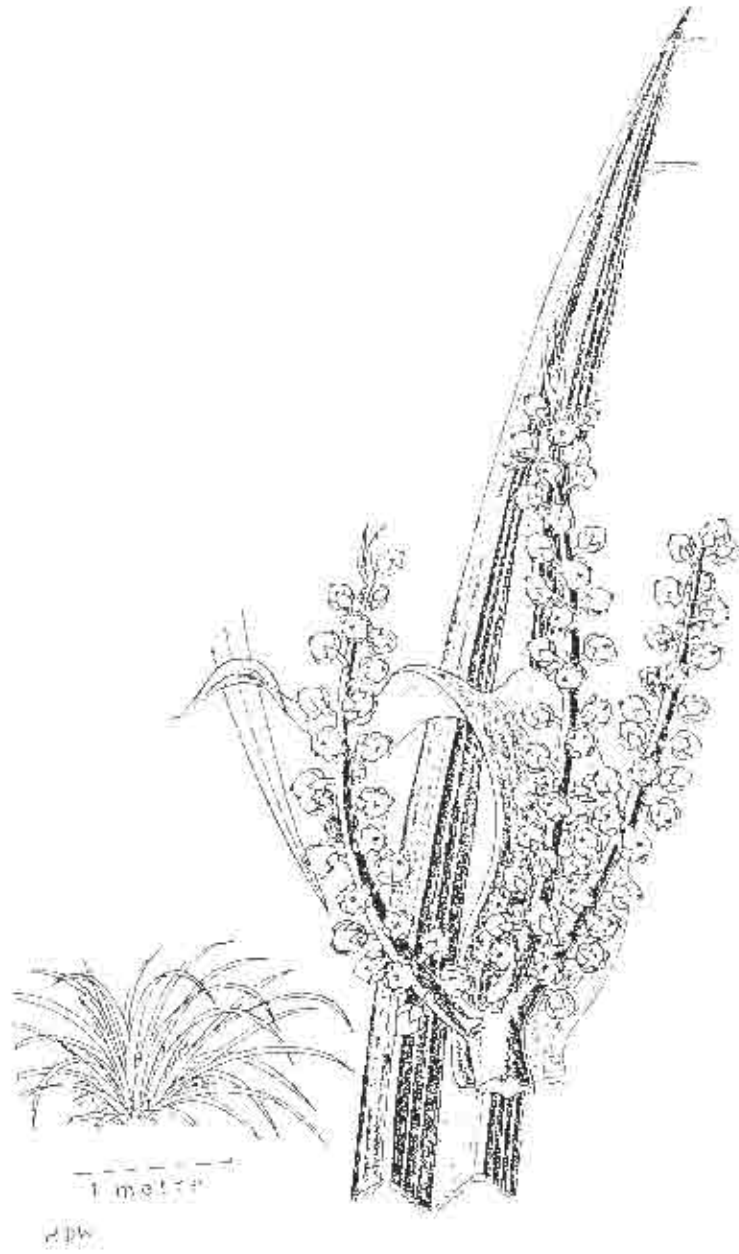


CM

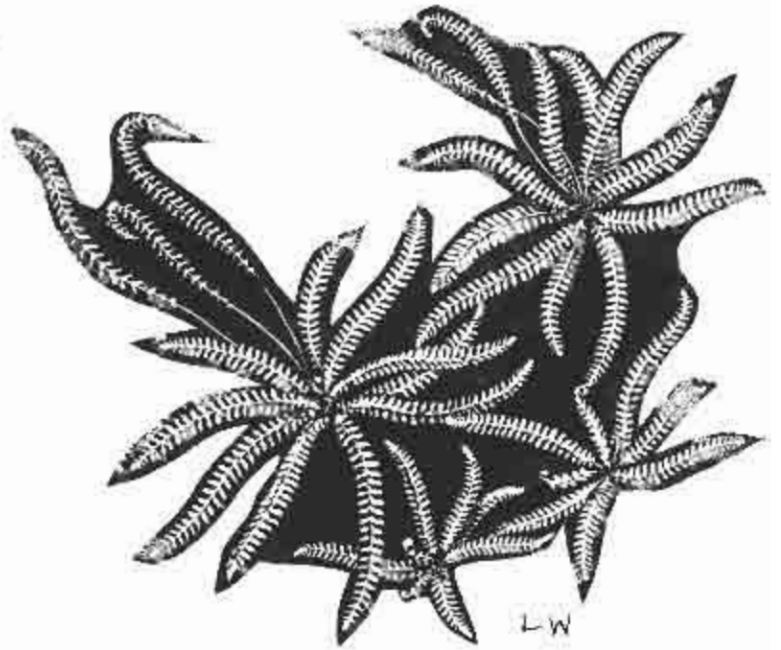


rocklace fern
Asplenium flabellifolium

C. Wood



Kakaha
buah flax
Astelia fragrans



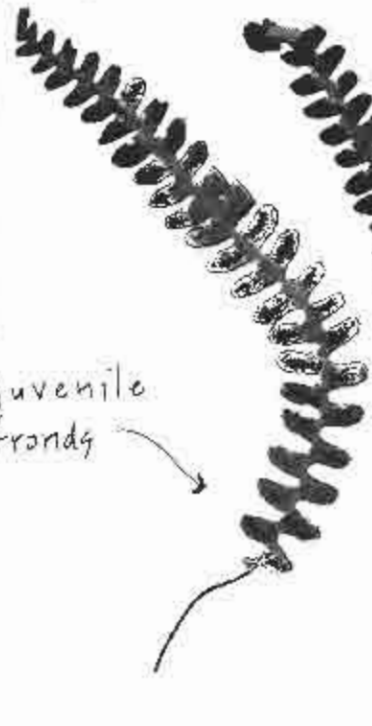
LW

fronds vary from 15 - 30 cm in size

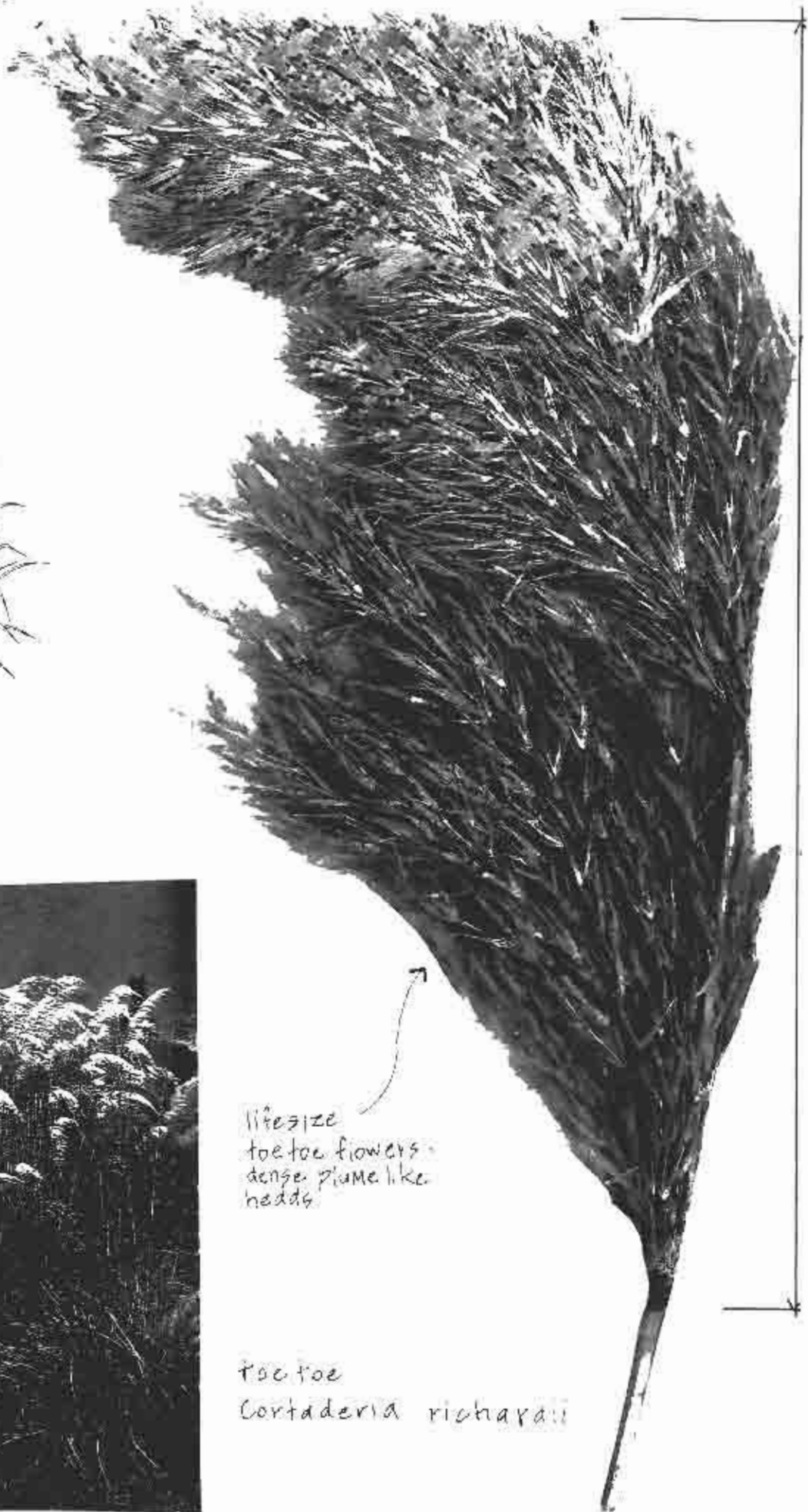
adult fronds

life size frond 20 cm

juvenile fronds



Kiskio
Blechnum penna-marina

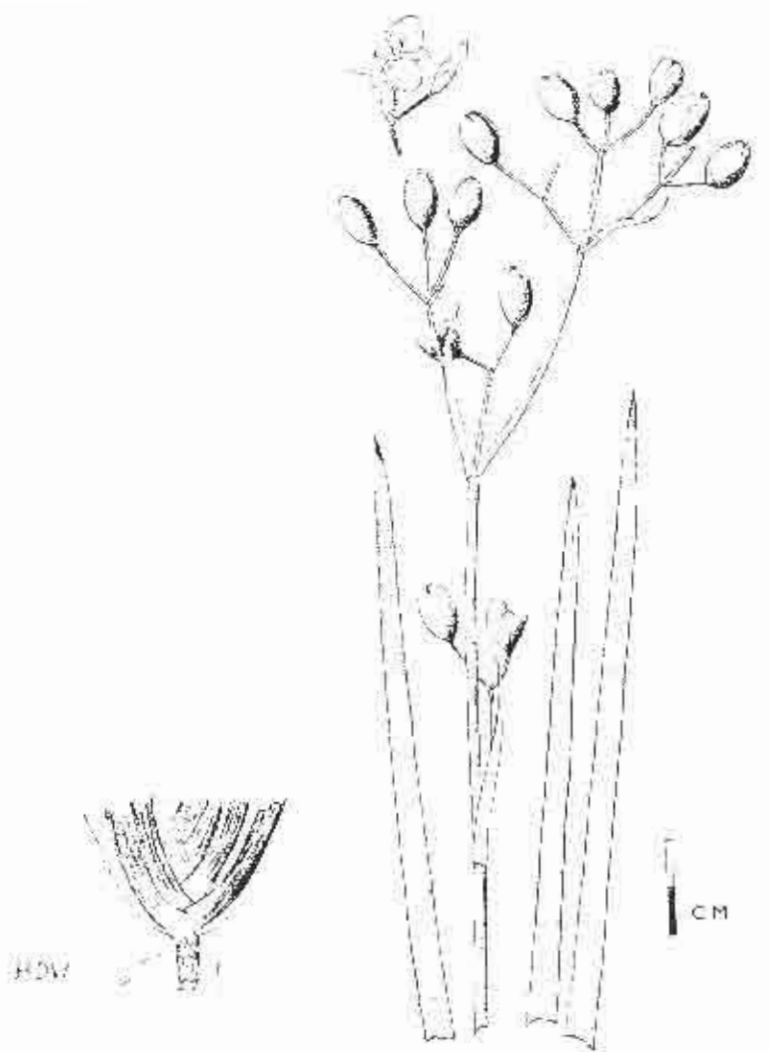


lifesize
toe toe flowers
dense plume like
heads

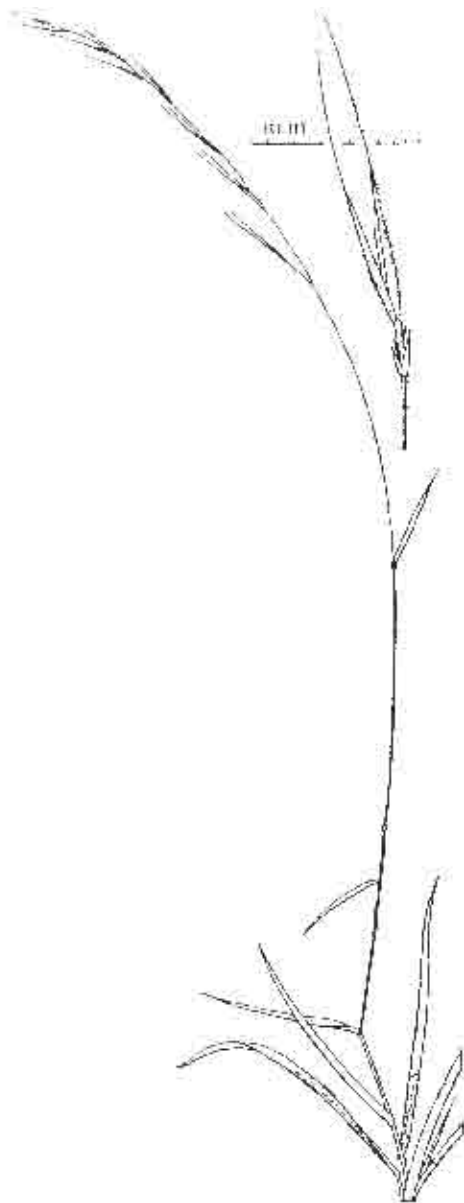
toe toe
Cortaderia richardii



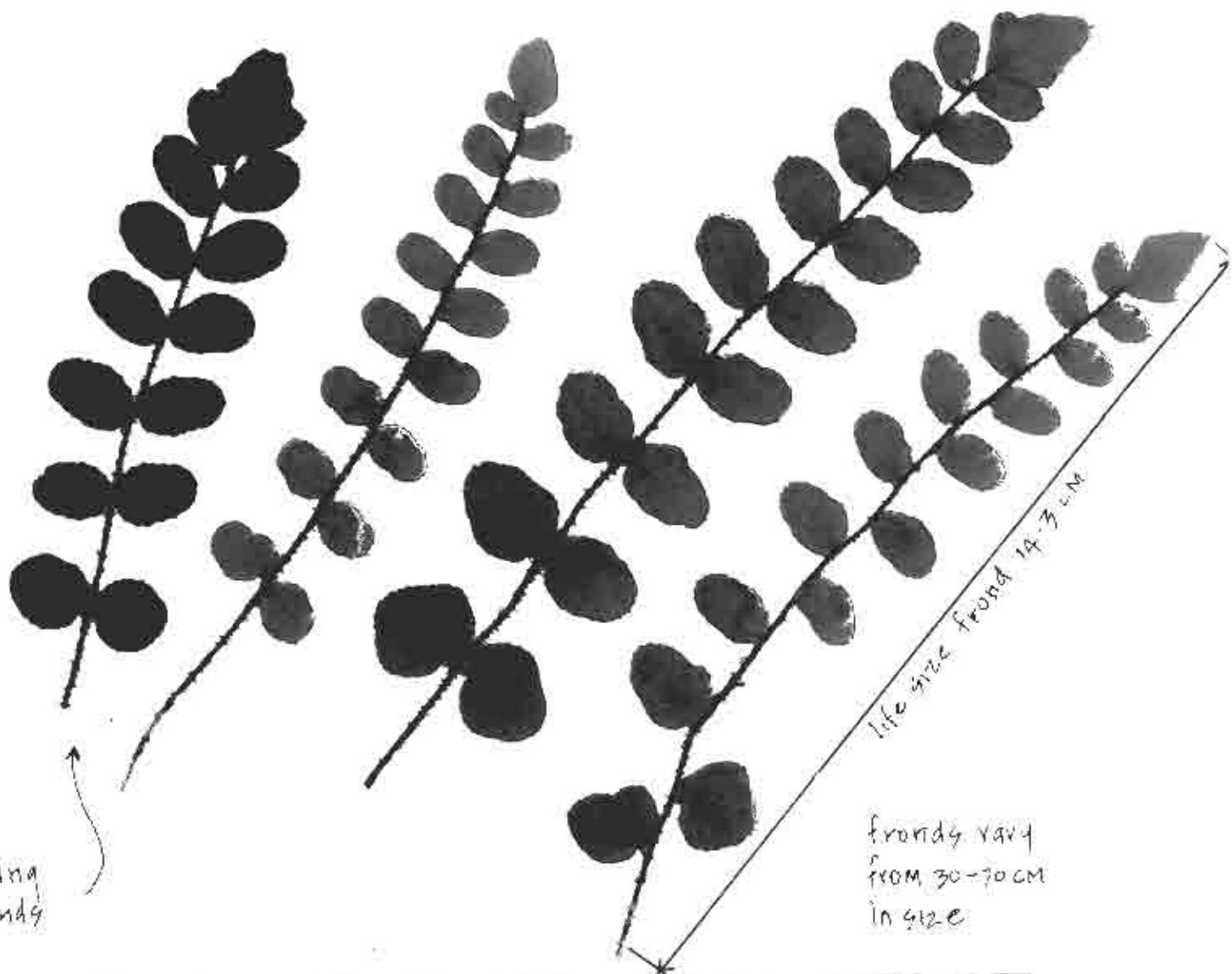
life size leaves 14-28cm



Mikoikoi
New Zealand iris
Libertia ixioides



a rice grass
Microbachna stipoides



young fronds

life size frond 14.3 cm

fronds vary from 30-70 cm in size



species is endemic to New Zealand

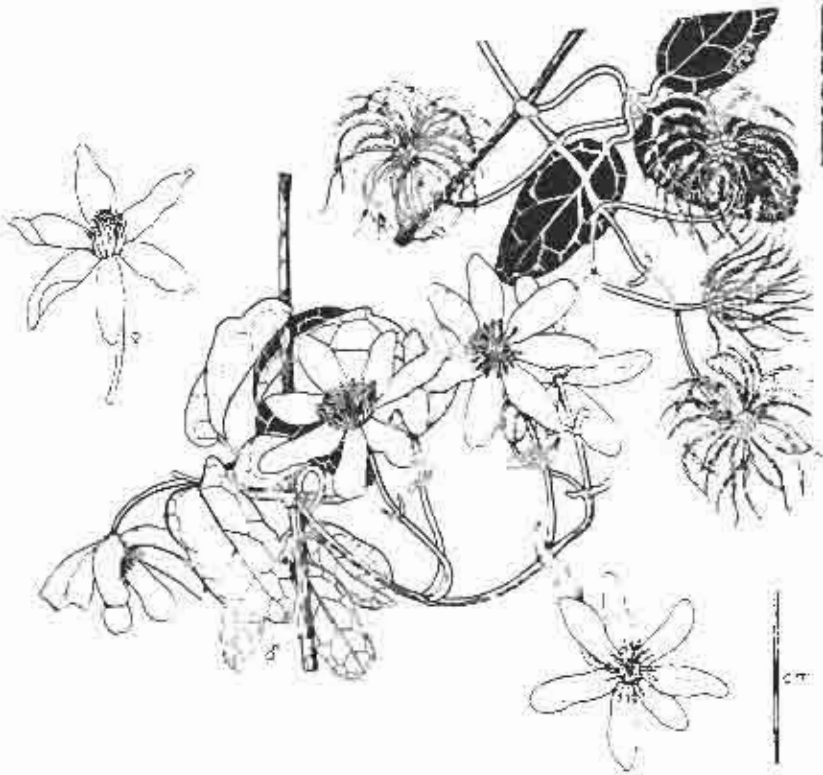
Button fern
Pellaea rotundifolia



wafau
hook sedge
Uncinia uncinata



vine growing through a tree



bush clematis
flowers (october)

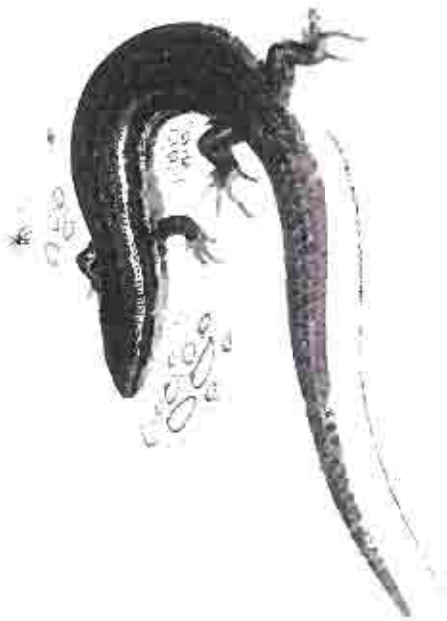
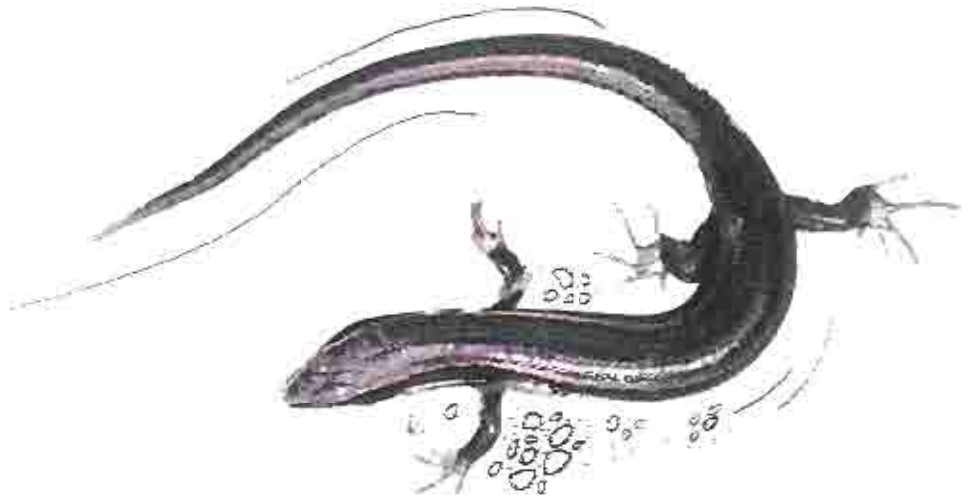
puawhananga
bush clematis
Clematis paniculata



Kereru
NZ pigeon



Kingfisher
Hāloya hāloya



Lizara
O. n. polyzona



Piwakawaka
Fantail
Rhipidura fuliginosa fuliginosa

ACKNOWLEDGMENTS

With thanks for drawings extracted from publications for private, one-off, reference use

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8 March 1999**