

Pukerua Bay Community Food Forest

Planting Guide

3 November 2015



Pukerua Bay Community Food Forest Planting Guide

Revision 1.1



Pukerua Bay Residents' Association, 2015.

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Table of Contents

What is a food forest?.....	4
Site inspection.....	5
Aspect.....	5
Climate.....	5
Drainage.....	7
Existing vegetation.....	7
Soil condition.....	7
Planning process.....	8
Time-line.....	8
Proposed works.....	9
Drainage.....	9
Water supply.....	9
Mulch and composting area.....	10
Allotments.....	10
Planting plan.....	10
List of plant species.....	11
Nursery species.....	11
Canopy and shelter trees.....	11
Sub-canopy small tree layer.....	13
Shrub layer.....	14
Herbaceous layer.....	14
Root crop layer.....	15
Groundcover layer.....	15
Climbing layer.....	15
References and acknowledgements.....	17
Books.....	17
Websites.....	17

What is a food forest?

A food forest is a food production system modelled on natural woodland, emphasising sustainability, low maintenance, and biodiversity. Using a carefully designed selection of edible (or otherwise useful) plants in all of the different layers, that are well adapted to the local climate, we combine them to enrich the soil, produce a productive and self-sustaining ecosystem that requires little maintenance, and eliminate the need for fertilisers and pesticides.

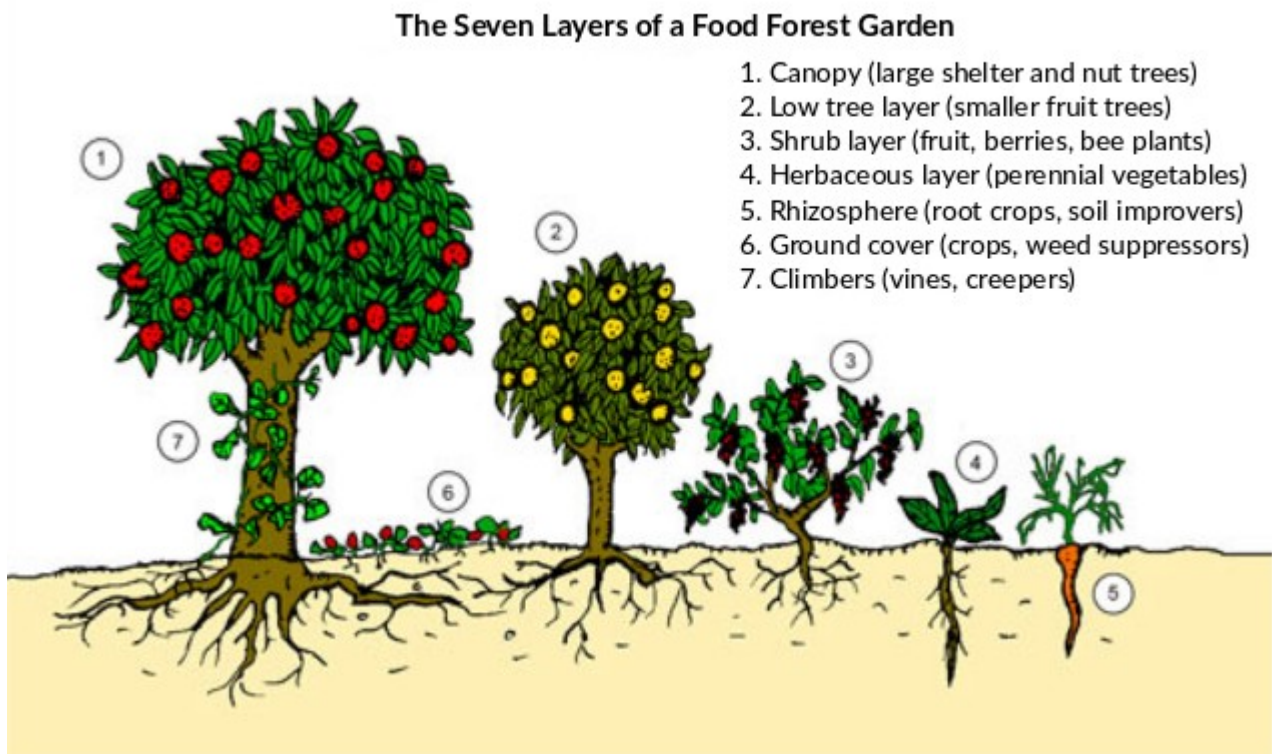


Figure 1: diagram of the seven layers of a food forest garden. From: *Temperate Climate Permaculture website*.

Site inspection

Aspect

The site is currently a bare patch of grassy ground, which gradually slopes sun-wards to the north at about 1:12 across 150 metres, as well as a fairly steep bank on the western edge that drops west into a gully of mostly native bush. The south and east borders of the site are the rear boundary fences of nearby Muri Road properties. The north border is a shelter belt of native species and tree lucerne about 3 metres high, along a fence that borders the closed Muri Station and marks the Kiwirail land boundary along the main trunk line corridor.



Figure 2: aerial plan of the community garden site, within the wider Village Planning proposal for the Muri Reserve.

Climate

Wind

The main feature of the climate in Pukerua Bay is the wind. It is a prevailing north-westerly, becoming particularly destructive during the Spring equinox (and to a lesser extent, Autumn equinox). These winds can roar through the landscape gusting up to 200 km/h and cause regional disruption, property and infrastructure damage, total loss of flimsy glasshouses, and outdoor furniture washed up in Chile.

Regional climate data from NIWA show the Wellington region has the highest average wind speed (22 km/h) and the second-highest number of gale days (days averaging over 63 km/h).

Some site shelter is afforded from a row of pine and macrocarpa trees to the north, and there is also some native vegetation and 1.8 m property fences to the south and east. The site may be somewhat exposed to wind from the west due to the facing gully slope.

Temperature

The temperature is typical of a New Zealand mid-temperate zone. Site is exposed to full sun most of the day. There is loss of early morning and late afternoon sun in winter, as the low sun goes behind hillsides.

Precipitation

The site can become dry in late summer due to the open vegetation and sun-ward sloped aspect.

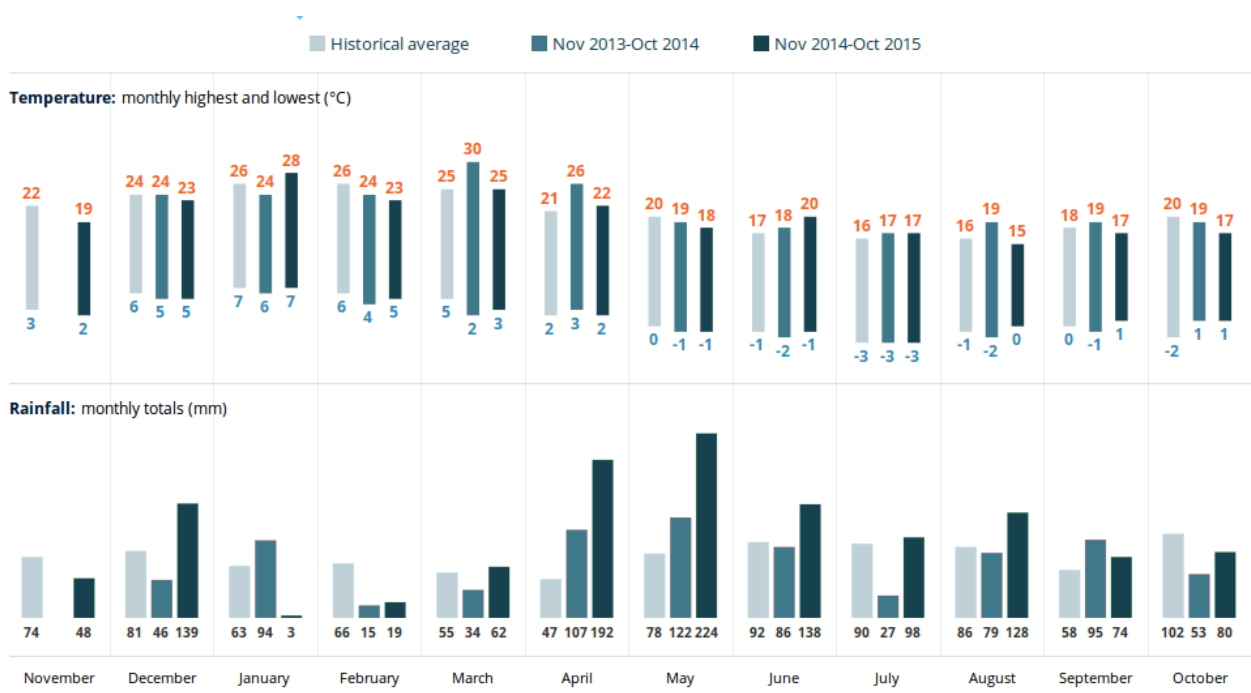


Figure 3: Historical and recent annual temperature and rainfall data for Kapiti. Source: Metservice, data from Parāparaumu Airport.

Drainage

The natural slope of the aspect means that water runs off, following the slope into the gully to the west, and to a lesser extent north. The open vegetation and exposure to wind ensure only low levels of soil moisture retention. The site can be bone dry in late summer.

Existing vegetation

Mainly open ground grasses. Some weeds to the north (near the fence-line), mostly dock and *Convolvulus*. There is documentary evidence to suggest there may be historical kumara pits on the site that will require appropriate handling after consultation with local iwi. Initial searches have not yet revealed kumara plants, but we are hoping they may emerge once work begins.

Soil condition

Profiles, component analysis and pH measurements yet to be conducted. Initial inspection has shown a thin topsoil 10-15 cm, on a sandy subsoil. Wet soil column test shows a low loam and clay content consistent with a typical undeveloped coastal soil.

Planning process

We have formed a group of interested individuals, acting under the auspices of the Pukerua Bay Residents' Association (PBRA) and with the assistance of Porirua City Council (PCC) and Greater Wellington Regional Council (GWRC). We will also be following guidelines from the New Zealand Department of Conservation around pest management and weed controls, and working with other community garden groups, for example the Khandallah Community Garden Project and Innermost Gardens (the Wellington city community garden in Mount Victoria).¹ We strive to arrive at decisions by consensus and welcome all interested Pukerua Bay residents.

We aim to establish the required infrastructure (gated access-way, composting bank, mulch heaps, water tank, tool-shed, etc.), modest earthworks to improve water retention, and the shelter tree plantings in the first 12 months. This will involve the purchase of local trade services and labour, and plants and other goods and supplies from local nurseries and other sources.

Time-line

Spring 2015: propose initial works plan, including Muri Station pedestrian & vehicle access, drainage, and water supply.

Summer 2016: Collaborate with experienced food forest experts and other community garden organisations to workshop and finalise our planting species and layout.

Autumn 2016: any required drainage and earthworks on the site before winter. Mow & sow nitrogen-fixing ground cover (clover/lucerne mix). Plant out nursery species.

Winter 2016: plant the shelter species. Start building mulch/compost. Build first lot of allotment beds.

¹ Innermost Gardens, <http://www.innermostgardens.org.nz/>

Proposed works

The first stage of establishing the food forest is groundworks to construct swales (contour bunds), plant the ground cover, and plant the shelter trees along the swale ridges. It will be at least two years after this is done before meaningful planning of the core food forest clusters can be done, since the initial shelter trees will need to be established and the soil layers will need time to develop.

Drainage

Given the dry, sun-facing northward incline of the site, and the lack of a readily accessible waterway or other divertible irrigation source, the site requires the construction of swales to help with moisture retention and irrigation; essentially, the opposite of drainage!

What are swales?

Sometimes called *contour bunds*, swales are small terraces built parallel to the contours of a hillside or slope, in order to retain moisture and prevent water run-off. This in turn improves soil structure, resists erosion and helps mitigate the effects of drought. They are formed by excavating a shallow trench along the horizontal contours of the slope, and the excavated material mounded downhill from the trench, to form a flat terrace. The retention of rainwater and prevention of run-off of properly constructed swales, combined with capillary action, can drastically improve the local water table, soil health, and plant yields.

Water supply

A water tank is required for garden activity during the summer months. This tank should be able to be fed from the downpipe on the existing Muri Station shed, next to the garden entrance off the Muri Station platform. There are two options, either:

- install a small collection tank at the shed, and a pump (and associated power supply) installed to pump the collected water via alkathene pipe to the main tank, situated at the highest (southernmost) point of the garden, so that water is gravity-fed to the garden, or
- install the main tank next to the shed to be fed directly, and a pump (and associated power supply) installed to pump the water as it is drawn.

The power required for the pump is fairly modest, and could be met by a solar panel and battery arrangement, which will probably require it all to be protected from vandalism inside the shed. The first option is more expensive due to the length of pipe and distance required to pump the water from the shed to the tank, which would be situated at the opposite end of the garden from the shed.

Mulch and composting area

An area near the entrance of the garden needs to be set aside for the construction of compost bins and mulch heaps. This will not require a lot of work but the area needs to be cleared of weeds and allow plausible vehicle access during community garden working bee days. We envision occasional “chipper days” to be held on a weekend, where we hire a chipper and residents may bring their garden waste (free of invasive species, of course!) to be processed into mulch for the garden. We also hope to collect the coffee grounds from several local cafés, which makes an excellent biochar to add to the compost. One average café produces ten to fifteen kilograms of excellent biochar material per week.

Allotments

An initial round of several allotment beds can be constructed near the entrance for minimal cost, once the mulch heaps and compost bins are building up. These beds can be rented out to residents for a small annual fee, to help with the income for the garden project. These are not really part of a forest garden, as they are usually focused on higher maintenance annual crops, but have a lot in common with the general spirit of a community garden.

Planting plan

Innermost Gardens recommend a planting plan using *sun traps*, which are plantings conducted in an arc facing the sun with the the toughest trees (e.g. peaches, nectarines and feijoas) at the back (south), tall shelter trees to the west to help filter the wind, even though it sacrifices some afternoon sun, and smaller, sun-loving plants like citrus and berries getting shorter towards the front.

Due to the open and fairly barren current state, we will need to use nursery species to fix nitrogen, improve the soil, and provide shelter for establishing the desired shelter and orchard tree species.

This planting stage of planning has not been finalised yet, as it will to some extent depend on the layout of the swale works. Certainly as of 2015 we do not envisage planning the later layers of the forest garden (climbers, small shrubs, ground cover, root crops) until there are established shelter and orchard trees for them to grow amongst.

List of plant species

Nursery species

This is a temporary scrub layer, used to reclaim relatively bare or poor ground. These species are selected to help improve the soil through nitrogen fixation, mineral accumulation, and leaf litter mulch, and provide additional shelter and protection for establishing the desired upper canopy and orchard tree species.

Tree Lucerne, *Cytisus proliferus*

Also called Tagasaste, a small, fast-growing wind-tolerant evergreen tree, to 4 m. Nitrogen fixing legume, excellent soil-improving nursery species for other trees.

Primary uses/crops: Fodder plant for cattle; nitrogen-fixing pioneer species.

Disadvantages: can self-seed; broom (*C. scoparius*) is closely related, and classified by the NZ Department of Conservation as an invasive species.



French Lavender, *Lavendula dentata*

Small, hardy evergreen shrub, up to 1.5 m high. Drought- and wind-tolerant, survives on just about any soil, forms a dense hedge. Persistent once established; wind damaged plants will regrow even from ground-levelled stumps.

Primary uses/crops: Bees, flowers all-year round.

Cosmetics, grown commercially for lavender oil, flowers can also be dried or used for dye.

Canopy and shelter trees

This layer provides the primary shelter for the garden, anchors the soil to prevent erosion, and provides many biological services – habitats for beneficial and native bird and insect species, shade to help mitigate arid conditions in summer, and leaf mulch which improves soil moisture and health.

Black Alder, *Alnus glutinosa*

Medium-sized, very fast-growing deciduous tree, growing to 30 m in as little as 20 years. Thrives in wet locations but tolerates most conditions, including poor quality soils. Can live for over 100 years but, like poplars, should be felled after 50-60 years due to heart-rot.



Primary uses/crops: *Shelter*; fast-growing, tall windbreak tree. *Nitrogen fixing*, pairs well with other trees to increase their growth and crop yields.

Other uses: *Wood*, coppicing (in late spring) for poles and firewood. Deciduous leaf mulch.

Black Mulberry, *Morus nigra*

A spreading, deciduous, long-lived tree, 8-12 m tall and up to 15 m across.² Specimens can be hundreds of years old, and tend to develop large, spreading canopies rather than put on height.

Primary uses/crops: *Berries*, early-mid summer. Dark purple-black when ripe, 2-4 cm long, resembling a blackberry; rich flavour, can be made into desserts, preserves, juice, and wine. Self-fertile, but yield increases with wind-pollination. Fruit from 3-6 years.³ *Leaves*, can be used like grape leaves in cooking, or made into tea.



Other uses: The large root system helps prevent soil erosion. Deciduous leaf mulch. Low spreading habit is ideal as a framework for climbing crops. Can be used as a windbreak. Can be lightly coppiced (in early summer) for firewood or food-smoking. Walnut buffer tree (tolerates juglone, the growth inhibitor produced by walnut trees).⁴ Related white mulberry (*M. alba*) has been used in China and South-east Asia since antiquity for silk production from the silkworm moth.

Holly oak, *Quercus ilex*

Large evergreen oak species, native to the Mediterranean. Can be clipped into tall hedges and windbreaks.

² Wikipedia. "Morus nigra." https://en.wikipedia.org/wiki/Morus_nigra

³ La'ulu, A. "Fruit for clay soils in NZ." Permaculture in NZ. <http://www.permaculture.org.nz/node/59>

⁴ "Permaculture Plants: Mulberry". Temperate Climate Permaculture. <http://tcpermaculture.com/site/2015/06/02/permaculture-plants-mulberries/>

Primary uses: *Acorns*, one of the few oak species with palatable acorns, can be eaten raw, ground for flour, or pressed for oil. *Shelter*, wind and drought resistant. *Timber*, very tough, used for wine barrels, tool handles. *Truffles*, if inoculated correctly, grow well on this species.

Walnut, *Juglans regia*

Large, deciduous tree. Comparatively slow-growing, but unattended older specimens can grow to over 40 m. Large taproot; rarely toppled but may shed large lower branches in severe weather. Pairing with a nitrogen-fixing tree (e.g. Alder) provides stronger wood and increased walnut yield.

Primary uses/crops: *Walnuts*, heavy crops from large trees. Wind-pollinated, usually dioecious; good yield requires several trees of compatible cultivars.

Other uses: *Timber*, usually must be felled, can be temperamental to coppice and go moribund.

Disadvantages: Vulnerable to very strong winds until well established. Allelopathic; inhibits nearby plant growth by producing juglone.

Willow, *Salix spp.*

Fast-growing, wind-tolerant, deciduous tree, to 15 m. Prefers proximity to waterways but can survive in other conditions. Tolerates poor soils. Can be invasive if unattended; produces root suckers which are easily coppiced.

Primary uses/crops: *Canes*, cut in early spring and replanted into living hedges, fences, and archways, or dried and used for basketry, wicker trellis, and other crafts. Willow cane also makes perfect artist charcoal. *Fibre* from cane bark, for making rope, string, paper, etc. *Wood*, which can be readily coppiced for poles, firewood and cricket bats.

Other uses: *Shelter*, fast growing. Helps mitigate subsidence and soil erosion around waterways and wetlands. Tolerance of poor soil conditions makes willow a useful pioneer species.

Sub-canopy small tree layer

This layer fills out the structure under the canopy, and helps the canopy layer protect the rest of the garden from the wind. This is also known as the *orchard layer*, since most of the traditional orchard species such as apples, pears, avocado, stonefruit and citrus belong here.

Feijoa, *Acca sellowiana*

Hardy, evergreen small tree to 5 m. Wind-tolerant, ideal for low shelter belts. The wood is brittle, so older plants may split trunks or shed branches in severe storms. Will usually recover from the base.

Primary uses/crops: *Fruit*, heavy crops of feijoas, late autumn; optimum fruiting requires 2-3 varieties.

Other uses: *Bees*, flowers mid-late summer. *Habitat* for several finch and related native bird species.

Hazelnut, *Corylus spp.*

Wind-tolerant, small deciduous tree, to 5 m. Tends to spread from suckers and form thickets. Thrives best near waterways, but can tolerate all but very dry conditions; shade tolerant, but good nut yields require sun. Traditional hedgerow and windbreak species in England. Saplings susceptible in NZ to stick insects.

Primary uses/crops: *Hazelnuts*, late summer through autumn; wind-pollinated, usually dioecious; good yield requires several trees of compatible cultivars. Untended crop will attract rodents.

Other uses: *Wood*, can be coppiced for poles and stakes. *Habitat* for birds and reservoir for beneficial insects.



Cherry Guava, *Psidium cattleianum*



Evergreen small tree. May be invasive if unchecked by frosts (check with DoC).

Primary uses/crops: *Fruit*, small red 2-4 cm fragrant fruit like feijoa but smaller, and more sour.

Other orchard species

All the orchard fruit species - apples, pears, stonefruit. Sturdy heirloom species preferred for pest resistance, growth (increase yield with a co-planting guild - nitrofixers and mineral miners). Black Doris, Billington, greengage; Bramley's Seedling. Crabapple pollinators.

Shrub layer

To come; planning not yet required.



Rocoto Chilli, *Capsicum pubescens*

Small woody shrub, to 1.5 m high. Can live up to fifteen years, mildly frost-tolerant.

Primary uses/crops: *Chilli peppers*, mid-late autumn, with black seeds. Very hot, thick fleshy red skins.

Cedrón/Lemon Verbena, *Aloysia citrodora*

Small shrub to 2 m high. 15+ years, semi-deciduous, mildly frost tolerant.

Primary uses/crops: *Leaves*, young shoots as tea, dried or fresh.

Other uses: *Bees*, flowering throughout summer to mid-autumn.

Chilean Guava, *Ugni molinae*

Shrub 1-2 m tall, evergreen, with small glossy leaves. Also known as strawberry myrtle, related to guavas and feijoas and native to South America.

Primary uses/crops: *Fruit*, small red cranberry-like guava fruits, autumn.



Tree Tomato/Tamarillo, *Solanum betaceum*

More a small tree, 1.5 – 2 m tall. Short-lived, 4-8 years, with a spreading habit. Hardy, salt tolerant.

Primary uses/crops: *Fruit*, tree tomatoes, normally red; orange variety is sweeter.

Redcurrant, *Ribes rubrum*; Blackcurrant, *R. nigrum*

Deciduous shrubs grow to about 1 - 1.5 m high. Require full sun for good berry crop. Propagate well from cuttings.

Primary uses/crops: *Berries*, require bird netting in NZ to get any significant harvest.

Lavender

See above, under *Nursery species*.

Herbaceous layer

To come; planning not yet required.

Rhubarb, culinary herbs, perennial leek, Welsh onion, three-cornered leek, Good King Henry, Kale, perpetual spinach, Turkish rocket, chicory, loveage, mallow, ... in fact, most of the things in ch. 15 of the Crawford "Creating A Forest Garden" book, that aren't invasive in New Zealand (check with the DoC list of invasive species).

Root crop layer

To come; planning not yet required.

Yam/Oca (*Oxalis tuberosa*). Root crop.

Jerusalem artichoke (*Helianthus tuberosus*). Root crop. Tall sunflower relative, 1.5 - 2.5m. Flatulent.

Comfrey. Mineral accumulator. Taproot up to 4m long mines zinc, magnesium, iron etc. from subsoil into leaves; crop & drop mulch. Plant around fruit tree drip line. Choose location carefully; difficult to exterminate.

Chicory. Mineral accumulator. Crop: bitter leaves, root can be dug up and roasted.

Groundcover layer

To come; planning not yet required.

Peppermint. Less vigorous, slower-growing, less invasive than common mint. Bees: all summer and autumn. Crop: peppermint leaves. Somewhat trample-tolerant.

Nasturtium. Dominant but easily controlled. It's about the only thing that can out-compete bindweed (*Convolvulus spp.*). Fixes nitrogen. Bees: flowers spring through autumn. Crop: peppery leaves, flowers.

Thyme.

Strawberries. Not trample-tolerant but can provide cover on litter and suppress other weeds. Will spread by vegetative propagation in autumn, but easily shifted.

Nepalese raspberry, orangeberry (*Rubus spp.*). Slow-growing, thornless, non-invasive bramble species. Crop: small raspberries. Trample-tolerant.

Climbing layer

To come; planning not yet required.

Scarlet Runner Beans (*Phaseolus coccineus*). Perennial, 10+ years. Dies off each winter and re-sprouts from root tuber. Fixes nitrogen. Bees: all summer. Crop: runner beans.

Passionfruit (*Passiflora edulis*). Short-lived, fast growing, requires at least partial sun, relative shelter. Not drought-tolerant.

Kiwiberry/Hardy Kiwi (*Actinidia arguta*). Very hardy, wind-tolerant, fast growing. Crop: bunches of small 3-4cm smooth-skinned kiwifruit.

Banksia Rose - thornless, old-fashioned rambler. Fast-growing, wind-tolerant. Bees: abundant yellow flowers late spring - early summer. Crop: rose-hips high in vitamin C.

Grape (*Vitis vinifera*). Wind-tolerant, hardy, deciduous. Muscat grows well in Wellington/Kapiti.

References and acknowledgements

I have made extensive use of various permaculture websites, several forest gardening books, NZ Gardener magazine, judicious use of Wikipedia and Te Ara online articles, data from NZ Metservice and LINZ, the good folks on the Pukerua Bay Residents' Association and at Porirua City Council, and of course the many clever people involved with permaculture and food forest gardens in Wellington, in particular Tim and Richard from Innermost Gardens. You are all amazing, let's get this show on the road!

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Wikipedia: various species articles. <http://en.wikipedia.org/wiki/>

Jonathan maintains a list of food forest species on his wiki: https://wiki.jon.geek.nz/Planting_list

Innermost Gardens. <http://www.innermostgardens.org.nz/>