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Establishing Native Forests

TĀNE'S TREE TRUST FACTSHEET SERIES

Planting native forest – selecting the right species for the right site

FACTSHEET 13, 2024 – by David Bergin & Mike Bergin

Refer to the other factsheets in this series for more about successfully establishing native forests.

Online version of this document with clickable links: https://docs.tanestrees.org.nz/1473/

A useful guide to selection of species is to check out what is growing in native forest remnants or regenerating shrubland on similar soils, elevation and climate to proposed planting sites.

Introduction

An understanding of the ecological requirements of native tree species being planted and of the sites being restored will allow matching of appropriate species to suitable sites. This approach of following local successional pathways is more likely to mimic the often slower natural regeneration processes and lead to good early performance.

There is considerable variation in the ecological requirements and site preferences of native species. Some require shelter in early years on open sites to improve growth, while others tolerate specific site conditions such as greater moisture levels. Planting native species at random through an area is unlikely to match species to most suitable sites and, therefore, will probably compromise overall performance.

Selecting species

Choice of species and planting pattern will also be influenced by planting objectives. Growth habit and performance of each species will influence which ones are most suited to specific objectives. Some examples of objectives and species choices include:

Shelterbelts or screens

Native species suited to windy open sites that have an erect form and are amenable to trimming are likely to form easily managed shelter. Species selection will depend on type of shelter or screen required, such as:

- **Hedges:** species that can be trimmed to form narrow low shelter with foliage retained to low levels, e.g., broadleaf, taupata, korokio, and pohutukawa (if not in an area with high incidence of rust).
- **Single row shelterbelts:** for farmland where only a narrow-fenced buffer is required, select single or multiple species to suit site, e.g., harakeke (though not next to electric fences or mown areas), ti kouka, and a range of hardy native shrub hardwoods.
- **Multiple row shelter or screens:** for farmland where there is more space available to establish multiple rows of mixed native shrub and tree species, e.g., mix of planted shrubs with trees such as totara, kauri, puriri, titoki planted at 4 m spacing.

Native trees planted in urban areas can add to green spaces and provide shade.

Urban amenity planting

Planting natives in parks or along streets. Options include:

- **Street or carpark trees:** depending on region and local climate, native tree species that form attractive spreading crowns, e.g., puriri, totara, kohekohe, beech, pohutukawa (need to consider rust in high-risk areas); smaller or erect trees, e.g., titoki, ribbonwood, houhere, and rewarewa. Select tree species for street planting which can be low pruned if necessary to retain views along road and give straight lower boles.
- **Parks and large gardens:** mixture of native shrub and tree species based on regional forest species composition, e.g., northern tree hardwoods, conifers, and beeches. Scope to plant large spreading trees to provide shade and shelter in large urban green spaces, e.g., pohutukawa, totara, beech, puriri.

A row of planted totara in an urban park to provide shelter and shade.

Revegetation sites and riparian zones

Depending on scale including width of retired riparian areas, planting of local forest type species at 4:1 proportion of shrubs to trees including:

- Hardy native shrub hardwood and monocot species for the bulk of planting, e.g., manuka or kanuka with broadleaved shrubs such as karamu, kohuhu, and five-finger.
- Interplanting a smaller proportion of local region tree species, e.g., native conifers (such as miro, rimu, kahikatea, totara, tanekaha, matai, etc.), kauri, tree hardwoods including rewarewa, kohekohe, beeches, puriri to give high forest structure in the longer term.

It is now common to see riparian areas with a mixture of planted natives in rural landscapes.

Hill country planting

Depending on scale and the difficulty of the site, and if there is good weed and pest animal control:

- **Higher rainfall sites:** plant a range of hardy shrub hardwoods such as manuka, karamu, five-finger, kohuhu, and ti kouka.
- **Drought prone or colder elevated sites:** plant more drought-tolerant species, e.g., kanuka, *Olearia* species, tauhinu, other grey land species as initial cover, followed by interplanting totara, Halls totara on elevated sites, and hard beech

Relatively large areas of steep hill country are increasingly being retired and planted in native forest.

Wetter sites

Depending on water table depth and period of inundation, options include:

- **High water table:** wetland species, e.g., rushes, sedges, *Carex* species, harakeke, and ti kouka.
- **Moist sites, occasional flooding:** harakeke, ti kouka, toetoe, swamp maire, kahikatea, and pukatea.

Wildfire risk

Check out low vs high flammability species. Plant species with low oil content and large fleshy leaves, e.g., broadleaf, karamu, ngaio, taupata, tree fuchsia, and mahoe. Avoid high oil species, e.g., manuka, kanuka, and akeake. Refer to Factsheet 16.

Coastal dune sites

Depending on zone and proximity to the sea, check out the options for species selection on the Coastal Restoration Trust website. Options for the different coastal dune zones are:

- **Foredunes:** sand binding grasses and sedges, e.g., spinifex, pingao, and wiwi.
- **Mid-dunes:** ground cover and shrubs, e.g., *Carex* species, sand coprosma, pohuehue, taupata, harakeke, tauhinu, and toetoe.
- **Backdunes:** taller shrubs and trees – ti kouka, houpara, karamu, kohuhu, karo, ngaio, pohutukawa, karaka, and totara.

The Coastal Restoration Trust of NZ, along with local authorities, iwi and coastal communities are increasingly planting natives along coastal zones as an alternative to exotics to stablise sand dunes and enhance local indigenous biodiversity.

Timber production

Choosing the most appropriate site and species that will give maximum growth rate and optimum wood quality will be the driving force for establishing a woodlot. Options will depend on region and local forest types, for example:

- **Northern sites:** native conifers such as kauri, rimu, matai, miro, totara, and tanekaha; and tree hardwoods such as rewarewa, kohekohe, and puriri.
- **Upland and southern sites:** native beeches and conifers (including rimu, matai, totara, and miro).

There are many examples of stands of native timber trees established on appropriate sites either as single or mixed species stands with the long-term option of future timber production.

A practitioner's advice

Nature is far from random. Naturally occurring vegetation sorts itself out according to ecological patterns and processes. Various species occupy particular niches, some are generalists and others are quite specific in terms of where they will or won't flourish. Different species have differing preferences or tolerances of soil types, aspect, rainfall, drainage, fertility, temperatures and shade, and juxtapose themselves in time and space accordingly.

Most regions comprise a broad range of habitat opportunities, stemming especially from its broad ranges of landforms and climates. Quite subtle site differences can have a strong bearing on what species prevail where.

Miles Giller, QEII National Trust, Canterbury

Selection of species for planting previously forested landscapes can take a lead from natural succession processes for each site. This often requires focusing on planting early pioneer species such as hardy shrub hardwoods on open sites that will quickly establish and provide sheltered sites for later establishment of native canopy trees.

Forest succession processes

- Consideration should also be given to forest successional processes mimicking natural succession of native forest.
- Planting programmes that include locally appropriate short-lived, pioneer native species, comprising a range of hardy shrubs and monocots, are recommended on most sites as a nurse cover to assist early development of later successional tree species.
- These nurse pioneers are the first to establish in reverting native forest and are able to out-compete weeds and quickly provide canopy cover.
- A staged implementation may be useful. Not all species need to be planted at once. Later successional species can be planted in light wells after pioneer species have become established, or the stand can be managed to encourage natural regeneration of later successional species.

Focus on planting just a few species – let nature do the rest

The temptation with restoration is to find the complete botanical species list for your region and then attempt to plant all of these species in your project. Some even go further by restricting their selection of species to the same proportions of species of what was considered to be the local forest type. There are many examples of planting plans where 30-50 native shrub and tree species from local botanical species lists have been used as the 'shopping list' to order plants from the local nursery.

This idealistic method of recreating a once diverse forest from scratch is fraught with problems. Not all species will be available as nursery-raised seedlings and will certainly not be ecosourced. Even if most species are available, they are unlikely to be in the proportions required for recreating your target forest type. And most importantly, this method does not take into account the successional processes of a newly establishing native forest that only require a limited number of species to be planted, initially at least.

Mimic nature

Rather, restoration is about understanding how natural restoration of native forest occurs on your site if it were given a chance and you had the patience. Initial colonisation of native forest is often by a limited number of the hardiest native shrub species, sometimes even monocultures like manuka or kanuka. Once the open site conditions are ameliorated, then there can be a slow invasion of other shrub and tree species, particularly with pest browsing animal control and ideally including bird predator control to promote seed dispersal.

Most native plant nurseries focus on producing hardy, early successional shrub species as they generally seed prolifically each year, are common in local regenerating forest areas, are easy to collect seed from, and are straightforward to raise in bulk. A core list of six to eight native broadleaved shrub or monocot species that commonly occur as early successional shrubland is available for every region. Most would typically include manuka, kanuka, karamu, kohuhu, harakeke, toetoe and ti kouka, which are the basis of establishing a nurse cover (refer to Factsheet 8).

Interplanted taller tree species should be planted in smaller numbers and again do not need to include all tree species that may have been present in the original forest cover, at least not initially. A handful of native conifer and tree hardwood species is all that is required. These can be interplanted amongst the nurse cover at the same time, or within a year or two depending on how challenging the site is for newly planted trees. Key tree species that would be included in the shortlist, depending on the region and the environmental characteristics of the planting site, include totara, kahikatea, kauri for northern regions, beech for southern regions, and tree hardwoods like puriri, kohekohe and titoki in northern regions.

You can still plant less common species

This does not stop you from planting less common shrub and tree species, but these should not necessarily be part of your bulk plantings to get a restoration programme underway. Uncommon species are only raised in small numbers by most native plant nurseries, or they would have to be ordered well in advance to allow collection of local seed and sufficient time to raise seedlings. Given that they are likely to be raised in small numbers and that some of these species are more challenging to propagate, the cost per plant will be greater than for standard lines of common species.

With the higher cost and often special care required for rare or endangered species, extra effort in planting will improve chances of success. This includes targeting the best microsites by planting individual or small groups of three to five plants with marker stakes that can be easily accessed for regular monitoring and maintenance.

Matching species to site

- Establishing groves of single or mixed species so that they resemble natural plant communities relies on a knowledge of the ecological requirements of each species as well as information on variation in site factors of the planting site, such as moisture and exposure.
- There are many options to be considered. For example, planting kahikatea in lower elevation, moist areas, siting frost-prone hardwood tree species in relatively sheltered valley sites, or planting manuka and/or kanuka on exposed ridge sites to ameliorate the site for later planting of native timber trees.
- While natural distributions of native species will give an indication of site preferences, some tree species may actually grow faster on sites where they are not naturally found.
- Species naturally occupy some sites because they tolerate particular site factors better than other species.

- For example, kahikatea is often found in low-lying swampy areas that are occasionally flooded. This is where they have a competitive advantage, as there are only a few other woody species that tolerate these conditions. However, the largest kahikatea are found on better-drained ground.
- Similarly, kauri is often found as dense regenerating pole stands on exposed drought-prone sites such as along ridges. It survives and grows slowly on these dry sites where there is less competition from other species that do not tolerate droughty conditions. The fastest growing kauri are, however, found on lower hill slopes where occasional trees have survived intense early competition from hardwood species.

Inter-planting miro within the open shade of a regenerating manuka stand will provide initial shelter to allow it to establish. Once established, ongoing growth is aided by maintaining a light well within the canopy of natural or inter-planted nurse cover species.

Establishing native plantations

- Locating species on sites matching their ecological requirements that mimic natural patterns of regeneration may give good survival and growth rates and is likely to be the most appropriate approach where revegetation is the primary objective.
- Such sites will contain native timber species and although growth rates are likely to be compromised by competition or other site factors, landowners still have the option of removing semi-mature or mature trees for future timber.
- For those landowners whose major objective is to establish plantations of native trees for eventual wood production, using natural patterns of regeneration may play a lesser role in determining planting sites and patterns.
- Targeting the best planting sites, in combination with good site management and silviculture practices, will ensure optimum growth rates of native tree plantations.
- There are many examples of native species being planted outside their natural range as potential future timber resources, stimulating debate over whether this compromises the integrity of local biodiversity if they become naturalised.

An example of a native timber species planted south of its natural range – an 80-year-old kauri plantation in New Plymouth.

Regional differences in selecting species

- Some native nurse species are common across many regions, e.g., manuka, kanuka, koromiko and tauhinu.
- However, other nurse species vary from one region to the next. Most regional planting guides available from local regional councils and the Department of Conservation identify the key native pioneer species for establishing on an open site.
- Of the 27 species listed in the table below, only four are commonly planted across all three regions, and there are many region-specific species (as indicated on council websites).
- Note this is not a definitive list of species planted in each region, just illustrative of the need to check with local recommended species lists for commonly planted native nurse species.

- The aim is to match these species to specific sites, such as the six species listed that prefer coastal sites.
- Selection of appropriate nurse species will also depend on the site characteristics including soil type, topography, degree of exposure, altitude and proximity to the sea. This will further limit selection on most sites to a handful of species.
- Also, it is prudent to check out regenerating vegetation on similar sites locally, to determine which local native pioneer species are successfully establishing.
- Planting guides with lists of local nurse species for all regions are available on the Trees That Count website.

Nurse species

Below is an indicative list of recommended nurse species for planting across a range of sites in restoration programmes in three regions. This list was derived from council websites. It demonstrates regional differences in the recommended selection of locally native and successful species for planting on open sites. For other regions, refer to local regional council websites and botanical species lists.

Maori/common name	Botanical name	Auckland region	Wellington region	Southland
Manuka	*Leptospermum scoparium*	*	*	*
Harakeke	*Phormium tenax*	*	*	*
Tı kōuka	*Cordyline australis*	*	*	*
Kohuhu	*Pittosporum tenuifolium*	*	*	*
Karamū	*Coprosma robusta*	*	*	
Koromiko	*Hebe stricta*	*	*	
Māpou	*Myrsine australis*	*	*	
Kānuka	*Kunzea ericoides*	*	*	
Tarata	*Pittosporum eugenioides*		*	*
Manatu	*Plagianthus regius*		*	*
Māhoe	*Melicytus ramiflorus*	*		
Coastal karamu (coastal)	*Coprosma macrocarpa*	*		
Five-finger	*Pseudopanax arboreus*	*	*	
Karo (coastal)	*Pittosporum crassifolium*	*		
Houhere	*Hoheria populnea*	*		
houpara (coastal)	*Pseudopanax lessonii*	*		
Akiraho	*Olearia paniculata*		*	
Ngaio (coastal)	*Myoporum laetum*		*	
Makomako	*Aristotelia serrata*		*	
Toetoe	*Cortaderia fulvida*		*	
Koromiko	*Hebe salicifolia*			*
Broadleaf	*Griselinia littoralis*			*
Mingimingi	*Coprosma propinqua*			*
Narrow-leaved mahoe	*Melicytus lanceolatus*			*
Common tree daisy (coastal)	*Olearia arborescens*			*
Kotukutuku (coastal)	*Fuchsia excorticata*			*

Types of shrublands

Shrubland can be divided into two main categories: short-lived (temporary) and long-lived (persistent).

Short-lived shrubland: Most people are familiar with this type of shrubland which, depending on the region, is usually made up of common shrub species like manuka, five-finger, kohuhu, karamu and wineberry. It forms a transitional covering, colonising bare land. As the shrubs grow, they change the microclimate, allowing native forest species to colonise and slowly take over. For this reason, short-lived shrubland plants are often referred to as 'nursery' species and in time they will be replaced or dominated by native trees.

Long-lived shrubland: This is only found in areas where the conditions are too harsh for native forest to take over. Permanent shrubland occurs in the toughest areas – on mountains, in wetlands, along exposed coastlines and on poor soils. Because growing conditions can be harsh, long-lived shrubland species are often highly specialised.

Modified from Lloyd Esler, Southland Community Nursery

Commonly planted native shrub species include (left to right) manuka, tarata, koromiko and kohuhu.

Selecting tree species

- Sometimes enrichment planting will be required to assist with providing a natural species composition within the planting, such as when the planting is isolated from natural seed sources or natural dispersers, i.e., birds, are absent.
- When interplanting tree species within a nurse cover, it is important to identify the forest type that would naturally occur on the planting site. The selection of tree species will vary even at a microsite level with changes in topography, aspect, and soil moisture levels.
- Forest types are known for most regions, based on local remnant forests and botanical surveys. This information is available from local regional councils, the Department of Conservation, and from environmental consultants.
- Also check surrounding natural areas to see what species are characteristic of your locality. Viewing local high-forest remnants will help identify key high forest species for planting.
- Information on mature forest types can be found online for all regions including regional council and Department of Conservation websites. Key forest types for each region can be used as a guide for selection of species for each region.
- When inter-planting tree species, note that all species have specific ecological requirements and microsite preferences. For example, rimu and tawa are likely to be more successful when planted within sheltered gaps of established nurse cover species, whereas totara can be planted at the same time as the nurse species.

Commonly planted native tree species (left to right) kahikatea, rewarewa, puriri, totara.

Native forest factsheets series

These factsheets on establishing native forest have been compiled by Tāne's Tree Trust with funding from Te Uru Rākau's One Billion Tree Partnership Fund with support from The Tindall Foundation and Trees That Count. Others providing information and undertaking peer review include Scion, Auckland University of Technology, Northland Totara Working Group, iwi, landowners and selected local authorities and government departments.

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Cite this factsheet as: Bergin D, Bergin M. 2024. Planting native forest – selecting the right species for the right site. Establishing Native Forests factsheet series, Factsheet No. 13. Tāne's Tree Trust. 10 pp. https://docs.tanestrees.org.nz/1473

Te Uru Rākau New Zealand Forest Service

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