TĀNE'S TREE TRUST
Native Forests for our Future | Hereherea te Wao-nui-a-Tāne

Establishing Native Forests

TĀNE'S TREE TRUST FACTSHEET SERIES

Planting nurse species – the concept of succession

FACTSHEET 8, 2022 – 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/1314/



The coloniser native shrub species manuka is often planted as a nurse for establishing native forest.

Introduction

Mature indigenous forest develops in multiple steps, with each step providing the conditions that will suit the next group of plants. The first step in forest restoration is to establish suitable native coloniser plants, often referred to as nurse species, which will cover the site quickly and shade out grass and weeds.

The process of recolonising a bare patch of land (either naturally or via human intervention) is called 'succession'. During the succession process, early colonising species creates conditions suitable for the establishment of other later successional species. It takes many years for the process of succession to transform an area from bare land to a mature forest. Coloniser species, sometimes called pioneer species, grow on open sites as they can cope with the extremes of local climate during the establishment phase.

These coloniser plants can establish naturally or be planted as part of the process to encourage a more diverse forest to develop. Native colonising species are hardy and even though every site is different, experience shows that using a small range of these species will result in the most success. Therefore, these species generally make up the bulk of most species planted on open areas.

Concept of planting nurse species

- The concept of ‘nurse crops’ has become well established in forest restoration circles. Creating a shaded environment by rapidly establishing a canopy is a particularly useful way of excluding light-demanding competitors such as exotic grass and woody brush weed species.
- The shelter provided by the nurse canopy moderates microclimatic conditions, favouring the establishment of late-successional woody species with greater shade-tolerance.
- Planting of a hardy vegetation cover in advance of the chosen tree species can mimic the process of natural regeneration.
- It is, therefore, a common practice when restoring native forest to establish a mixture of hardy pioneer shrub species along with the native tree species.
- Many native tree species grow slowly in their early years but performance can often be improved when they are planted within shelter.
- The use of quicker growing, early pioneer shrub species will provide a rapid canopy cover and reduce the time needed for weed control.
- For those planting native timber trees, interplanting trees within a nurse crop will also assist in developing straight single stems and small lower branches due to the side shade provided by the nurse species.



A nurse of manuka and red beech trees planted in a wide fenced off riparian margin, Te Anau, Southland. Plastic plant guards are used to protect the beech seedlings from exposure and hare damage.

Selecting species for your region

- Native tree and shrub species vary from one region to the next, including early successional species used for establishing as a nurse cover as well as high forest canopy tree species.
- While some native nurse species are common across many regions, e.g., manuka, kanuka, koromiko and tauhinu, there are many others that are specific to the region.
- Most regional planting guides available from regional councils and the Department of Conservation identify the key native pioneer species for establishing on an open site.
- Also refer to Factsheet No. 4 for selecting species – the right species for the right place.

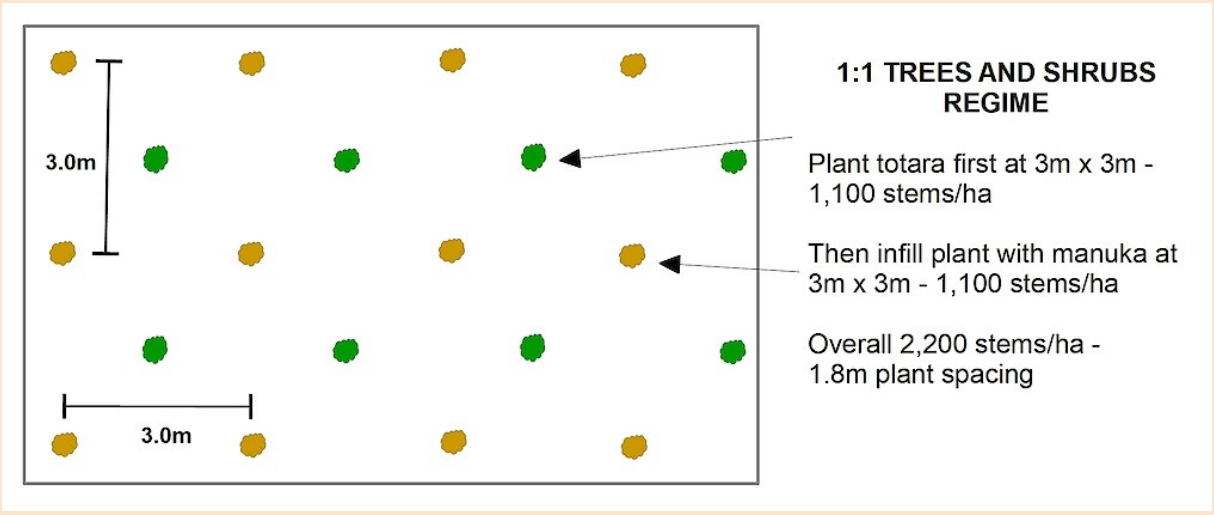
Using a nurse cover

- While some natural regeneration of later-successional tree species may occur if there is a local seed source, too many restoration programmes do not factor in planting of native later-successional tree species.
- If all seedlings - both nurse and tree species - can be planted in one operation, this is less costly and avoids the risk of leaving interplanting trees too late when the nurse crop has already formed a dense canopy.
- Depending on site, existing vegetation and objectives, there is range of scenarios for planters to utilise a nurse cover.
- Three examples of planting densities and ratios of nurse to tree species for establishing native forest on retired pasture sites are provided below. A further example of planting is provided for interplanting within existing shrubland.
- A practical option during planting is to layout or plant tree species first at the desired spacing ensuring species match the site (e.g., kahikatea on lower moister sites, totara on slopes that may become dry), and then follow through by infill planting the nurse shrub species to achieve the target overall stocking.

Even density nurse to trees – 2200 stems per ha (trees planted 3 m apart)

An easy layout is to plant trees at 3 m spacing and follow through by planting shrubs also at 3 m spacing but interplanted within the trees. This gives an overall stocking of 2200 stems per ha with approximately 1.8 m plant spacing.

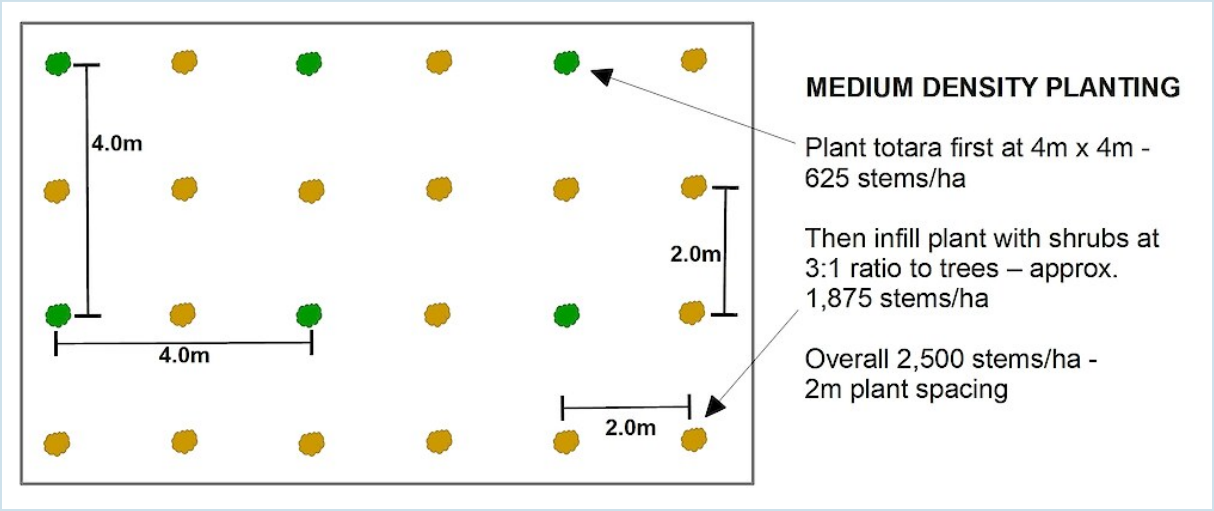
Pamu Farms have adopted this regime for large scale planting of retired river terraces and hill country, planting mostly totara, beech or kahikatea (depending on site) at 3 m spacing and manuka inter-planted as the main nurse cover. It is also an example of manuka planted at the recommended stocking of 1100 stems per ha by the manuka honey industry to provide an intermediate income from manuka honey over the first decade or so, while providing a nurse cover for the development of interplanted native trees.



Medium density planting – 2500 stems per ha (trees planted 4 m apart)

This is a planting regime commonly recommended by Tane's Tree Trust for planting native forest, with a planting density of 2500 stems per ha, equivalent to 2 m spacing between plants. At a recommended 3:1 proportion of shrubs to trees, 1875 pioneer nurse species and 625 native tree species will be required per ha.

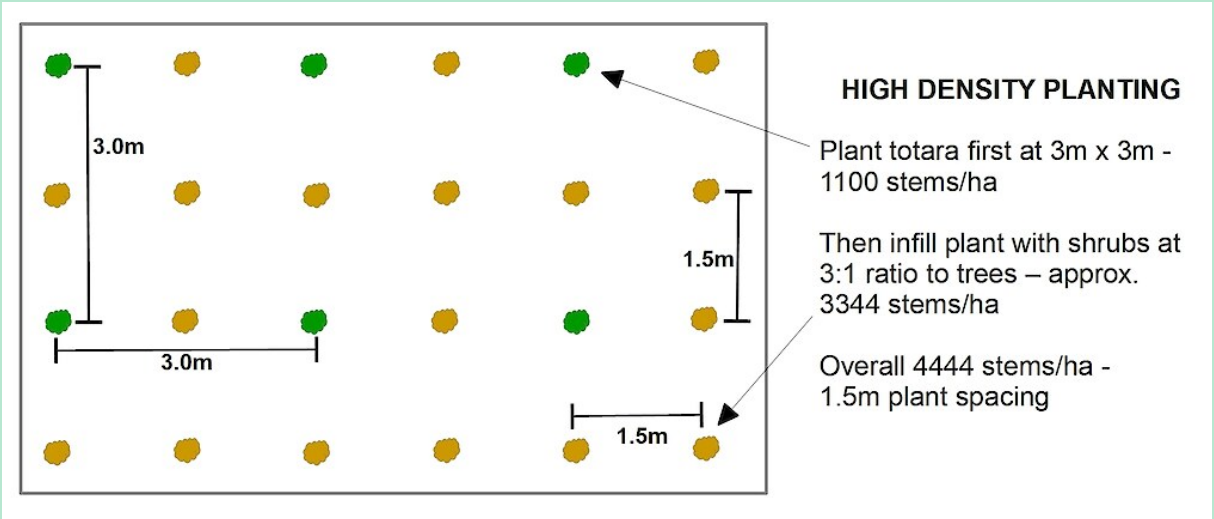
This planting regime has been used for tens of hectares of steep retired pastoral hill country at a Tane's Tree Trust flagship property, Cassie's Farm, in the Waikato, to establish native forest with the long term aim to selectively harvest using continuous cover forestry methods.



High density planting – 4444 stems per ha (trees planted 3 m apart)

For smaller-scale restoration projects such as along riparian zones and where weed growth is a problem, a higher plant stocking of 1.5 m spaced plants is often favoured (equivalent to 4444 stems per ha). At a ratio of 3:1 shrubs to trees, the faster growing shrubs will provide canopy cover within 2 or so years after planting reducing the need for extended weed control.

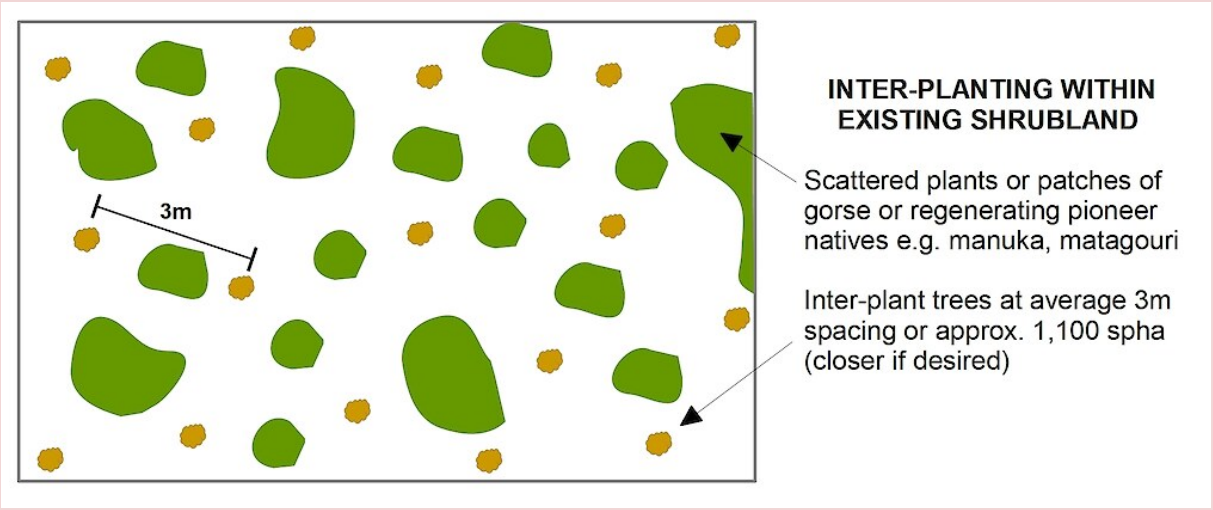
Planters can select a ratio with a lower number of trees if desired such as 4:1 shrubs to trees requiring approximately 3550 shrubs and 890 trees (trees spaced approximately 3.5 m apart).



Interplanting within existing scattered shrubs

Where regeneration of pioneer species is underway providing some shelter, plant trees species at an average 3 m spacing between existing shrubs using the best microsites within small and large gaps.

Where there is continuous shrub cover, then gaps or lines will need to be cut to allow interplanting of trees to supplement any natural regeneration. Cutting gaps and lines can be labour-intensive and maintaining a canopy opening to retain light wells above planted trees will be required.



Exposed sites

- On severely exposed open sites, shelter must be provided for more sensitive tree species by advance planting of nurse species such as manuka, kanuka, kohuhu and karamu.
- Planting the nurse crop a year or more ahead of interplanting tree species may be required. Once the nurse species is established, native trees can be interplanted at the desired stocking rate and planting pattern.
- Plant tree species 1 to 5 years after the nurse crop, depending on the growth rate of the nurse species and the severity of the site.



Matagouri with trees interplanted in the gaps.

Maintenance

- Regular maintenance will be required to ensure that light levels remain adequate for growth of interplanted trees.
- Maintenance of a light- well above each inter-planted tree is essential to encourage height growth. In time, the nurse species will be suppressed.

Improving tree form

- For those interested in planting native trees as a long-term timber resource, the side shelter provided by nurse species in early years will encourage single stem form in interplanted trees.
- Planting of trees at wide spacing without a nurse cover will result in poor form in many tree species. Nurse species planted to fill in gaps between trees encourages apical dominance of main leaders of interplanted trees, smaller branch size and a lower incidence of multiple leaders.
- For instance, totara planted at 2500 stems per ha without a nurse cover will take at least 8 years to achieve canopy closure on a good site and most trees will have multiple leaders and coarse lower branching. However, totara planted within a nurse of manuka at 3:1 mix of shrubs to trees will provide canopy closure within half this time and will result in mostly single-leader totara and smaller lower branching, requiring less silviculture.



Ensuring a light well is maintained within the canopy of an establishing nurse shrub cover is essential for slower establishing inter-planted native trees to maintain good growth.



A nurse cover of manuka 4 years after planting at wide spacing of 3m apart on a former grazed site that will take several years to near canopy closure. Low density planting runs the risk of aggressive weeds establishing between planted natives so vigilance is required in ensuring timely weed control is carried out.

It's a balancing act!

The choice of planting pattern and density is a balance between planting at a dense spacing to achieve canopy cover and therefore quick weed control, and wider spacing requiring a commitment to monitoring and controlling potential weed invasion over longer timeframes.

- While dense planting can give a canopy cover within 2 to 3 years, this option requires large numbers of plants and intensive site preparation and planting for it to succeed.
- Conversely, with a low plant stocking it may take a decade on some sites to become fully covered in native woody vegetation, especially if growth rates are slowed by poor climatic conditions and a limited maintenance regime.
- Shrub hardwood species are cheaper than native tree species and can 'bulk-out' a planting site to give early canopy cover and reduce the length of time for weed control to about 5 to 10 years for widely spaced stands, and about 2 to 3 years for dense plantings.



A nurse crop of manuka planted on a steep hillside retired from grazing will be used initially as a potential source of manuka honey but in the longer term will assist in a succession to a diverse native forest from seed spread from nearby native forest remnants or by interplanting of native tree species.





Totara is one of only a small number of native trees that can establish in open conditions either by natural regeneration (left) or by planting (right).

Totara is a pioneer!

Totara has many of the ecological characteristics of a pioneer species. It is one of the most light demanding of the podocarps, requiring open sites to germinate and develop. It regenerates readily in grazed pasture, particularly on hill slopes and along river terraces subject to occasional flooding. Hence totara is one of the most common native trees regenerating across rural landscapes where there is a local seed source.

Totara has great ecological vigour, it is adapted to a range of climates and sites, is moderately resistant to browsing, and is therefore found on many different site types. It is tolerant of dry soils and seasonal drought but is intolerant of poorly drained soils.

Totara is one of only a few New Zealand's native trees that can be planted directly on tough sites with or without a nurse species. However, tree form can be poor unless it is densely stocked, planted on its own or with a nurse cover species.



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.

Information and recommendations are provided by Tāne's Tree Trust in good faith based on interpretation of information collated and reviewed which must be assessed by users on a case-by-case basis and/or specific technical advice for their sites. Accordingly, Tāne's Tree Trust is not liable on any ground for any loss, claim, liability or expense arising from or due to any errors, omissions or advice provided within these factsheets.

Cite this factsheet as: Bergin D, Bergin M. 2022. Planting nurse species – the concept of succession. Establishing Native Forests factsheet series, Factsheet No. 8. Tāne's Tree Trust. 8 pp. https://docs.tanestrees.org.nz/1314

Te Uru Rākau New Zealand Forest Service

The Tindall Foundation

TREES THAT COUNT
TE RAHI O TĀNE