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

# Establishing Native Forests

**TĀNE'S TREE TRUST FACTSHEET SERIES**

## How to establish "seed islands" of natives

**FACTSHEET 7, 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/1186/

Within regenerating shrubland establish 'seed islands' to re-introduce native trees as steppingstones for bird and wind dispersal of later successional high forest species. Locating seed islands in accessible gaps within regenerating shrubs on lower to mid slopes are likely to benefit from increased shelter and better soils than ridge top sites.

## Introduction

Establishing 'seed islands' across landscapes is a method for using small target planting areas to assist nature to establish diverse native forests at scale through natural regeneration. It is a pragmatic and cost-effective option, given the high cost of planting natives at $20,000 (or more) per ha, and the impracticality of intensive blanket planting, especially on a large scale.

The aim is to plant intensively managed small groves of native trees to provide greater diversity of wind- and bird-dispersed seed across the wider regenerating or more sparsely planted landscape. Intensively managed seed islands focuses time and resources to ensure greater success of planted groups of natives at small scale by high density planting using tall well-conditioned seedlings, providing extra shelter species if required, reducing pest animal browsing, ensuring timely weed control, and where practical, undertaking control of predators of rodents and mustelids to boost bird populations and seed production of natives.

## A pragmatic approach

There is no single prescription for seed-islands – it is a concept that is increasingly recommended as a pragmatic approach to native revegetation when the scale and cost of blanket-planting is prohibitive.

The strategy is simply to create a network of small groves of more diverse native flora, which may at the start be like islands amongst a matrix of regenerating shrubland, grass and weeds, or amongst blanket low-density planting of manuka or other pioneer natives.

## The seed island concept

- Marginal pastoral hill country will often revert naturally to native species over long periods; however, in the absence of diverse seed sources there tends to be a dominance of only a few native pioneers such as manuka, kanuka or tauhinu, or exotic brush species like gorse, broom and blackberry.
- Establishing seed islands as intensively managed groves within larger areas, targeting only the best sites to optimise growth, will create 'hot spots' of species diversity.
- This allows for the reintroduction of a range of native tree and shrub species that were once common to the area and will help accelerate the regeneration process to a complex high forest with a diverse mix of species.
- Seed islands will become like steppingstones, attracting birds to roost, feed and fly between groves and assist in spreading seed across the wider regenerating or planted landscape.
- This concept works with nature, enlisting the help of birds as agents of seed dispersal.

## Seed islands for assisting natural regeneration

- Following livestock removal, large areas of marginal pastureland would likely revert to native forest if there are existing seed banks or nearby seed sources.
- Grazing by farm stock, wild animal browsing, and loss of local sources of the palatable native shrub and trees species are barriers to reversion to complex, high forest, but seed islands can help circumvent these limitations.
- Planting diverse species in groves within open areas of regenerating monocultures of manuka or kanuka can re-introduce seed sources of high forest tree species that have long been lost locally.
- Seed islands can be established to provide linkages between remnants of native forest - so aim to set them up as 'steppingstones' for birds, i.e., at about 100 - 200 m apart, where practical.

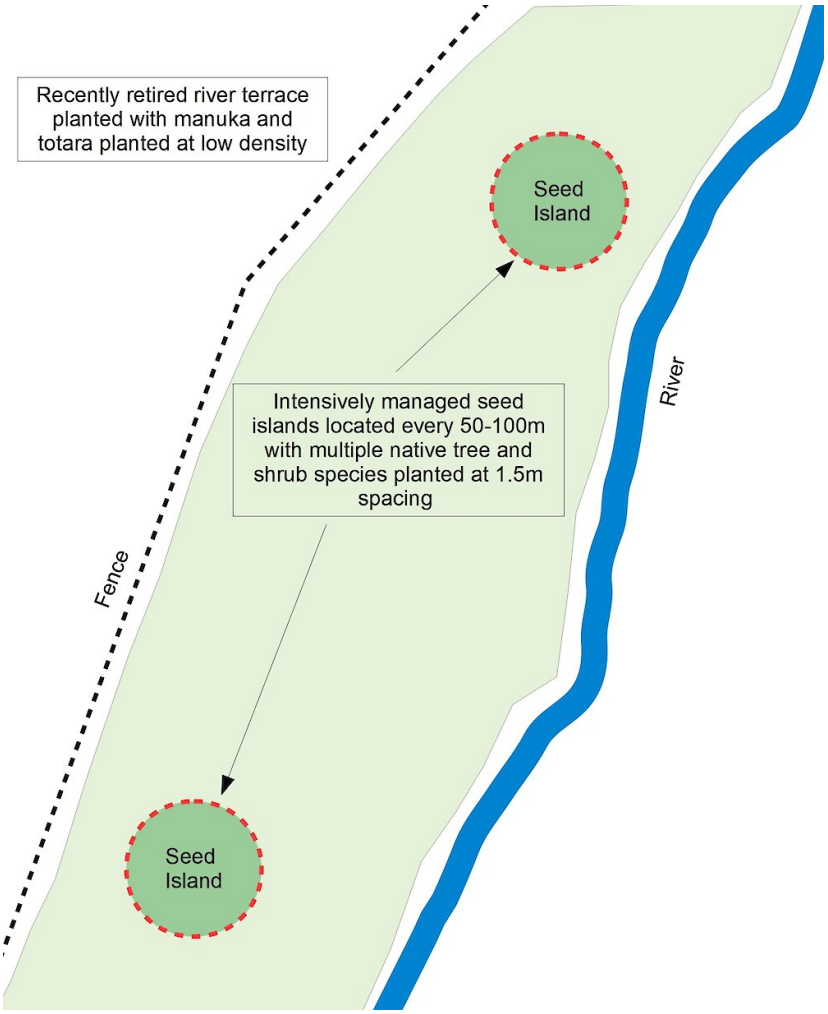
## Our 'natural drones' - the wind and the birds!

There is increasing interest in using high-tech methods such as drones for direct seeding natives across our degraded landscapes to establish native forest. While research is underway by various groups to evaluate direct seeding by machines such as drones and helicopters, the practicality and economics of aerially spreading seed to establish native forest at scale is yet to be proven.

But we already have 'natural drones' - the wind and birds - to do this for us. All we need to do is provide the seed sources across these degraded landscapes by establishing seed islands, trapping predators and thereby increasing our bird populations, and letting the wind and birds do the rest to spread seed and encourage natural regeneration. This is likely to be a far cheaper and more practical option than what we can achieve with machines.

## Seed islands as “hot spots” of diversity for planted sites

- Some retired pasture sites will remain in grass, potentially for decades, so planting native seedlings may be the only option to hasten establishment of native forest. However, planting at scale may only be feasible at low density and with a limited number of the hardiest pioneer trees and shrubs.
- Large tracts of pasture-dominated riparian zones and retired pastoral hill country can be planted at low density in key pioneer species, such as manuka and totara to cover the bulk of area, with strategically located seed islands interspersed.
- It is recommended that these seed islands are planted on the best, accessible sites with a greater diversity of key native trees.
- Eventually, these scattered ‘hot spots’ of diversity will produce seed and attract birds, which will subsequently assist with regeneration across the wider planted area.

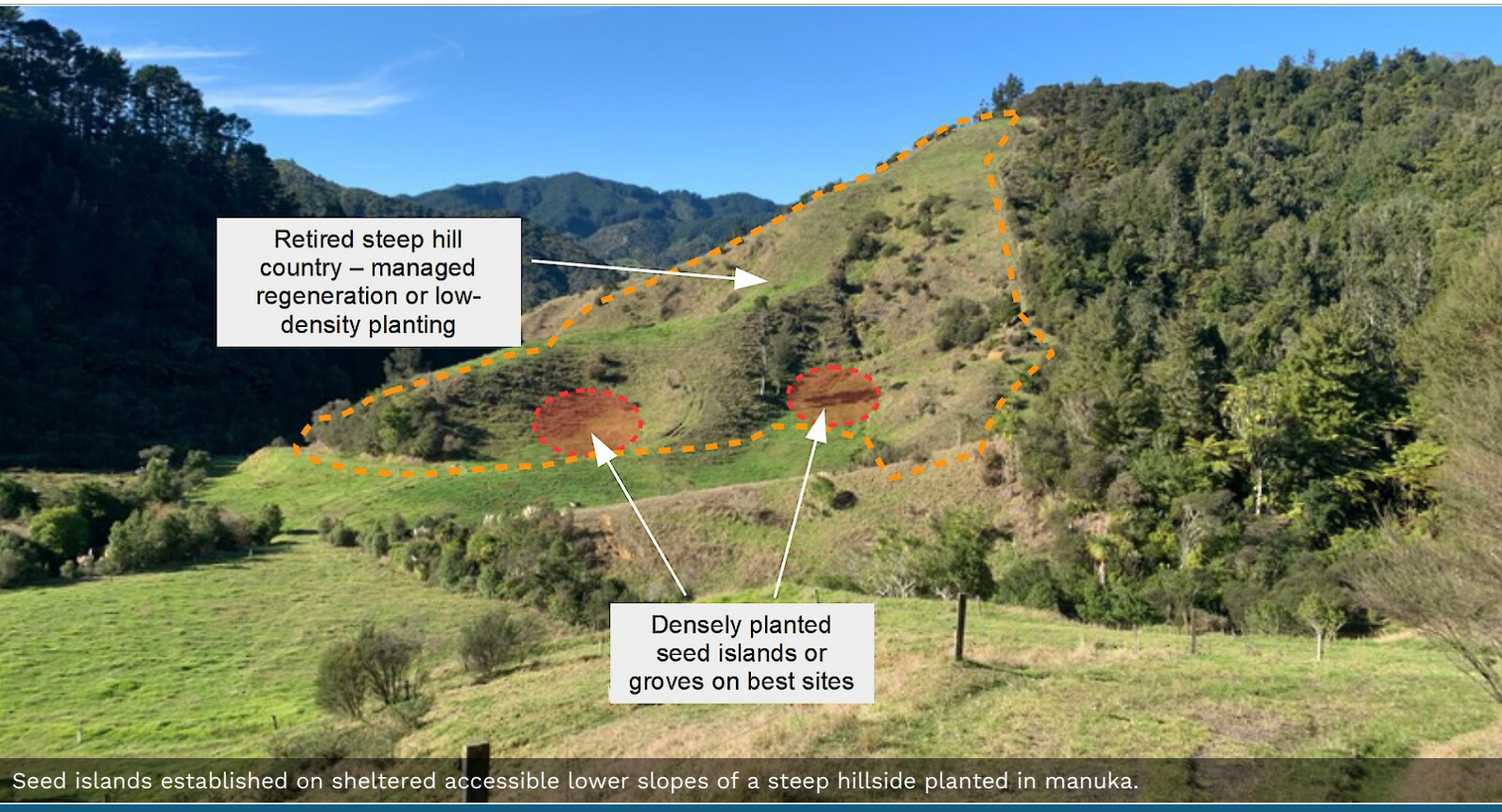



Seed islands of a diverse range of native tree and shrub species can be established within a matrix of manuka or other pioneer species.

## Location, size and site characteristics for seed islands

- By necessity, seed islands must be accessible to make sure they are monitored and maintained using best practice management.
- While seed islands can be of any size or shape to suit the site and resources, selecting areas that range in size from 10 - 30 m across is likely to suit most regenerating sites.
- Aim for an average of one seed island per hectare.
- Locate seed islands on the best sites that can be easily accessed for establishment and subsequent monitoring and maintenance. Remote and difficult-to-access sites will invariably become forgotten and opportunities to maintain plantings and learn from early performance will not happen.
- To help identify the best, most accessible sites, take note of the topography, existing vegetation cover (including any native forest or exotic shrubland), and access points and tracks that are accessible by foot or vehicle.
- It will be impossible to systematically plant seed islands across very steep, inaccessible hill country, so establish clusters along the valley bottoms or on gently sloping ground either side of tracks and allow the steepest hill country to revert naturally. Birds are far better than humans at accessing rugged country!
- Use sites with good topsoil to maximise the growth of planted natives - this is more likely found on flatter sites, within basins, on gentle slopes, and along the base of steep slopes.

- Avoid steep exposed sites with skeletal soils where survival and growth are likely to be poor and access difficult. Similarly, select open sites with minimal dense, aggressive, exotic brush weeds that will need clearing and long-term maintenance.
- Avoid large areas of wet boggy soils although a seed island could include wetland and seeps as long as there are areas for planting a diverse range of native trees and shrubs.
- Utilise shelter from any existing vegetation such as scattered native trees or groups of regenerating trees and shrubs; some exotics such as gorse could also be managed as useful shelter.
- If wild animals such as rabbits, hares, deer or pigs cannot be controlled, consider erecting a low-cost temporary fence with waratahs and netting around each seed island.



Seed islands established on sheltered accessible lower slopes of a steep hillside planted in manuka.

## Waikereru Ecosanctuary

The seed island approach is currently being evaluated by Tāne's Tree Trust at Waikereru Ecosanctuary, near Gisborne (and other sites) and is proving to be a cost-effective method for large-scale forest restoration. The aim is to cost-effectively enhance indigenous biodiversity by working with (and supplementing) natural processes of regeneration and accelerating succession to high forest.

## Selection of species and plant spacing

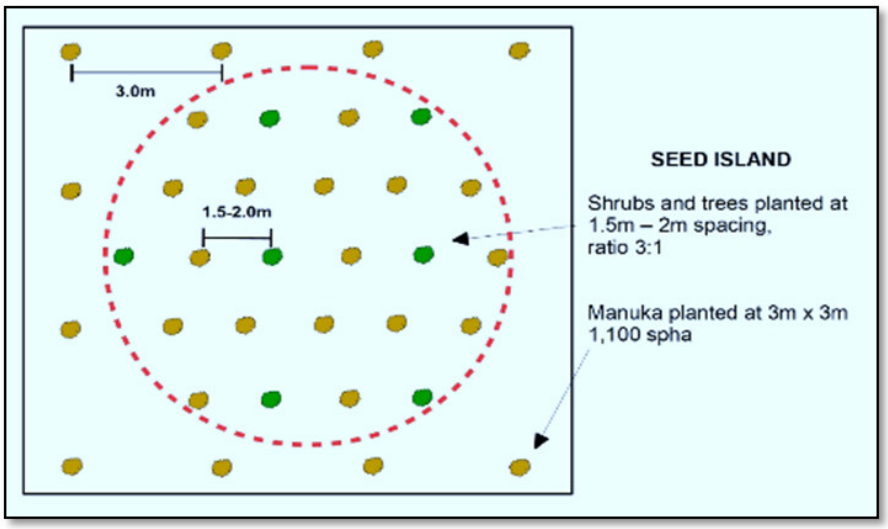
The aim is to plant late-successional, high-forest species that would eventually provide seed for spreading across the landscape to increase the diversity of surrounding shrubland. Given seed islands are relatively small, there is scope to plant at relatively high stocking of up to 4500 stems per ha (equivalent to 1.5 m plant spacing) to achieve canopy cover quickly. However, wider spacing can also be undertaken but canopy cover will take more time with scope for exotic brush weed invasion unless there is a prolonged commitment to weed control.

Two options can be considered for establishing seed islands – using a nurse cover with inter-planted trees, or plant groves of tree species only.

Seed islands should be located on better sites such as these gentle slopes near the base of small gullies and near tracks for easy access and maintenance. The steeper hill country can either be planted with hardy shrub hardwoods such as kanuka and manuka as a nurse cover or left to naturally regenerate long term from bird and wind dispersed seed from seed islands and surrounding native forest.

## Nurse cover option

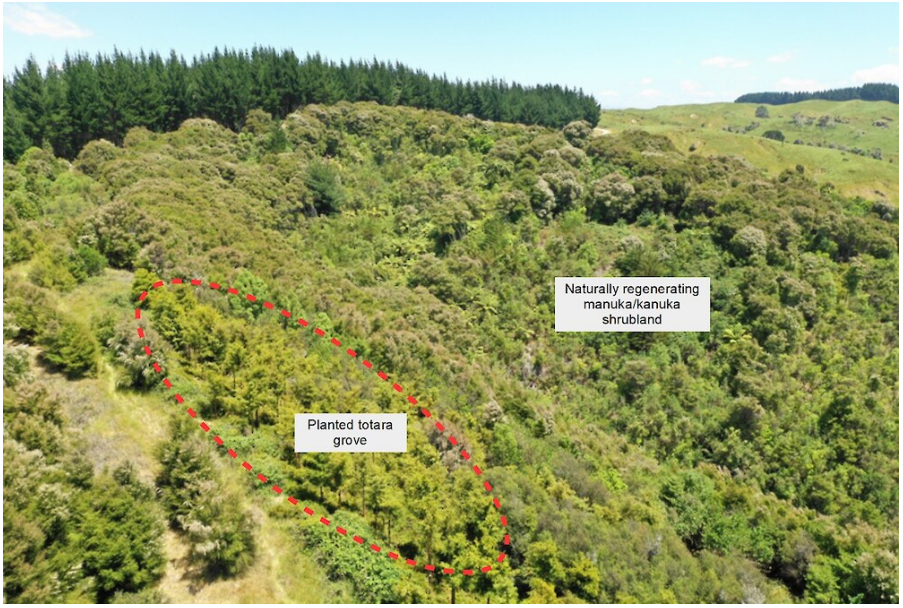
- Most native tree species benefit from planting within a nurse cover of planted or existing pioneer, native shrub species, especially on exposed, harsh sites.
- If the site is particularly exposed, planting hardy, early-successional shrub species such as kanuka and manuka may be required a year or more ahead of inter-planting tree species.
- However, it is less costly if all seedlings are planted in one operation; also, this avoids the risk of leaving the inter-planting of trees too late, i.e., the nurse crop has already formed a dense canopy.
- Use a 3:1 or 4:1 proportion of shrubs to trees. Shrubs are generally less expensive planting stock, they grow faster and will provide canopy cover and suppress weed growth quicker than trees alone; plus side shelter in early years will encourage single-stem form in inter-planted trees.
- Plant natives at 1.5 - 2 m apart - with inter-planted trees at around 4 m apart within a matrix of native shrub species. For a 20 m x 20 m seed island (400 m2 or one-twenty-fifth ha):
  - 1.5 m spaced plants (4444 stems per ha) will require 180 plants – at a 3:1 proportion of shrubs to trees – 135 shrubs and 45 trees.
  - 2 m spaced plants (2500 stems per ha) will require 100 plants – at 3:1 proportion of shrubs to trees – 75 shrubs and 25 trees.




An example of a seed island within a matrix of wider spaced planted shrub hardwoods such as manuka.

## Tree species groves

- Alternatively, seed islands can be established on relatively sheltered sites as groves of single or multiple tree species without a nurse cover, where better performance of tree species is more likely.
- Most tree species are slower growing than shrubs so tree groves ideally should be planted at a higher density to decrease the time for trees to form a canopy and provide some degree of mutual protection.
- For instance, totara (right), kauri and kahikatea can be planted as single-species stands on good sites without a nurse crop but canopy closure can take one or more decades. At 2 m plant spacing (2500 stems per ha):
  - Totara can take 8 - 10 years to achieve canopy cover on a good site with most trees forming multiple leaders and heavy lower branching unless pruned.
  - Kauri and kahikatea with a monopodial habit (upright growth generally forming a single trunk) will take over 2 decades to achieve canopy cover on a good site.
- The delay in canopy coverage for lower-density plantings can be a major problem where an invasion of exotic weed species could potentially overtake planted trees unless there is vigilance in weed control, particularly over the first decade.
- Higher-density planting at 1.5 m spacing for tree species will give a single species grove within a decade of planting but planting trees at high stocking will be expensive. Longer term, if maximising growth of trees is the objective, stands will require thinning from 2 to 3 decades after planting.



An established grove of totara 10 years after planting within a regenerating mixture of manuka and kanuka, Hawkes Bay.

- For a 20 m x 20 m seed island (400 m2 or one-twenty-fifth ha):
  - 1.5 m spaced trees (4444 stems per ha) will require 180 trees.
  - 2 m spaced plants (2500 stems per ha) will require 100 trees.

## Match species to appropriate sites

- Follow best-practice guidelines on selection of the most appropriate tree and shrub species for the site and region.
- The concept of targeting only the best microsites provides opportunities for planting single or multiple-species plantations of native trees, with or without nurse species, to provide shelter and assist in developing improved tree form of straight, single leaders with lighter lower branching.
- Seed islands allow opportunities to intensively manage smaller areas with a greater diversity of species, and this may allow for some testing of sites for a range of tree species of interest; however, selection of species to best suit appropriate microsites is still required to maximise survival and growth.

Planting natives within the sheltered canopy of a slowly degrading exotic coastal pine buffer to slowly transition to native forest, Te Hiku, Far North .

## Seed islands – can they help transition exotic forest to native?

There is increasing interest in conversion of exotic forest to natives, sometimes at large scales, as well as the option of using exotic forestry for production as the first step to eventual native forest. There is a tendency to regard our native and exotic species as mutually exclusive when there are likely to be practical options for most sites for a gradual transition from exotics to natives. A major concern is the knowledge gap on methods to transition exotics to native forest across the range of sites where exotics occur.

There are many examples of native understorey dominated by a diverse range of native shrub and tree species. However, the requirement of nearby native seed sources and a local bird population to help spread seed to encourage natives within exotic stands is often overlooked. This readily available avian workforce, which costs nothing is willing to collect and deliver the seeds, neatly packaged in pellets of organic fertiliser. They have a good track record, establishing forests in Aotearoa for millions of years. Their demands are simple. All they need is a nearby seed source and a convenient perch for a pit-stop. We could take it further by creating a plantation system that will generate cash flow, while the birds help the transition to native forest.

Strategically located ‘seed islands’ within existing exotic production forestry could provide a seed source allowing for bird- and wind-dispersed species to help facilitate establishment of natives forest in gaps and as an understorey as the exotic canopy opens up naturally or by management. Groves of natives planted in gaps within pine forest can be a tool for assisting wider regeneration within the exotics, particularly if the exotic overstorey is either naturally opening up or can be managed to increase light levels, and the shelter of surrounding pines especially on exposed sites will benefit establishment of natives.

An example of using a network of seed island to slowly convert pines to native is currently being evaluated by Tane’s Tree Trust in collaboration with forestry companies, councils and local communities. This project is exploring practical options to transition failing exotic forest used as coastal buffers to resilient permanent buffers comprising native coastal forest species using the shelter of the pines to nurture planted seed island of natives.

## Integrated best-practice establishment

- The success of seed islands relies on investment in best-practice forest establishment techniques applied to small manageable areas, ideally complemented by wider pest and weed control.
- As the seeds of many of our native shrub and tree species are spread by birds, reducing populations of possums, rats, mice and hedgehogs that predate on birds and seed will boost bird populations to help disperse seed and increase seed banks of native plant species.
- Fencing out farm stock and pest animals will encourage natural regeneration of a diverse range of broadleaved native species.
- Seed islands can be progressively established over many years depending on resources and the ability to maintain them for several years after planting.

## Monitoring and maintenance

- With seed islands established at accessible sites, regular monitoring and maintenance can be easily carried out.
- Undertake regular monitoring and maintenance to ensure planted natives within each seed island are not being suppressed by aggressive grass and weed growth, and pest animals are not causing damage.

### 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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