



Tāne's Tree Trust
NATIVE FORESTS FOR OUR FUTURE
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TREES THAT COUNT



TE RAHI O TĀNE

Year 2 planted seed islands, Waikereru Ecosanctuary, Tairāwhiti

Milestones 3 & 4 Progress report

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January 2024



A wide-open planted gap dominated by rank grass within the existing scrub vegetation at Waikereru Ecosanctuary, Tairāwhiti

Introduction

Seed islands comprising planted native trees and shrub species were established in mid-2022 and mid- 2023 as part of a 3-year project to demonstrate how to speed up succession of kānuka scrub into a diverse native forest on steep marginal former pastoral hill country in the Tairāwhiti region. This demonstration area was established in collaboration with The Longbush Ecological Trust at the Waikereru Ecosanctuary where over 100 ha of mostly regenerating hill country is located adjacent to the Longbush Reserve in the Waimatā River valley approximately 9 km north of Gisborne.

This report provides a brief description of the establishment of the first and second year of seed islands at the Waikereru Ecosanctuary including baseline measurement of planted native trees and shrubs and plans for ongoing monitoring and maintenance. Refer to the workplan for further details on the establishment of seed islands (Bergin and Bergin 2021), and to a report on evaluation of species and proposed location of sites for seed islands at Waikereru (Bergin and Bergin 2022a).

The project is funded by the Lotteries Board with support from owners Anne and Jeremy Salmond, Trees That Count, research associates from Manaaki Whenua, NZ Landcare Trust, and Waimata River restoration landcare group. Nursery seedlings for the seed island are funded by Trees That Count (TTC). The planting site at Waikereru Ecosanctuary has been registered as a TTC planting site and sample plots established to monitor early performance.

Project milestones

Year 2 of this project comprised 2 milestones that have been reported jointly as part of this report.

Milestone No.	Due Date	Activities/tasks	Outputs/measurables
3 (Year 2)	30 th April 2023	<ul style="list-style-type: none">• Project planning for Year 2• Liaison with project partners• Confirm selection of second seed island locations in natural gaps• Confirm selection of species for planting and orders for Year 2	<ul style="list-style-type: none">• List of Nursery order for second year seed islands• Milestone progress report
4 (Year 2)	31 st Oct 2023 (extended to January 2024)	<ul style="list-style-type: none">• Liaison with Ecoworks re planting of second set of seed islands• Complete assessment of Year 2 seed islands and remeasurement of Year 1 planting• Undertake post-plant site inspection	<ul style="list-style-type: none">• Year 2 progress report including establishment of second year seed islands• TTT Newsletter article and website update

Milestone 3 tasks and deliverables

Tasks undertaken during the 6-month period of Milestone 3 up to 30th April 2023 included:

- Completion of Year 1 establishment and baseline measurement report and dispatch to stakeholders
- In collaboration with Trees That Count, compile a nursery order list of tree and shrub species seedlings for Year 2 seed island plantings.

- Consider including substitute tree and shrub species identified in Year 1 but not available for planting in seed islands in Year 2.
- Confirm the Waikereru seed island planting is registered and met the criteria for funding up to 500 nursery-raised natives including approximate cost.
- Liaison with Lana and Nigel at the Native Garden Nursery on availability of species and adjust order accordingly including species selection and numbers to be supplied.
- Undertake data entry of baseline measurements of Year 1 plantings across 20 established seed islands including site classification for each plot into recently developed Tane's Tree Trust database system for planted natives.
- Undertake preliminary analysis of Year 1 data and reporting.
- Identify area immediately southwest of Year 1 planted seed island for planting 10-20 seed islands in mid-2023 targeting natural gaps within established regenerating kanuka shrubland; restrict locations to lower slopes with good soils, moisture retention and shelter.

Milestone 4 tasks and deliverables

Tasks undertaken during the 9-month extended period of Milestone 4 May 2023 to January 2024 included:

- Complete remeasurement of Year 1 planting, data entry and preliminary data analysis
- Continue liaison with Ecoworks regarding the planting of second set of seed islands including locations of seed islands in a range of gap sizes across the proposed new planting site
- Continue liaison with Native Garden Nursery on availability of species and adjust order accordingly including species selection and numbers to be supplied; explore potential for including an extra tree species including totara, rewarewa, puriri, karaka and matai in collaboration with Trees That Count
- Undertake post-plant site inspection of Year 2 plantings and complete baseline assessment of Year 2 seed islands
- Year 2 progress report including establishment of second year seed islands and preliminary results of Year 1 survival and growth
- Initiate planning for remeasurement of Year 1 and 2 seed island plantings
- Draft articles for the TTT Newsletter article, TTT 2023 AGM report and as a website update.

Establishment of Year 2 seed islands

Location of Year 2 seed island plots

As with Year 1 seed island plantings, the Year 2 seed islands were located on the lower slopes along the base of the steep hill country of Waikereru within the existing kanuka shrubland. The aim was to locate seed islands on the lower slopes where there are the better soils, moisture retention and shelter from regenerating kanuka to maximise performance of planted natives compared to the upper slope land use classes.

The sites for all seed islands were located on alluvial fans as mapped and described by Marden and Seymour (2022) as part of a Land Use Capability (LUC) survey, together with contours and parcel boundaries based on an aerial view of the ecosanctuary flown in 2017 (Figure 1). The Year 2 seed islands were located immediately adjacent and to the southwest of the Year 1 seed islands.

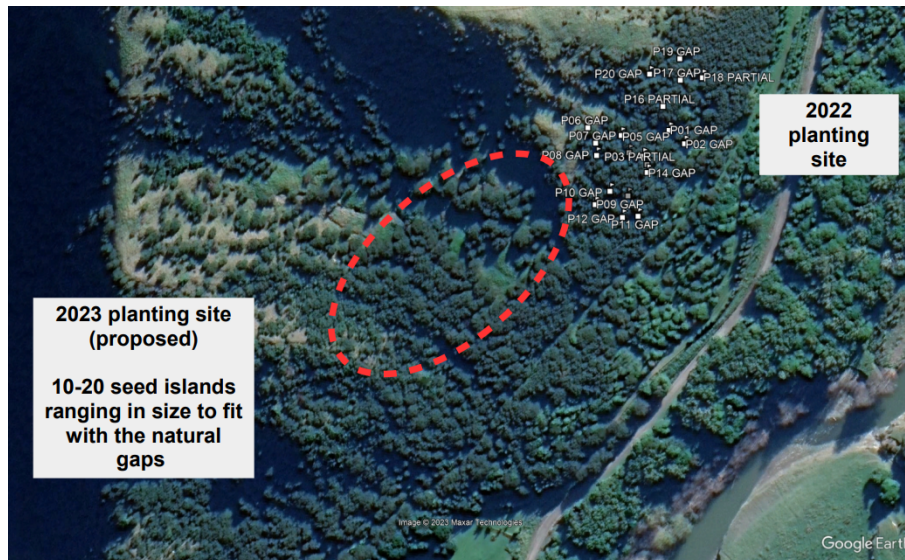


Figure 1: Area where Year 2 seed islands were planted on the lower slopes at Waikereru, immediately southwest of the Year 1 seed islands.

Potential seed island sites were identified based on the degree of shade and shelter into one of two broad shade categories – open canopy gaps with full overhead blue sky, and partial shade gaps with some degree of light canopy cover from the existing naturally regenerating kanuka. While the aim was to select up to 20 seed island sites as for the first-year planting, the nature of the shrubland and natural gaps available dictated a smaller number of larger seed islands to be planted.

Table 1 lists the 11 seed islands planted in the second year including the GPS location of the centre of each seed island along with three categories of shade/exposure – canopy gap, partial shade and exposed – and approximate location within the alluvial fan Land Use Capability (LUC) class.

Table 1: List of plots established in 2023 including the latitude and longitude, cover treatments, plots sizes and location within the alluvial fan Land Use Capability (LUC) class.

Plot no.	Latitude:	Longitude	Shade category for each seed island	Plot size	Location within alluvial fan LUC
P21	-38.6067700	178.0620100	Canopy gap	6m x 6m	Mid
P22	-38.6068400	178.0619700	Partial shade	6m x 6m	Mid
P23	-38.6068200	178.0618700	Canopy gap	6m x 6m	Mid
P24	-38.6069300	178.0611900	Partial shade	6m x 6m	Mid
P25	-38.6068800	178.0616800	Exposed	6m x 12m	Upper
P26	-38.6070700	178.0614600	Canopy gap	6m x 6m	Upper
P27	-38.6070100	178.0613299	Exposed	12m x 12m	Upper
P28	-38.6071900	178.0612300	Canopy gap	6m x 6m	Upper
P29	-38.6071700	178.0616100	Shade only	5m x 7m	Lower
P30	-38.6069100	178.0621200	Partial shade	4m x 8m	Lower
P31	-38.6070300	178.0612000	Partial shade	4m x 8m	Lower

Species and planting of seed islands

Seedlings supplied by the local nursery Native Plant Nursery comprised 500 native tree and shrub species as listed in Table 2. Planters reported that the seedlings were in excellent condition. Species were randomly allocated across the 11 seed islands but ensuring all seed islands had a sample of all species.

The local planting contractors Ecoworks laid out the plots by marking the plot centres and corners and recorded the vegetation cover and other characteristics of each seed island site. Planting was then undertaken by Ecoworks in June 2023 over several days.

Table 2: List of species planted in the 2023 plots at Longbush Waikereru

Scientific name	Maori name	Form	No. planted in 2023
<i>Alectryon excelsus</i>	Titoki	Small tree	50
<i>Aristotelia serrata</i>	Makomako (wineberry)	Shrub	50
<i>Coprosma robusta</i>	Karamu	Shrub	21
<i>Corynocarpus laevigatus</i>	Karaka	Tree	13
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Tree	49
<i>Dysoxylum spectabile</i>	Kohekohe	Tree	19
<i>Knightia excelsa</i>	Rewarewa	Tree	50
<i>Metrosideros robusta</i>	Rata	Tree	20
<i>Myoporum laetum</i>	Ngaio	Small tree	29
<i>Pittosporum tenuifolium</i>	Kohuhu	Shrub	19
<i>Podocarpus totara</i>	Totara	Tree	60
<i>Pseudopanax arboreus</i>	Whauwhaupaku (five-finger)	Shrub	20
<i>Sophora microphylla</i>	Kowhai	Small tree	7
<i>Sophora tetraptera</i>	Kowhai (large leaved)	Small tree	41
<i>Vitex lucens</i>	Puriri	Tree	58

Seedlings were laid out in a square plot with a centre peg and four corner pegs. The centre peg has a red plastic triangle marker attached to it. The four corner pegs of each plot are painted blue. All seedlings have a bamboo stake beside each seedling to help identify its location and to indicate that it is planted. The stake was not used to physically support the seedling, rather to allow quick relocation during post-planting maintenance and monitoring.

Fifteen species were planted in the seed islands with the number of seedlings varying between seed island depending on the gap size. There were 4 shrub species planted (makomako, karamu, kohuhu, whauwhaupaku), and the balance small or large tree species as listed in Table 2.

The Ecoworks team used backpacks for carting the stock up the slopes from the drop off areas to each seed island site. Seedlings were raised in PB3 containers with each carrier able to carry approximately 25 seedlings at a time. Carriers and planters would prefer to use smaller containerised stock for carting uphill and would be highly recommended for establishing seed islands at a large scale on steep hill country.

A tall (1.2m) bamboo stake was inserted beside all planted seedlings to allow easy relocation after planting.

Baseline monitoring

Monitoring of each of the seed islands is following the plot based methods used by Tāne's Tree Trust and Trees That Count (Bergin, Sallis, Kimberley, Bergin 2022). For the baseline survey undertaken within one month of planting this has involved recording:

- Species planted
- Plant height
- Plant vigour using a subjective visual assessment score of 1-5:
 1. poor - few or no leaves, just alive
 2. unthrifty - loss of leaves, severe frosting damage or browsing, poor foliage colour
 3. average - moderate health and vigour
 4. good - minor browsing, frosting damage, etc..., otherwise good growth
 5. excellent - healthy plant with good foliage colour and growth

The level of overhead cover was assessed for each seedling based on the presence of existing vegetation canopy directly over each planted seedling. This provides a baseline dataset of the planted native seedlings so that we can assess under different overhead shade conditions.

Overhead cover was rated as:

- Exposed – blue sky with no canopy cover
- Partial cover – light shading from overarched kanuka branches around gap margins
- Extensive cover – some overhead shading from surrounding kanuka.

Other plant characteristics were also recorded such as animal browse damage and the presence of naturally regenerating species within each seed island. For the baseline assessment this included:

- Browsing noted on some palatable species on the uphill plots, goats and deer suspected. Observed browsed species include karamu and five finger.
- The open sites have a higher proportion of exotic weed vegetation and pose a potential threat to the planted natives.
- Other naturally regenerating species observed in the plots included lancewood, mapou, kanuka, titoki, koromiko and ferns.

Results of 2022 planting remeasurement

Assessment

The 20 seed island planted in 2022 were assessed for survival, height growth and plant vigour one year after planting following the standard assessment methods described in the previous progress report (Bergin and Bergin 2022b). Between 20-60 trees of each species as listed in Table 3 were planted in 2022 seed islands.

Species		Total plant order for Year 1	Average plants per plot
Shrubs/small trees			
ngaio	<i>Myoporum laetum</i>	30	3
five-finger	<i>Pseudopanax arboreus</i>	20	2
karamu	<i>Coprosma robusta</i>	20	2
kohuhu	<i>Pittosporum tenuifolium</i>	20	2

wineberry	<i>Aristotelia serrata</i>	20	2
ribbonwood	<i>Plagianthus regius</i>		
Trees			
kowhai	<i>Sophora tetraptera</i>	50	5
rewarewa	<i>Knightia excelsa</i>	50	5
titoki	<i>Alectryon excelsus</i>	50	5
puriri	<i>Vitex lucens</i>	60	6
totara	<i>Podocarpus totara</i>	60	6
kahikatea	<i>Dacrycarpus dacrydioides</i>	50	5
northern rata	<i>Metrosideros robusta</i>	20	2
black beech	<i>Fuscospora solandri</i> var. <i>solandri</i>	30	3
kohekohe	<i>Dysoxylum spectabile</i>	20	2

Survival

There was very good survival across all species and overhead canopy cover categories (shade, partial cover and gap) at over 80%. Eight of the species of the 15 planted had 100% survival one year after planting for all overhead canopy cover categories. This included the trees titoki, kahikatea, kohekohe, northern rata, totara and puriri, and the shrubs or smaller trees karamu and ribbonwood. Only kowhai had consistently lower survival in all canopy cover treatments

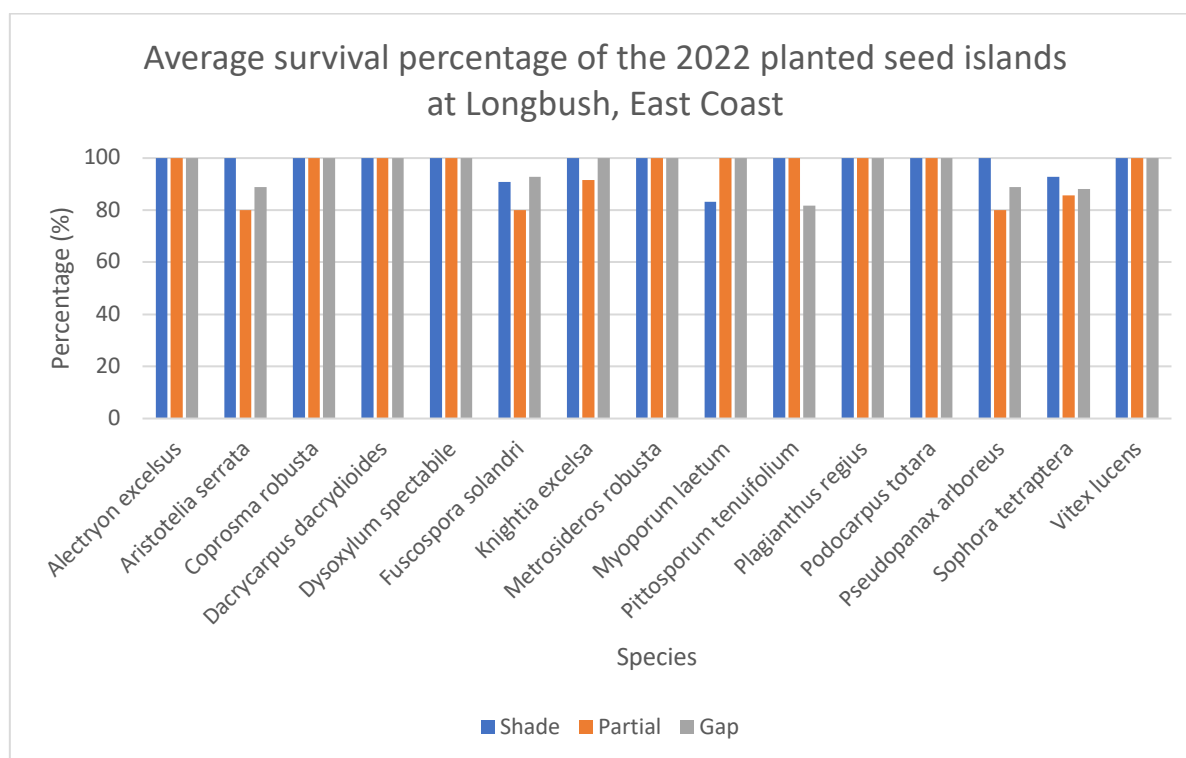


Figure 2: Average survival of the 2022 planted seed islands one year after planting, Longbush Waikereru, Tairāwhiti.

Height growth and increment

Height and height increment across all species and seed islands is shown in Figure 3 and Figure 4 respectively. Three species have equalled or exceeded an average 1m in height 12 months after planting particularly when planted on the open exposed sites – black beech, ribbonwood and puriri. Puriri planted in the partial shade gaps were on average close to 1.3m high one year after planting.

The best species in terms of increased height growth was black beech, rewarewa, ngaio, ribbonwood and puriri (Figure 4). The species with a decrease in height was kohekohe and whauwhaupaku (five-finger). Interestingly, totara which is one of the more shade intolerant podocarp species, had best height growth only in the gap sites likely due to the increased light.

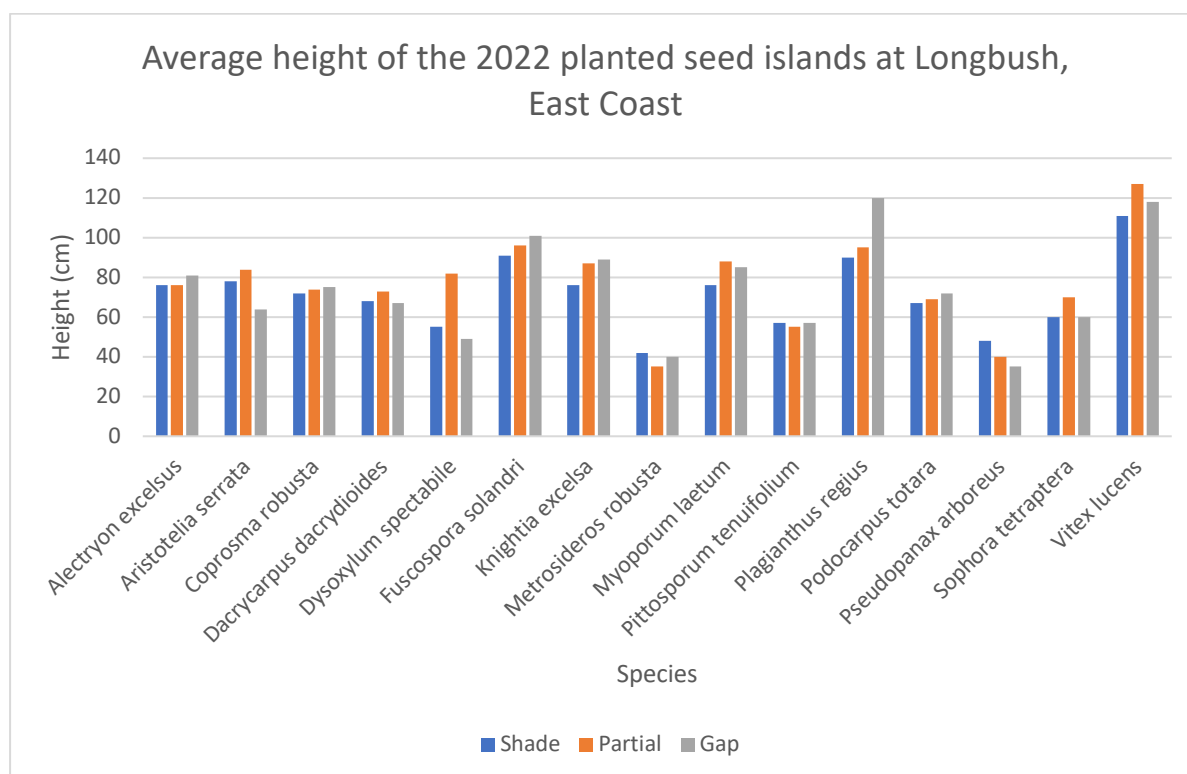


Figure 3: Average height of the 2022 planted seed islands one year after planting, Longbush Waikereru, Tairāwhiti.

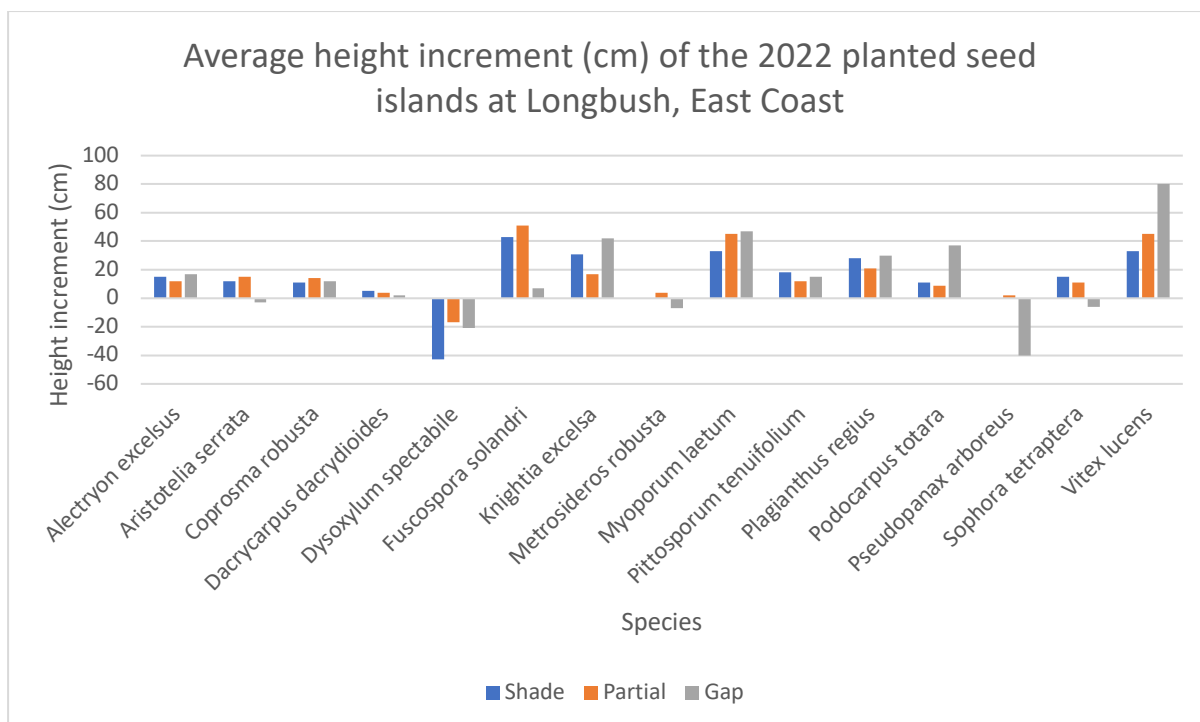


Figure 4: Average height increment of the 2022 planted seed islands one year after planting at Longbush Waikereru, Tairāwhiti.

Vigour (plant health)

While plant vigour score is subjective, it has proven to be a useful measure of plant performance in planting trials for many years. One year after planting five species – kahikatea, kohuhu, ribbonwood, totara and puriri – had very high plant vigour scores of 4 or more across all canopy cover treatments (Figure 5). The poorest performing species in terms of plant health were makomako (wineberry), karamu and whauwhaupaku (five-finger) with vigour scores below 3.

Rewarewa, rata, kohuhu, ribbonwood, totara and whauwhaupaku had slightly higher vigour scores in the shade plots which may indicate that the increased shelter benefited the visual health of these species.

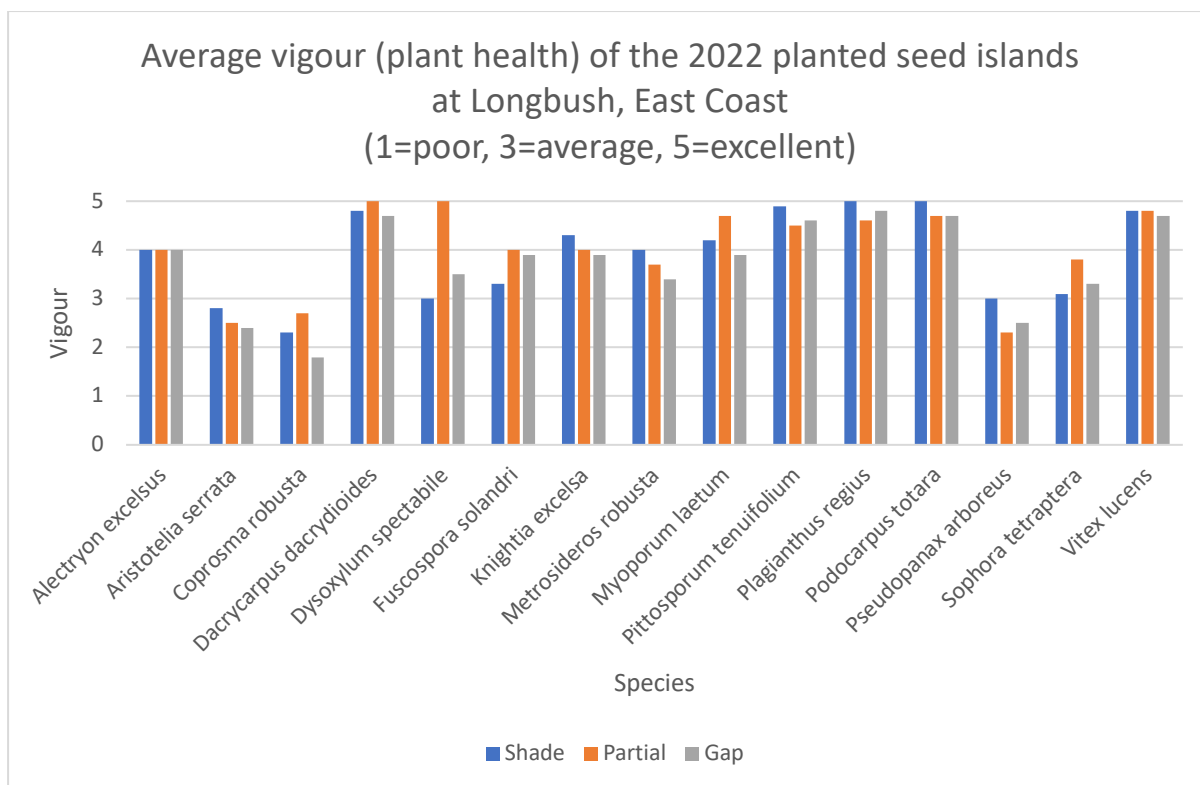


Figure 5: Average vigour, a measure of the plant health, of the 2022 planted seed islands at Longbush Waikereru, Tairāwhiti. Plant vigour scoring is; 0=dead, 1=poor, 3=average, 5=excellent.

Ongoing monitoring and maintenance

As with the first-year assessment, a full remeasurement of both the 2022 and 2023 planted seed islands will be undertaken in mid-2024.

Maintenance lead by the Ecoworks team has been kept up to a high standard and has included:

- Continued pest animal control to reduce damage by browsing animals such as possums, goats and deer.
- Minimal weed control has been required including in the open sites where dense exotic grass and herbs species did not eventuate and compete with the planted natives.

Some minor deer browsing was reported on some of the shrub hardwood species, particularly karamu and this is reflected in the lower-than-expected growth and vigour of this species.

Ecoworks (Steve Sawyer and team, pers comm.) were keeping deer numbers to low level by shooting the area with a thermal as required and installed 6 trail cameras to monitor any extant pests over the 4 weeks after planting in the larger lower Waikereru area. Possum chew card indices were also used after planting along with traps including A24's, AT220's and possum feracol bait stations deployed across Waikereru along with new mustelid and cat traps. Blackberry spraying via c-dax chopper was also planned as required after winter.

The weed levels were relatively low across all plots with some blackberry in one plot and Mexican daisy dominant in others, the latter not considered to be a major issue.

Photographic record and notes

A range of photographs taken of the Year 1 (2022) natives 12 months after planting and during the baseline measurement of the Year 2 (2023) planted natives with field observations are provided below to give an indication of the performance of the planted seed islands at Waikereru.



Undertaking the baseline monitoring of the latest June 2023 planting at Longbush Waikereru, Tairāwhiti. Nicola Carter of Ecoworks is measuring the height and vigour of each seedling within a shaded plot. Note the light ground cover and limited species and diversity in the understory typical of what is found in the dense kanuka dominated stands.



Nicola Carter of Ecoworks measuring the height of a seedling in an open/exposed plot planted in June 2023. Note the dense ground cover of exotic pasture grass and herb species.



Incredible growth was recorded on some species especially the puriri. The one-year-old puriri seedling on the left is over 2m tall, indicating at least 1m growth over the previous year since planting. That seedling was in a sheltered partial shade plot. The puriri on the right is healthy but hasn't grown as much likely due to the full shade site with lower light levels.



New fruit on a one-year-old planted karamu, Coprosma robusta.



There is good survival in the partial shade sites as the weed competition is limited.



Rata (left) and (titoki) right are growing well especially where there is shelter from taller vegetation.



Small seedlings like the totara left and right are easily hidden by surrounding vegetation. Bamboo stakes at least 1m out of the ground placed beside each plant when planted allows for quick relocation of planted seedlings for monitoring or releasing, particularly amongst any weed regrowth.

Preliminary results

Year 1 seed islands were remeasured in August 2023 and indicate excellent survival of planted native shrubs and trees within all seed islands. Tairawhiti did not experience the usual summer drought during the 2022/23 period and is likely to be a contributing factor to the good performance of planted natives.

When comparing the three site types, the best height growth was in the seed island located within partial kanuka shade. Most seedlings had double in height 12 months after planting. Puriri in particular had grown over 1m in height within the first year.

Despite deer fencing of the property and the ongoing pest animal control programme, a small number of goats and deer have resulted in some browsing of highly palatable planted natives such as kohekohe.

Although at an early stage, the concept of establishing seed islands of selected key native trees and shrubs within a largely monoculture of naturally regenerating kanuka is looking promising. The aim or re-introducing or boosting local populations of additional native species is to provide seed sources of key natives to allow bird and wind distribution of seed across marginal hill country retired from grazing to enhance the natural succession to a diverse high forest long term.

Some key factors that are becoming apparent in successful establishment of seed islands on kanuka regenerating steep hill country such as at Waikereru includes:

- Undertake a Land Use Capability survey of the hill country to determine the most likely suitable sites for planting natives such as the lower slopes and alluvial fans where there is likely to be deeper topsoils, higher moisture retention and more shelter.
- Utilise natural canopy gaps in the existing kanuka for establishing seed islands to avoid the need for expensive line and gap cutting.
- Select sites for seed islands that are close to access tracks so that planting equipment and stock can be more easily deployed rather than planting remote difficult to reach locations. Seed islands close to accessways will be easier to monitor and maintain.
- Early results are confirming observations from previous planting trials that selecting the right species for the right microsite will increase performance. Some species will perform better within partial shade (e.g. puriri) compared to others that prefer more overhead light (e.g. totara).
- In addition to permanent exclusion of domestic grazing stock, it is essential to have a coordinated pest animal control plan implemented before planting and for this control to be sustained post-planting to reduce or eliminate possums, deer, goats etc.
- Use of high-quality nursery raised plants focussed on the hardiest early successional shrub species to add early diversity of seeding species, and selection of key high native forest tree species that are local to the region and appropriate for the planting site is essential. The use of medium grade and size containers will allow easier transport by planters to readily accessible seed islands located within marginal hill country.

References

Bergin, D.; Bergin, M. 2021: Establishment of seed islands to promote regenerating native forest, Waikereru Ecosanctuary, Tairāwhiti. Work plan. Tane's Tree Trust. 14p.

Bergin, M.; Bergin, D. 2022a: Evaluation of species and sites for establishing seed islands, Waikereru Ecosanctuary, Tairāwhiti. Tāne's Tree Trust. 13p.

Bergin, M.; Bergin, D. 2022b: First year establishment of baseline monitoring of planted seed islands, Waikereru Ecosanctuary, Tairāwhiti. Tāne's Tree Trust. 11p.

Bergin, D; Sallis, R.; Kimberley, M.; Bergin, M. 2022: Guide to short-term monitoring of planted natives – field and online methods for measuring early success. Tane's Tree Trust and Trees That Count. 15p.

Carter, N. 2023: Filenote: Waikereru Seed island Project September 2023. Ecoworks NZ Ltd., Gisborne. 6p.

Marden, M.; Seymour, A. 2022: Landform mapping of Waikereru Ecosanctuary. Unpublished report produced for the Longbush Ecological Trust. 5p.