



TĀNE'S TREE TRUST

Native Forests for our Future | Hereherea te Wao-nui-a-Tāne

Establishing Native Forests

TĀNE'S TREE TRUST FACTSHEET SERIES

Monitoring success of planted natives

FACTSHEET 14, 2024 – by David Bergin & Mike Bergin

Refer to the [other factsheets in this series](#) for more about successfully establishing native forests.

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Rapid plot-based monitoring by local iwi 2 years after planting natives on a central North Island site.

Introduction

Most native planting projects are focused on just planting, and few follow up with monitoring other than a cursory glance hoping that most planted natives have survived and beaten the weeds. However, planting trees is only the first step towards establishing new areas of native forest.

Monitoring early survival and growth of your plantings will provide you with valuable insights into what is working or what isn't. It will help you schedule in timely weed and pest animal control and enable you to learn from any failures.

Councils and some community groups are very keen to see a more formal quantitative approach but few have the skills, resources or practical methods to undertake monitoring, so it is hardly ever carried out. This factsheet outlines the options for monitoring newly planted native forest. It provides options for a subjective assessment of performance that should be the minimum applied to all planting programmes, as well as providing a quantitative plot-based sampling method that is easy to implement but provides a more scientific and statistically robust method of the assessing planting performance.



Regrowth of weeds after planting is often the biggest cause of failure of native planting programmes. Implementing a rapid easy-to-use monitoring system that will identify factors that may lead to failure will allow early and timely intervention such as weed control or pest animal management.

Need for monitoring

- While there many monitoring guidelines and toolboxes have been developed for native plant ecosystems, some are not often used as they can be too complex or not widely known.
- Furthermore, while monitoring data can be collected, there are few easy ways to process the data so that planters and landowners can get feedback on how well their planting is performing.
- Monitoring the success of native plantings, if done at all, is therefore often a quick look over the fence or taking a few photographs.
- We need to encourage those planting, especially when significant numbers of natives are involved, to undertake monitoring in a more systematic way to provide robust data on survival and early growth, user-friendly methods for analysing the data and feedback on success or otherwise of planting efforts.

It's easy – anyone can monitor

Options for monitoring early performance of recently planted native forest for planters, managers and landowners need not be complex and can provide readily accessible results.

Site information and regular inspections

At the very least, those investing in planting should carry out the basics such as:

- **Recording site and planting information** including number and species planted, density of planting or average plant spacing, and location of your planting site on a map – all the background required on when and where your trees are planted and how many of them there are.
- **Setting up a photographic record** of your planting is easy but especially useful when before and after planting shots are taken especially from the same location and direction.
- **Undertaking early regular inspections** of your site after planting to identify any issues within the first few weeks of planting that may need to be addressed, such as implementing more effective pest animal control.

Measuring performance

It is recommended that monitoring of early performance of natives up until near canopy closure (usually within 2-5 years of planting) should include more active assessment. There are two options to consider based on resources and commitment, the scale of your planting or where a more accurate assessment of performance is required such as from funders:

- **Subjective walk-through assessment:** As a minimum, estimate overall performance using a walk-through assessment. This is a subjective assessment of performance that can be acceptable for smaller plantings but may not be sufficient for larger plantings or where more accurate accountability of success is required.
- **Quantitative rapid plot-based assessment:** For large plantings or where more accurate estimates of performance that are statistically robust are required, we recommend measuring a sample of planted natives to determine average survival and growth by species using a network of plots located across a representative area of the planting area. This is a quantitative method for sampling planting performance where plots can be rapidly established and remeasured over the first few years after planting until near canopy closure has occurred or when any threats to planted natives have diminished significantly.



A planting crew in central Northland laying out monitoring plots within planted natives on a recently cleared pine cutover.

Planting information

- It is essential to have an accurate record of your planting site, including what was undertaken and when, for monitoring success going forward. This includes recording details of your planting site, i.e., planting name, region and district, location so this can be pin-pointed on a map, how many trees and shrubs were planted by species, planting date, who was involved in planting, contact details of those who own or manage the site, and where the site and growth data is located.
- Record this planting information on a customised **planting information sheet**. This sheet can be accessed via the online monitoring tool (see below).

Take a photograph – photo points

- Taking before and after photographs of your site is always an easy way to verify that planting has been undertaken. Photographs taken over time will provide a visual record of the development of your planted natives.
- Ideally, take a photograph of your planting from a fixed point (known as a photo point) which can be repeated to systematically capture changes of your planting site over time. Tips for effective photo points include:
 - Locate each photo point on a high point to best cover a representative section of your planting area;
 - Where possible, site the camera from a fixed point such as a fence post;
 - Select a view that will show changes in your planting area over time, framing the view so it will be easy to repeat in future;
 - If possible, position the camera to the north of your planting area to minimise shadows and sun glare;
 - Have a copy of the last photograph you took from the photo point to help replicate previous photos as closely as possible; and
 - Repeat photographs annually preferably at the same time of the year using the same camera angle and zoom setting.
- Avoid taking too many photographs as storage and captioning can be onerous. Setting up one, well-positioned photo point should be sufficient for most planting projects.
- Photographs can be uploaded when entering data for a survey measurement using the online monitoring tool (see below).

Regular inspections

- After planting is completed, we highly recommended that you inspect your projects within the first week after planting to check that your planting is still there and there is nothing affecting early performance.
- This includes ensuring fences are keeping out grazing stock, pest animals such as rabbits are not browsing the natives and noting any other factors that may reduce success of your planting to guide timely post-plant maintenance.
- Early inspection and action to address any issues affecting your planted natives could mean the difference between success and failure and provide insights into what is required for future planting plans.
- Ongoing occasional inspections over the first 12 months such as every 3 months after planting will ensure that any issues are managed in a timely manner to ensure high survival and early growth when natives are at their most vulnerable to pest animals and weed regrowth.



Regular inspections after natives have been planted include checking fences continue to exclude farm stock as well as other factors that compromise early performance such as an adequate level of pest animal control.

Monitoring

For monitoring performance, usually at approximately 12 months intervals after planting, select one of two options based on the scale of your planting and need for quality of data:

- For smaller plantings or where there is a lack of time or resources, estimate overall performance from a **walk-through monitoring assessment**.
- For larger plantings and where a more accurate assessment of performance is required, quantify survival and growth by species using a **network of rapid monitoring plots**.

Walk-through monitoring

This method is recommended as the minimum that all those planting natives should undertake. A walk-through assessment carried out for all plantings soon after planting will identify any issues that may arise such as an unexpected presence of browsing pest animals or vigorous growth of weeds compromising establishment of natives.

Field method

- The aim is to estimate how well recently planted natives are progressing without imposing an undue burden on those checking on performance who may lack the time or resources to carry out more formal monitoring using plots.
- This walk-through estimate is best done by those who planted the site, or where planting records and photographs taken at the time of planting are available to compare what was planted with what has successfully established.
- To this end, this level of monitoring requires only the collection of data on the overall survival of your planted natives.



Inspecting an established grove of planted natives where regular monitoring after planting has helped with timely weed management and infill planting has resulted in success.

Collecting monitoring data

The aim is to take a 5-10 minute walk through the representative area of the planting site, observing the surviving planted natives, comparing frequency and plant spacing to what the planting density was when planted. Subjective estimates of the following should be recorded:

- Overall survival of planted natives across the site, estimated to the nearest 10%, e.g., 0%, 10%, 20%, 30%, etc.
- It is useful to note any patterns in success or failure, noting especially which species are performing well in both survival and early growth and which are performing poorly.
- Optional further information would be useful including an estimate of the average overall height of planted natives.
- Additional notes on any major factors affecting performance is also useful, e.g., frost damage, animal browsing, effect of drought, weed suppression (this could be a dropdown menu of the four to five main issues for field devices or when entering on computer).
- This information not only helps build a picture of the risks that newly planted trees are facing in your region and nationwide, but can also help you to better target resources such as pest animal control, as well as help to identify those species more likely to survive at your site in future.

Monitoring frequency

Initial data collection should be undertaken as soon as possible after planting (i.e., within 2 weeks). The minimum recommended frequency for monitoring is at intervals of approximately 1 year until plants are likely to be contributing to a permanent cover of natives, which depending on the site an growth of natives will likely be 2 to 5 years after planting.

Recording data

Data can be recorded in the field using the **walk-through monitoring field sheet**. This can then be entered directly into a spreadsheet for analysis via the online monitoring tool (see below).

Rapid plot monitoring

For larger projects or where a more robust sampling of performance is required, it is strongly recommended that planters use the rapid plot method to provide a statistically robust estimate of survival and early growth. While you can use the walk-through method to provide an estimate of survival, this will only provide a subjective estimate of performance.

Sampling method

The plot method is based on sampling a small proportion of planted natives using a network of plots placed across a representative area of the planting site.

This level of monitoring has been designed to be quick and easy to implement while still collecting high quality data. It should take two persons approximately half a day to set up and complete baseline measurements across a relatively consistent planting site. Subsequent measurements will take less time.

Field method

The aim is to establish several circular bounded plots across representative areas of your planting to provide a quantitative sample of the performance of your planted natives. The method involves:

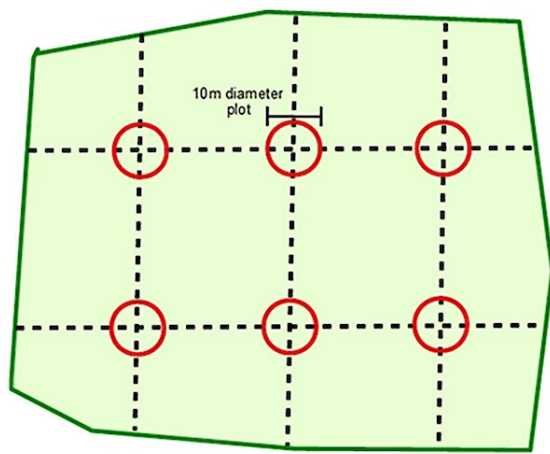
- To avoid any sampling bias (e.g., placing plots only on the best sites), plots should be distributed evenly along a transect or in a grid pattern across the planting site (Figure 1). However, in practice, many plantings have irregular size and shapes, and have tracks or existing vegetation, so the aim is make sure plots are widely established across a representative area of the planting site.
- Establish each circular plot using a permanent peg placed in the centre of each plot (Figure 2).
- Depending on density of planting, a 10 m diameter plot will contain between 15 and 50 trees.
- When plots are established on a hill, there is no need to correct for slope.



Most failure of native plantings occur within the first few weeks or months of planting, so early inspections within the first year after planting is recommended to identify causal factors and modify maintenance schedules.



A treated wooden peg located in the centre of a 10 m diameter monitoring plot is required so that the exact same spot can be relocated for ongoing assessment of natives for 1-5 years after planting.



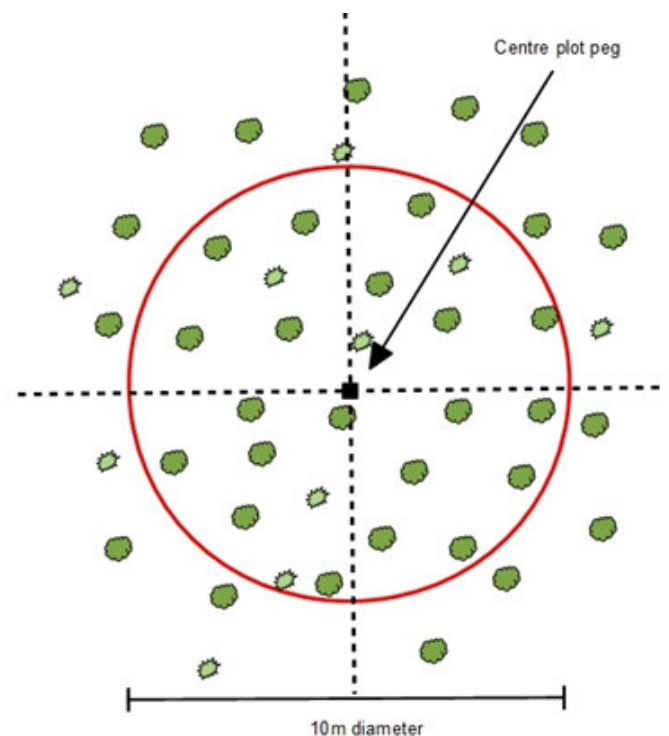
Sampling large-scale TTC planted areas

- Establish grid across planted area with plot at each intersect of grid
- Require minimum of six 10m diameter plots per planting
- Aim to sample minimum of 200 planted natives



Figure 1: Ideally plots should be distributed evenly along a transect or in a grid pattern across the planting site to avoid sampling bias. However, in practice, a rigid grid of plots is often difficult to achieve with highly variable terrain and where placement of plots needs to avoid tracks and existing vegetation. The aim is to spread plots evenly across a representative area of the planting site as shown for this recently planted Hawkes Bay hill country station (right).

- Sufficient sampling plots should be established at your site to ensure that a minimum total sample of at least 200 planted natives are measured, preferably aiming for at least 250 plants. A minimum of six plots is recommended. However, the exact number of plots required will be determined by the density of planting (refer to Table 1).
- If the planting site comprises clearly different site types (e.g., flats, hill country) where success of planted natives could be significantly different, then ideally these major site types should be sampled separately to provide two data sets.
- For a 10 m diameter circular plot, a 5 m string with a short pole or peg fastened at each end can be used to establish the plot perimeter at each measurement. A measurement is ideally performed by two observers. One observer records the data while holding the pole at one end of the string against the centre peg. The other observer moves around the plot holding the other end of the string, counting planted natives by species within the plot area, measuring heights using a height pole or long ruler, and assessing seedling vigour.
- A note should be made of any plants within the plot area that are on the very edge of the plot, to avoid errors in repeat survival assessments. Establish your plots as soon as possible after your trees are first planted, ideally within a few days of planting.



Sample plot layout

- Place permanent peg at centre of each plot
- Record survival and height by species for planted natives within 5m radius

Figure 2: A circular 10 m diameter plot for sampling planted natives appropriate to use for larger scale plantings.

A guide to selecting plot size

- Selecting plot size and number of plots will depend on density of planted seedlings. The challenge is to keep the number of seedlings per plot to around 30 – too many seedlings makes it difficult to keep track of measured seedlings, and too few seedlings mean you will need to establish more or larger plots to achieve the minimum of 200 planted natives sampled for a site.
- As a guide for planters, recommended plot size and number of plots is provided for a range of planting densities in Table 1.
- Many small native planting programmes have an average plant spacing of around 1.5 m, equivalent to 4,444 planted seedlings per ha.
- For denser plantings, smaller plots down to 5 m diameter can be used, and for wider spacing larger plots can be used. However, in larger plots it can become cumbersome to keep track of scattered seedlings particularly on rough weedy ground.
- Most large-scale planting programmes have an average plant spacing of 2m apart (2500 stems per ha) or up to 3 m apart (1100 stems per ha).
- Based on Table 1:
 - For planting at an average 1.5m plant spacing a 10 m diameter plot should capture approximately 35 plants per plot, so the minimum of six plots will provide a sample of 210 planted natives.
 - Planting at an average of 2 m apart requires seven 12.5 diameter plots to sample approximately 217 planted natives.
 - And plantings at an average 3 m apart requires eight plots each at 17.5m in diameter to achieve an approximate sample of 218 plants.



Assessment of planted native seedlings within a 10m diameter monitoring plot by local volunteers on Otamahua/Quail Island, Lyttelton Harbour.

Table 1: Plot size and number of plots required for different plant spacings to achieve the minimum total of 200 planted natives for monitoring at each planting site.

Average plant spacing (m)	Equivalent density per hectare planted	Plot diameter (m)	No. of plants per plot	No. of plots required	Total number of plants sampled
0.5	40,000	5	78	6	468
1	10,000	7.5	44	6	264
1.5	4,444	10	35	6	210
2	2500	12.5	31	7	217
2.5	1,600	15	28	7	196
3	1,111	17.5	27	8	216
3.5	816	20	26	8	208
4	625	22.5	25	8	200

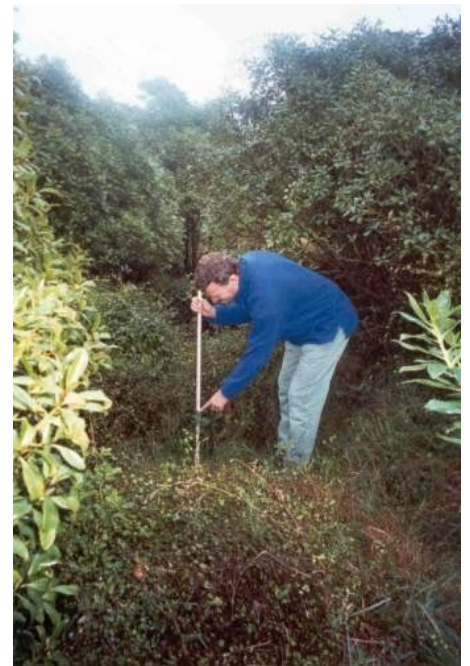
Alternative sampling plots

- Ten-metre diameter plots are quick and easy to establish at most large-scale planting sites. However, alternative plot size and shape can sometimes be appropriate, such as rectangular plots to fit within narrow planting sites along riparian zones.
- Whatever plot size and shape is selected, this information should be recorded so that the exact location of the plot can be determined at future assessments.
- Circular plots are preferred because they only require a central peg, whereas rectangular or square plots require corner pegs for easy location in subsequent remeasurements.

Collecting monitoring data

Initial baseline monitoring should be undertaken as soon as possible after planting. The following data is to be recorded for each planted seedling within the plot:

- Species.
- Height (in centimetres).
- Subjective assessment of plant vigour using 1-5 score (optional):
 - Poor
 - Unthrifty
 - Average
 - Good
 - Excellent
- Optional additional information affecting each seedling, e.g., frost damage, animal browsing, broken top, drought, weed suppression (this can be loaded as a dropdown menu of the main issues for field devices or when entering on computer).
- For each subsequent monitoring, species, height and vigour should be recorded for living trees only.



Monitoring can be adapted to include inter-planting of native tree species in gaps where the nurse cover of native shrubs has been established.

Remeasurement and monitoring intervals

- It is essential that the exact location of established plots is used for subsequent remeasurement of planting sites. Hence, mapping, GPS coordinates and a robust central plot marker such as a treated 60 cm long 50x50mm wooden peg or waratah are used to relocate plots. Where short stakes are used, it is often prudent to include a tall (1-2m high) stake so that each plot can be quickly located in regrowth of grass, weeds or as the planted natives grow.
- The minimum recommended frequency for monitoring is at intervals of approximately one year until a permanent cover of natives has been established, which could be 2-5 years after planting, depending on the site and rate of growth of planted natives.
- As this monitoring method is aimed at assessing early establishment of native forest cover, long term monitoring is not required. Once it is obvious that the planting site is likely to become dominated by natives as planned, then further monitoring is not required. Very high-density plantings may achieve 80% canopy cover within 1-2 years of planting whereas lower density planting may take 5 or more years before natives dominate the site.

Long-term monitoring

Note if planters or landowners wish to undertake long term monitoring, then some of the short-term rapid monitoring plots could be used to set up permanent sampling system. However, this will require a new approach to plot set up and plant measurement. For those interested in monitoring changes longer term, there are a range of long-term monitoring options for users to consider, which are outside the scope of this guide.

Refer to the [Tāne's Tree Trust website](#) if you require further information on long-term monitoring. To contact us please email [Enable JavaScript to view protected content].

Recording field data

Data can be recorded in the field using the **plot monitoring field sheet**. This can then be entered directly into a spreadsheet for analysis via the online monitoring tool (see below).

Online monitoring tool

An online toolkit for short-term monitoring of planted natives as described in this factsheet has been jointly development by Tāne's Tree Trust (TTT) and Trees That Count (TTC) with support from project partners the Tasman Environmental Trust, Auckland Council, Pamu Farms and The Tindall Foundation. It focuses on assessing early survival and growth of planted natives to be undertaken by planters including community groups, iwi, landowners, councils, consultants and environmental NGOs.

This monitoring tool provides all planters of natives with an easy method for recording early survival and growth on an annual basis for the first few years after planting. It is expected most sites will either be forming a canopy dominated by natives within 5 years of planting without further management or monitoring required. Some sites may only require 1 or 2 years of monitoring before it becomes obvious that the site is on its way to becoming successfully establish in native cover.

The tool includes:

- Registering as a user to gain access to the Tāne's Tree Trust monitoring tool for planted natives.
- Recording site and planting information.
- Taking a photographic record of the planting site.
- Undertaking regular inspections.
- Choosing from a selection of two methods for assessing early survival and growth of planted natives:
 - A subjective basic method for individual planters, or
 - A quantitative plot-based method for large planting organisations.
- Online user-friendly data entry.
- The ability for users to undertake automated data processing and analysis, and generation of results in graphical and tabular form to allow interpretation of the performance of your planted natives.



Once canopy closure by natives is likely to occur without risk of invading weeds or pest animals, then monitoring is no longer required. Depending on the site and early growth rates of natives, monitoring may only be required for 1-2 years on good sites but could be 5 or more years on tough sites or where the original planting density was low.

Mapping and photo points

- One feature of the online toolkit is mapping. Monitoring needs to be integrated with mapping using GIS to collect, manage and visualise (map) information. This includes location where trees have actually been planted as a polygon (or point if small) and identifying the locations of plots or transects within an established planting where monitoring has been carried out.
- Photo points are also recorded as specified coordinates from which photographs are to be taken and will be represented as a point.

Data analysis and results

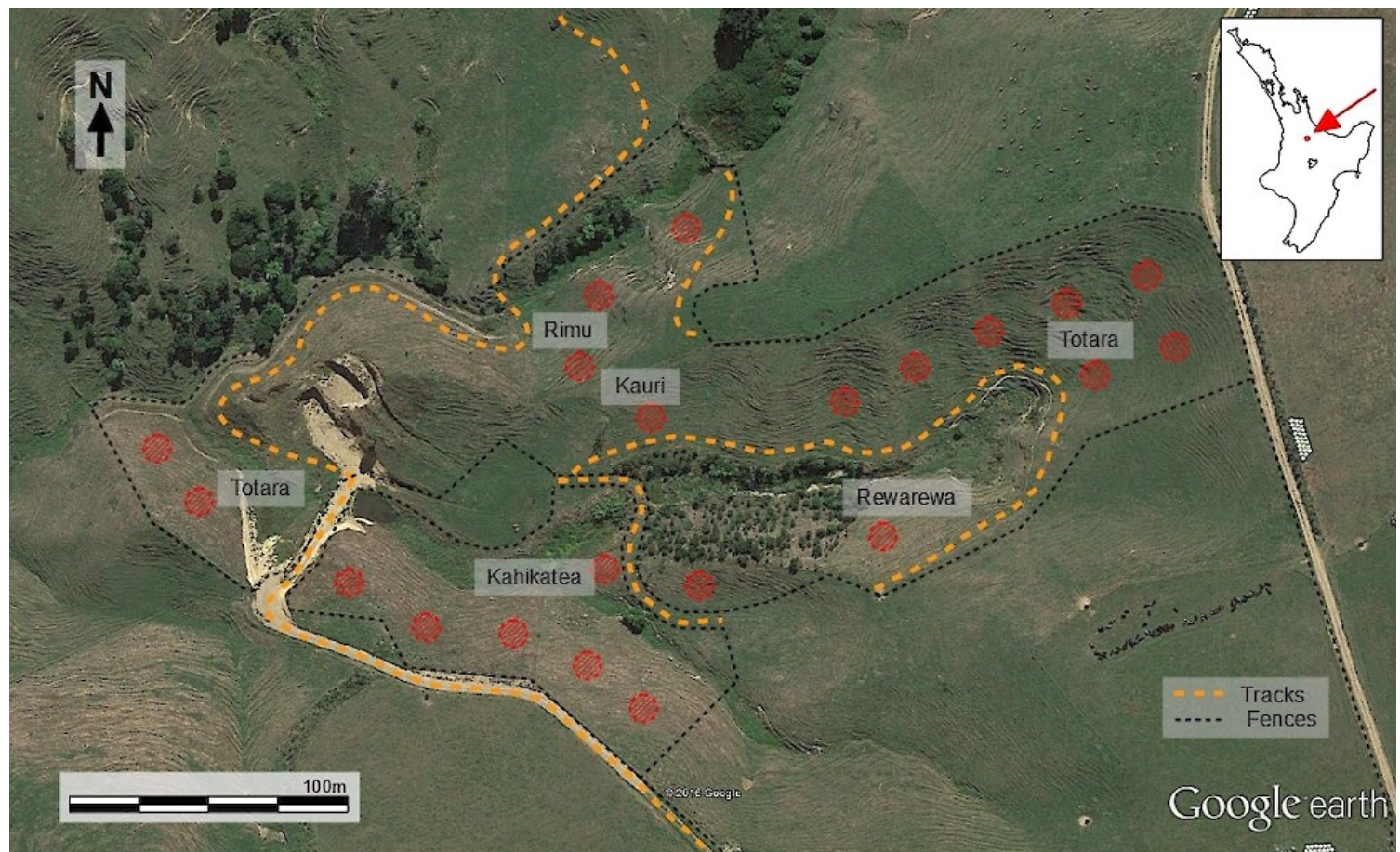
The online monitoring tool automatically processes the data entered by users when transferred from field data sheets onto Excel spreadsheets, then automatically analyses the data and provides users with data summaries and graphics comparing performance over time.

Access

The monitoring tool can be found at:

- [Trees That Count](#)
- [Tāne's Tree Trust](#)

While access to the online monitoring tool is free, those who wish to use the advanced rapid plot survey method are requested to register first to allow users to access additional information to assist in planning and implementing sample plots, as well as data entry and storage, and analysis and presentation of results.



The online monitoring tool allows users to map planting areas and using GPS coordinates to display the location of plots. This is an example of a 30ha planting on hill country in the Waikato where 20 rapid monitoring plots were established to monitor growth of natives planted over different years.



Tāne's Tree Trust run field-based workshops for those planting natives interested in monitoring early performance funded and hosted by local councils and community groups. These prove invaluable to attendees in how to plan a monitoring programme, set up plots, and provide practical guidance on plant measurements, species identification, data collection and processing.

Monitoring workshops

Tāne's Tree Trust holds workshops to demonstrate monitoring methods to those interested, funded and hosted by local councils and community groups. These provide practical guidance in the field for groups to become familiar with both the walk-through and rapid plot monitoring methods. The workshops including demonstrating the Online Monitoring Tool where a step-by-step guide is presented on how to collect field data, enter and process on the computer, and the display of results.

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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