Te tiaki me te aroturuki
Maintenance and monitoring

"Everybody loves planting, and lots of people think that's what looking after these sites is all about – but planting is only 5% of the job, the other 95% is good site preparation and good maintenance."

Peter, Trelissick Park Group

Te toro i ngā wāhi whakatō tipu
Site visits

Volunteers are often keen to do planting but less enthusiastic about the maintenance that is essential to get good rates of plant survival. You will need commitment within your group for weeding or 'releasing' the plants on a regular basis. Visit your site a couple of weeks after planting and then at least every quarter to check on progress.

Two to three weeks after planting, visit the site and check for:

- Wobbly plants that haven't been properly firmed into the ground or not planted deep enough. 'Socketing' occurs, which is when the plants - buffeted by the wind, rotate in the ground, eventually causing the plants to break or die as the roots snap.
- Orphan plants that were overlooked and not actually put in the ground.
- Buried plants that have been planted too deep or partially buried in mulch, which may cause smothering, stem damage or collar rot.

The plant has not been planted deep enough and the roots are now exposed to the air.

The plant has socketed in the ground, exposing the root system.

Te whakahaere/whakawātea tarutaru
Weed control/releasing your plants

The purpose of releasing plants is to protect them from weeds or grass that are competing for light, moisture and nutrients. There is no need to make the site completely weed free. In Wellington's windy climate, long grass in the gaps between plants can provide useful shelter and shade, provided it's not so tall that it falls over onto your plants. Bare ground between plants can dry out rapidly and become infested with weeds.

Visit your site regularly so that you can work out which weeds are a problem, and which can be left without causing harm to your new seedlings. Check out the Weedbusters website *weedbusters.org.nz* if you need help identifying weeds or finding out how to best control and dispose of them.

There are several options for releasing plants:

- Hand releasing - pulling out weeds around the base of your plants is often enough to get them through the first summer. Most weed material can be left around your plants to mulch them. However, any weeds that regenerate from stems (eg wandering willie) or bulbs/rhizomes (eg montbretia) should be completely removed from between plants.
- Mechanical releasing - using a line trimmer/weed-eater or other machinery to cut back weeds. Make sure the operator is experienced because it is very easy to get too close to the seedlings and ring bark them or completely slice them off. If the grass is long your plants can be very difficult to see - hand release around them first and then use a line trimmer if need be. On smaller sites, it is just as easy to use hand shears. If working on Wellington City Council land you will require competency sign-off from your ranger before using power tools.
- Paste-on herbicide can be useful for treating any regrowth of problem woody weeds. Wellington City Council authorisation is required to use herbicides on Wellington City Council reserve land. Cut the problem plants close to the ground and apply the herbicide paste to the freshly cut surface. Do not use paste if rain is forecast within 12 hours as it could be washed off and damage desirable plants. Follow the label instructions closely, wear gloves and wash your hands before handling other plants to avoid inadvertent application.
- Spray releasing - should only be used as a last resort as spray drift can adversely affect young plants and over-spraying can result in weed species' resistance. Ensure that spraying is carried out by people who hold the relevant spray qualifications and approvals.

Young seedlings sheltered by grass growth. They need releasing only enough to prevent the grass smothering them. The plants further down the slope have pushed through the long grass and no longer need releasing.

Mate atu he tētēkura, ara mai rā he tētēkura
Replacing plants that die

It is not unusual for some plants on a planting site to die. Occasionally, quite large losses can occur. Where plants die, wider gaps are created that take much longer for the canopy to close over. It is worthwhile replacing dead plants, a process referred to as 'infilling'.

With a smaller site you may be able to do a rough count of all gaps needing a replacement plant but with larger sites an estimate based on representative areas will be more feasible. Use the formula below to work out survival rate and replacement plant numbers required.

The percentage rate of plant loss is useful to assess how serious your losses are. Between 5% and 10% would not be unexpected but if you have over 20% a review of your planting and maintenance, including overall species selection, might be needed.

When ordering your replacement plants, look to see which species failed and which are doing well and order mainly the ones that have done well, even if that means having less diversity in the short term.

Think about where the plant losses have occurred and whether there is any correlation with microsites. For example, if there was a 50% plant loss on a steep, exposed north-facing bank compared to 10% loss on the remainder of your site, you would replant mainly the species that survived on the bank for the infill planting and a wider range of the species for the rest of the site.

Formula for working out plant survival rates and number of replacement plants required

1: Plant survival rates

i. Mark out a 10 x 10 metre plot (100m²) within your overall planting where the amount of plant loss looks typical of the whole area.

ii. If plant spacings were 1 metre, there would have been around 100 plants in your 10 x 10 metre plot.

iii. Count the plants within the plot. If 75 plants remain, then 25 plants out of the original 100 have died, ie a 75% survival rate (or 25% loss rate).

2: Estimate of replacement plants needed for a 1,200m² planting area

i. Work out your survival rate and loss rate as above.

ii. Work out how many plants you had in the ground originally for the whole area. Eg for a 1,200m² planting, planted at 1 metre spacings there would be 1,200 plants in the ground.

iii. Multiply the original number of plants by the loss rate. Eg for 1,200 plants at a 25% loss rate = 1,200 * 0.25 = 300 replacement plants.

Planting a pukatea in a carefully selected location.

Mate atu he tētēkura,
ara mai rā he tētēkura.

When one plant frond
dies, another plant frond
rises to take its place.

Te aroturuki Monitoring

How do you know your planting project is succeeding? If progress is slow, can you figure out why? If you monitor your site and record the changes over time you can learn from your experience and use the information to improve your likelihood of success.

Monitoring helps to:

- Keep track of what works and what doesn't - for example regrowth of aggressive weeds, result of damage from animal or site conditions that could be affecting survival, like wind or moisture.
- Work out if, and how many, replacement plants are needed and at what spacings.
- Decide when later stage plantings that require more shelter can be added in.
- Show your volunteers that their efforts are worthwhile to attract future support.
- Report outcomes to partners, sponsors and funders.
- Plan for the future and prioritise your next steps.

"Monitoring is useful to check survival rate, particularly which plants do and don't survive. The important thing is to work out what is the most useful information to collect for your project and for who."

Garth, Highbury, who plants in the Polhill Reserve

Infill planting at Worser Bay. Wellington City Council staff assisting Worser Bay school children to plant wiwi in the backdunes.

He aha ngā mea me aroturuki
What to monitor

Monitoring can be as simple or complex as you decide. The key is to make sure you record information that shows change and reflects your overall goal. For example, if your goal is to attract native birds to your site, one of the measures of success for your project will be whether native bird numbers have increased over time.

Set up a simple record sheet to track what you are going to measure and when. Record any baseline data about your site before you start planting so you have a comparison to work from. Refer to example on the following page spread.

Monitoring plant survival

Work out and record your plant survival each year by either counting your plants in a specific area or working out the percentage of survival based on the size of the area and the numbers of trees planted.

Record whether there are particular species that have died, particular locations where more plants have died (eg slopes facing south, streamside etc) and any events that might have caused this (eg storms, floods, obvious rabbit damage etc).

Monitoring other outcomes

There are likely to be other outcomes you need to monitor to reach your goal. For example, are native bird numbers actually increasing? Is the bush regenerating itself?

There are a few basic techniques you can use to monitor these types of outcomes as well as a wide range of good resources available for more complex species monitoring.

Bird presence – 5 minute bird count

Stand in a fixed point (mark or GPS this so you can use it each time), record the number and species of all birds seen and heard. Record any weather variables (eg wind, temperature, rain etc). Schedule twice a year, generally March and September. For more information see the Department of Conservation five-minute bird count information and resources, or New Zealand eBird website *ebird.org*. This is a great way to record bird observations.

Counting seedlings

One basic technique for measuring seedlings including natural regeneration, is to set up a monitoring plot. Stake out a 10 metre x 10 metre square somewhere that represents your site. Visit the plot at the same time each year and record the number, type and height of all seedlings (ie including the ones you didn't plant). You can then compare your annual findings.

Photo points

Photo points can be a very effective way of showing your progress over time. Select a view that will show useful information about your planting project. Mark (or GPS) a fixed point where you will take your photo from. Record the direction you were looking and the height of the camera. Take a photo at least once a year so you can compare changes over time periods and seasons.

Record any observations about what you see on your monitoring sheet, like weed growth, variation in plant height, damage etc. Save your photos using their date in the title and a brief explanation so you can easily locate them again.

iNaturalist is another digital tool to help you record living things in your planting area. Visit *inaturalist.org*

Example of progress photos of restoration planting on inland hillslopes in Crofton Downs

November 2014
I McGregor

January 2017
I McGregor

August 2018
I McGregor

Lifestyle block in Ohariu Valley

Goal		**Our small bush remnant is flourishing and is connected to our stream with native vegetation that attracts native birds.**							
Measures of success		**Baseline**	**Year 1**	**Comments**	**Year 2**	**Comments**	**Year 3**	**Comments**	**Year ...**
Plant 500 plants a year for eight years until all the site area has been planted		N/A	500	Species lists on order form in file; siting of plants marked on planting plan	500		400		
Ninety per cent of plants have survived three years after planting.	Area A Bush	Planted at avg 1 metre spacings	100%	Gorse popping up, pulled out	90%	All Manuka growing well, northern side	90%	Added extra species into gaps	
	Area B Stream	Planted at avg 0.8 metre spacings	90%	Grass growing tall, have staked plants so easy to find	90%	Range of species, others look healthy, infilled	70%	Stream flooded, lost grasses along the edge	
Bird counts to measure bird presence.	Sept	5	4	3 starlings, 1 tūī	5	3 starlings, 2 tūī,	10	3 tūī, 4 fantail, 3 starlings	
	March	3	4	2 starlings, 2 fantails	3	3 fantails	8	5 fantail, 1 starling, 1 rosella, first kererū seen!	
	Total	**8**	**8**		**8**		**18**		
Seedlings are regenerating in the bush remnant -measured in June in a 10 x 10 metre plot.	Total	5	5	Pigeonwood	10	Pigeonwood, māhoe	15	Pigeonwood, māhoe	
	Number of native species	1	1		2		4		
Photo Points									
PP1: GPSxxx view west	*PP1:*	1/3/2017	1/6/2017; 16/3/2018		13/6/2018; 10/3/2018		21/6/2019; 1/3/2019		
PP2: GPSxxx view west	*PP2:*	1/3/2017	1/6/2017; 16/3/2018		13/6/2018; 10/3/2018		21/6/2019; 1/3/2019		
Other observations			Looks like the blackberry control along the stream was successful, haven't seen any coming up. Watch gorse - is seeding across the fence line.		Rabbit and possum numbers still low across the farm. Pulling gorse from paddock site, leaving it around bush block, doesn't seem to have grown any bigger.		Check planting of stream plants to see if need to plant further back next time or use different plant. Keep an eye on the presence of rosellas - not seen in the area before.		