



# GUIDELINES FOR CONVERTING PINE PLANTATIONS TO NATIVE VEGETATION IN THE MARLBOROUGH SOUNDS



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## **Compiled by:**

Marlborough District Council  
Department of Conservation  
Marlborough Sounds Restoration Trust

## **Acknowledgements:**

These guidelines were prepared to collate existing information and experiences relating to the conversion of pine plantations back to native vegetation in the Marlborough Sounds. The main contributors were: Andrew Macalister (R&D Environmental Ltd), Penny Wardle (Wordpower Communications Ltd), and Nicky Eade (Marlborough District Council). Thanks to Pete Shaw from the Forest Lifeforce Restoration Trust, Rick Osborne, Emily Osborne and Mitch Bartlett and the Macalister family for providing real life case study information. Thanks also to Mark Bryant (Nelson Forests Ltd) and Phil Woodward (Merrill Ring NZ Ltd) for practical forestry management advice.

## **Disclaimer:**

While every effort has been made to ensure that these guidelines are clear and contain accurate information they should not be taken as providing a definitive statement for any particular user's circumstances. All user's should satisfy themselves in regard to the relevance of the advice contained in these guidelines and seek expert advice where necessary.

November 2016

This document is available on the following websites:

Marlborough District Council : [www.marlborough.govt.nz](http://www.marlborough.govt.nz)

Marlborough Sounds Restoration Trust: [www.soundsrestoration.org.nz](http://www.soundsrestoration.org.nz)

**Photo—front and back pages:** Nydia Bay, Marlborough Sounds

## INTRODUCTION

There is growing interest in restoring land currently planted in *Pinus radiata* (pine) plantations, to native vegetation in the Marlborough Sounds to improve both landscape and biodiversity values. In some instances landowners may plan to harvest the trees commercially and then attempt to re-establish native vegetation, in other cases the pines may be left standing.

Native regeneration can be vigorous in north Marlborough, especially on shady and moist south-facing slopes. However, regrowth tends to be slower and less dense on northern faces and weeds including unwanted pine seedlings, broom, old man's beard etc can quickly become dominant once pines are removed. Experience shows that where there is no management intervention after harvesting, pine seedlings will generally regenerate vigorously and dominate a site. While some believe that in the long term (100 years plus), pines will eventually be replaced by natives through successional processes, others suspect that pines will instead continually re-colonise light gaps as they become available and therefore perpetuate themselves in many cases.



*A NW facing Queen Charlotte Sound property showing dense pine regeneration on the mid-slopes following harvest where no intervention has taken place.*

A number of factors should be considered when making the decision to convert sites from pines to native vegetation. These include the site aspect and location, the weed situation both within and surrounding the site, the location of nearby native seed sources and resources available. While the Sounds environment does lend itself to the restoration process, it is still a difficult task requiring investment of significant time and money and then many years of follow-up pine control to succeed.

These guidelines draw together the knowledge of people with experience in converting pine plantations to native vegetation and the related weed control. They provide an overview of the questions that need to be asked, the main control methods available, case studies, further reading and useful links.

## GETTING STARTED

There are five key questions to consider before starting the process of converting pine plantations to native vegetation:

- **How should the existing pine plantation be removed?**
- **What factors will influence what happens after the pines are removed?**
- **How should subsequent pine seedling and weed regrowth be dealt with?**
- **Will there be Emissions Trading Scheme (ETS) liabilities?**
- **Whether to plant natives to enhance natural regeneration?**

There are no definitive answers and the way forward will be to balance site characteristics and landowner preferences and resources. Initial assessment and evaluation of the site is important, ideally using the expertise of a qualified forestry consultant or ecologist.

## HOW SHOULD THE EXISTING PINE PLANTATION BE REMOVED?

There are four ways in which an existing pine block might be removed.

- **Commercial logging contract**

While log prices fluctuate, and some Sounds forests are not ideally located for harvesting operations, in many cases commercial logging will be undertaken to harvest the trees. This leaves landowners with a bare site with a significant bank of viable pine seed present in the ground.

- **Aerial boom spraying**

Aerial boom spraying of mature pine plantations is a viable control method which should be effective on all but the largest trees. There are slight variations, but essentially the method involves using a high water rate, a high herbicide rate (metsulfuron-methyl), and a good penetrant, applied when the trees are actively growing between October and January. The application rate will be at the higher end, around 500 grams per hectare at a cost of \$250-\$400/ha depending on tree location and size.

There is ongoing research to perfect this method for other pine species in New Zealand with new options potentially becoming available over time.



*A block of 20 year old pines on D'Urville Island six months after being sprayed from the air using metsulfuron-methyl.*

- **Ground-based chemical control – herbicide injection or basal bark application**

Manual control of trees by ground workers has been the most common approach to dealing with scattered wilding pines throughout New Zealand. It can also be applied to closed canopy forests but, being labour intensive, is best suited to smaller forests up to about five hectares. The two most commonly used methods are herbicide injection (herbicide is squirted into holes drilled into the sap wood of the tree), or basal bark application (chemical “ring barking” where a chemical mix is applied around the perimeter of the trunk). The herbicide injection method is more suitable for larger trees while the basal bark method is generally preferred on younger saplings.

Guidelines on choosing a method can be found at [www.soundsrestoration.org.nz](http://www.soundsrestoration.org.nz), under “Wilding Pine-Advice For Landowners”. The cost of control can vary widely depending on tree size and location. Marlborough Sounds Restoration Trust experience is that it should be possible to manually ground control a closed-canopy forest of radiata pine for \$1,500 to \$3,000/ha. While this is an



*Example of small standing forest on Maud Island in central Pelorus Sound where ground based control is being carried out using herbicide injection.*

expensive up front control cost, it can significantly reduce follow up control costs and the need for ongoing aerial boom spraying of pine seedlings.

- **Felling to waste**

Felling to waste involves felling trees then leaving them on the ground to rot and break down. This method has been used in the Sounds in the past, and in the right conditions may foster native regeneration through the felled trees, but is not considered an option in these guidelines due to the issues it can create with future access to the site, fire risk and weed control.

## WHAT FACTORS WILL INFLUENCE WHAT HAPPENS AFTER THE PINES ARE REMOVED?

The ideal scenario is that after removing mature pine trees in a block native species naturally regenerate, creating a relatively quick and low-maintenance transition to native forest. However, predicting what happens next - the succession trajectory - will depend on a range of factors including:

- **Control methods used to kill or remove the pine plantation**

Commercial logging will result in most of the native understorey being destroyed and a bare site that is ideal for pine seedling germination. This will generally lead to an abundance of pine seedlings carpeting the ground, probably more prolific on dry faces and ridges. Follow up aerial boom spraying may be required, causing some collateral damage to any surviving or re-generating native plants on the site. However some waxy-leaved native species such as putaputawētā, māhoe, mānuka and kānuka, can survive the spraying and initiate native recovery process quite quickly.

A standing pine block that has been aurally boom sprayed will probably result in by-kill of a fair proportion of the native understorey, but at least there will be residual shade from the dead standing trees to help suppress some pine regrowth. This should result in less seedling regeneration than if the site was logged commercially.

Ground-based manual control using either herbicide injection or basal bark methods is the most targeted method, in that only pines die with no incidental by-kill of native understorey. Surrounding natives will therefore provide shade and competition to any pine regrowth. While manual control is initially expensive, it may save money in the long run by reducing follow-up costs.



*Pine seedlings carpeting the ground two years after harvest in Port Underwood.*



*Native vegetation regeneration under dead standing pine trees killed through herbicide injection in Tory Channel.*

- **Aspect and soil**

Generally, the more south-facing the site and moister the soil in a pine block, the denser the native understorey. Such a site will also be better for native forest establishment following pine removal.

By contrast, dry, north-facing faces and ridges are likely to have a sparser native understorey and higher pine abundance after removal.

- **Near-by seed sources**

What is growing in and adjacent to the pine block will have a big influence on what happens after control. An ideal scenario will be a pine block with a healthy native understorey and that is surrounded by native forest.

For sites with weeds present, these will need to be removed along with any pine regrowth. Any adjoining pines or weeds are likely to spread into the site as well. In this context, gorse and broom shouldn't necessarily be considered weeds, as they can act as nursery crops through which native forest will grow eventually.

Commercial logging may also introduce the risk of new weed species being introduced to a site on the tracks of heavy machinery. It is quite common to see species such as pampas and buddleia appear after heavy machinery has been used.



*A recently harvested forest surrounded by native vegetation and seed sources.*

- **Ungulate (goats, deer and pigs) and possum numbers**

High numbers of browsing animals can compromise native forest regrowth on a site after pine removal. Of particular concern are feral goats, which can browse out native forest regrowth, and possums. Pigs are another ungulate species that can compromise native forest regrowth by rooting up significant patches of soil.

All of these species can cause damage to regenerating native vegetation. If the numbers of pigs, deer and possums are kept under control through hunting and trapping they will not reach high enough levels to cause major damage to native vegetation. However, feral goats are not generally sought after, and can reach very high numbers in some parts of the Sounds. In these areas, some targeted goat control may be required after pine removal to promote native forest succession.



## HOW SHOULD SUBSEQUENT PINE SEEDLINGS AND WEED REGROWTH BE DEALT WITH?

Regardless of how a pine block is initially removed, there will always be some level of pine seedling re-growth and in the worst-case scenario a carpet of seedlings will emerge.

On the positive side, *P. radiata* seed has a relatively short five-year life span and young trees take at least 12 years to mature and set seed. That means there is time to keep on top of pine regrowth and reduce the risk of wilding tree spread.

- **Aerial boom spraying of pine re-growth**

Aerial boom spraying, widely used in the forestry industry, is a reliable method for clearing a site of young pine regrowth post-harvest and prior to re-planting. It is the only viable method of control for large areas. Again, metsulfuron-methyl is the chemical to use with an organosilicone penetrant to enhance absorption. Rates can be less than for mature standing pine plantations, about 200grams per hectare at a cost of approximately \$150-\$250/ha. The chemical is most effective while the tree is actively growing (October-January). To minimise the inevitable by-kill of native species, it is important that metsulfuron-methyl only is used, rather than another herbicide or herbicide mix, such as metsulfuron and glyphosate. Although most native species will initially be knocked back, some waxy-leaved native species such as putaputawētā, māhoe, mānuka and kānuka can survive the spraying and initiate the native recovery process quite quickly in some cases.



*A carpet of regenerating pine seedlings suitable for control by aerial spraying.*

Timing of aerial spraying is critical. *P. radiata* trees release seed through summer and these will usually germinate during the warmer months from spring to autumn, depending on temperature and moisture conditions. If a plantation has been harvested before October most seed should germinate that same spring-summer and an autumn spray should be effective. However, if harvesting takes place later than September, only a proportion of seed will be released and germinate that same summer season. Aerial control should then be left until the following late summer/autumn to allow for further germination, ie, a 15 month stand down period after harvest prior to spraying.

- **Manual control - hand pulling or cutting**

Hand pulling seedlings is a viable option, as long as pine abundance is not too high and/or the site is not too large. It should be supplemented by cutting any slightly larger saplings using good quality pruning saws or loppers. Saplings must be cut right through close to the ground so that every branch and all needle growth is removed from the stump to prevent re-growth.

This activity lends itself to volunteers with no particular expertise. It is best undertaken in winter and spring when the ground is soft and there are no wasps around. Care should also be exercised if working under dead standing trees. Do not work in areas with dead standing trees during strong winds.

While hard physical work, this can be staged over two or three years. Initial attention could be given to areas where natives are already germinating to provide them with a light well so they can continue to grow at maximum rates. In subsequent years return to do more control in surrounding areas, perhaps using

other methods more suited to larger trees, i.e. basal bark application for smaller trees and herbicide injection for any larger stragglers.

- **Ground-based chemical control, - basal bark application , herbicide injection and spot spraying**

Basal bark application or herbicide injection can also be used for dealing with regrowth, as long as pine abundance is not too high and/or the site is not too large. Basal bark application is generally preferred on young saplings while herbicide injection is a more effective for larger trees. There are guidelines on choosing a method at [www.soundsrestoration.org.nz](http://www.soundsrestoration.org.nz) under Wilding Pines - Advice For Landowners.

These methods are generally best suited to contractors, who will have the required gear and qualifications for this work. There is a cost in employing contractors, however landowners are often pleasantly surprised at how much can be achieved in a day. Once again, work should not be carried out under dead standing trees in strong winds.



*Standing pine trees that have been treated using the herbicide injection method. The grey trees were treated two years ago, the orange trees six months ago.*

- **Dealing with gorse and broom**

Gorse and broom are colonising species and can be a first stage to native succession where conditions are favourable. They can also out-compete pine seedlings and therefore be used to suppress pine re-growth on some sites. Some native species (pittosporums, tōtara, mānuka, kānuka, māhoe and putaputawētā), have some tolerance to Terbutylazine, so spot spraying of young gorse or broom with this or other suitable products could be used to create light wells for native regeneration. Gorse/broom would continue growing outside treated spots suppressing pine re-growth in the surrounding area.

- **Other common weeds**

Chemical control is the most viable option to deal with most other weed species that may be encountered on a forestry site following harvest. General advice on a number of weed species can be found on-line at [www.weedbusters.org.nz](http://www.weedbusters.org.nz) or on Department of Conservation or Marlborough District Council websites. Experienced weed control contractors are a good source of information.

For a number of species including old man's beard, banana passionfruit, buddleia, gorse and broom, the occasional plant is best dealt with by cutting and pasting with Picloram based gel products (Vigilant or Picloram gel).

Pampas is another species which sometimes colonises forestry sites and can be controlled effectively if kept on top of in the early stages. Break off any flowering heads, poke them into the middle of the plant and sprinkle Velpar 20G granules into the centre of the plant.





## WILL THERE BE EMISSION TRADING SCHEME (ETS) LIABILITIES?

The New Zealand Emissions Trading Scheme (ETS) aims to discourage de-forestation and therefore can seem a disincentive to remove a pine block, but with the right advice and decision-making this need not be an obstacle. As of late 2016, the scheme is under review and it may be that future versions will provide more incentives for native forest regeneration.

Under the ETS as it currently stands the landowner, or person with the right to deforest, incurs liabilities for the carbon released when pre-1990 forest land is deforested. Pre-1990 forest is defined as:-

- *land of more than 1ha covered by forest species (either exotic or indigenous) on 31 December 1989 that remained in forest, and was predominantly exotic forest species on 31 December 2007.*

The ETS definition of “forest” is:

- *an area of land of at least 1 hectare that has, or will have, tree crown cover from forest species (exotic or indigenous) of more than 30 percent of each hectare (does not include narrow areas of forest less than 30 metres in width)*

Pre-1990 forest land is considered deforested when the land use is changed from forestry to another land use, such as grazing, any time after December 2007 when the first ETS accounting period started.

However, land is not considered deforested if left to regenerate back into forest, or if forest species are planted, where regeneration meets the following thresholds:

- *4 years after clearing, each hectare has been replanted or has naturally regenerated with at least 500 stems per hectare of forest species*
- *or 10 years after clearing, predominantly exotic forest species are growing, but each hectare has tree crown cover of at least 30 percent from trees that have reached 5 metres*

- *or 20 years after clearing, predominantly indigenous forest species are growing, but each hectare has tree crown cover of at least 30 percent from trees that have reached 5 metres.*

What this means in practice is that the forest owner needs to ask three questions:

- Would the forest be considered pre-1990 forest land?
- Is it greater than 1ha?
- Is it unlikely to regenerate back into forest in a relatively short timeframe?

If the answer is 'yes' to all these factors, then there is a risk of incurring carbon liabilities.

The last question is the most difficult to answer. As a general guideline, experience has shown it can be assumed that in most of the Sounds there will be sufficient forest regeneration on sites where pines have been removed to avoid ETS liabilities. Left unmanaged, this regeneration is likely to be a combination of pines and natives.

If however the process is slowed through a managed transition back to native vegetation only, the situation is more challenging. Will you still see adequate regeneration of forest if you remove pine regrowth from the site? The answer is still a qualified yes, but two factors need to be taken into account.



*Mature pines killed by herbicide injection with vigorous regeneration coming through underneath.*

- **Presence of abundant weeds on the site that suppress growth of forest species.**

Old man's beard and banana passionfruit are the most likely species to suppress forest species in an existing pine block if allowed to form a mat of vines. Ironically, tree weeds, such as sycamore and wattles will still meet ETS commitments. A thick cover of gorse or broom can be considered as acceptable for ETS purposes, where they are acting as a nursery crop for native species.

- **Presence of abundant ungulates, particularly goats.**

As outlined earlier, feral animals, particularly goats, can reach high numbers in parts of the Sounds, and have the ability to browse out all native forest regrowth. This has the potential to undermine the native forest regeneration required for ETS purposes.

While it is possible to manage both feral animals and weeds on site, anyone worried about incurring ETS liabilities can apply for a Tree Weed Exemption from the Ministry for Primary Industries (MPI) which would allow wilding pine control to be undertaken without liability. This process involves a lot of paperwork and conditions, and is best discussed directly with MPI. Information is available on [www.mpi.govt.nz](http://www.mpi.govt.nz). Alternatively, it would be possible to undertake some supplementary planting of natives to meet ETS obligations. This has the added advantage, if local podocarp species such as rimu, tōtara and kahikatea are planted, of speeding up the slow process of native forest succession.

## WHETHER TO PLANT NATIVES TO ENHANCE NATURAL REGENERATION?

For large areas, widespread native planting is generally not practical or affordable. Nor is it necessary in parts of the Marlborough Sounds where natural regeneration will take place over time. However for smaller areas, or if some particular intervention such as re-introducing podocarps such as tōtara and rimu into a locality to speed up the regeneration process, is desired, planting might be feasible. Some plants, for instance mānuka, kānuka and tauhinu, can also be spread by cutting branches and pinning them to the ground.

Experience in the Sounds shows that some waxy-leaved native species including putaputawētā, māhoe, tauhinu, mānuka and kānuka can survive spraying with metsulfuron and initiate the native recovery process quite quickly in some cases. As discussed in the weed control section, these same native species can survive the application of Terbutylazine herbicide which can be used to spot spray areas of gorse and broom or rank grasses to create light wells for native species. The gorse/broom can continue growing outside treated spots suppressing pine re-growth in the surrounding area. Other common species like wineberry and five-finger can re-colonise sites fairly quickly from nearby sources.

Gorse and broom are colonising species and can be a first stage to native succession where conditions are favourable. They can also out-compete pine seedlings and therefore are a preferable weed species if the long-term goal is native succession. There are a number of examples in the Sounds where gorse has been succeeded by native species within 20-30 years with no active intervention.



*Emily Osborne with a load of mānuka branches for spreading at Skiddaw in Pelorus Sound.*

Detailed information on restoration planting in the Sounds is available in two Council publications-the North Marlborough Significant Natural Areas Summary Report and the Native Vegetation for North Marlborough-Planting and Restoration Guide.

<http://www.marlborough.govt.nz/Environment/Biodiversity/Biodiversity-Publications-Reports.aspx>

## SUMMARY

There are a number of factors to consider before embarking on a project to convert areas of pines to native vegetation. While native regeneration can be vigorous in the Sounds environment, pines will also regenerate readily in some situations. Significant time and money and many years of follow-up must be invested for the conversion to succeed.

Early planning and site assessment, possibly with the help of a qualified forestry consultant or ecologist, will help identify the best way to approach the project depending on each property and site. Control methods for different situations are available and a realistic assessment of the time and cost involved will help ensure success.

The following three case studies provide examples of conversion projects that have taken place in the Marlborough Sounds and in Hawke's Bay.

## CASE STUDIES

### BLACKWOOD BAY, SMALL-SCALE QUEEN CHARLOTTE SOUND SITE

The Macalister family is overseeing regeneration of a 2ha radiata pine plantation, planted in the 1920s, into native bush.

The trees were harvested by a commercial contractor in 2002, using the Wyssen skyline system, at a small profit. This money covered the cost of employing Student Job Search workers to hand-pull a carpet of regenerating seedlings over three summers, with a little left in the bank.

With few weed species growing beneath the 80-year-old trees and native bush surrounding the site, weed invasion is not a major threat. The pines on the adjoining Department of Conservation land were killed using herbicide injection methods after the Macalister trees were harvested.

Andrew Macalister regularly patrols the block for the odd remaining pine, mostly in hard-to-reach spots. He drills these trees then injects them with herbicide and has encountered the occasional pampas and wattle seedling.

It's been a satisfying project, with native broadleaf species already 3-4 metres-high in damp gullies and kanuka spreading up the ridges at a slower rate to replace grasses. The surrounding native forest is a good source of seed.

"The virtual absence of goats has made things much easier," says Andrew.

Because the plantation pines were harvested before 2007, there is no Emissions Trading Scheme (ETS) obligation to replant natives.

"In any case, in the high rainfall yet warm Marlborough Sounds environment the site is certainly on-track to meet ETS thresholds," says Andrew.



*Two photos of the Blackwood Bay property showing the 2ha area where trees were harvested in 2002 on the mid-slope, and trees on adjoining property behind (top photo), which were later killed by herbicide injection, removing a future pine seed source (bottom photo)*



**How was the pine plantation removed?**

The 2ha plantation was commercially harvested.

**What happened after the trees were removed?**

Profits from the forest harvest were invested in Student Job Search workers who pulled out a carpet of regenerating seedlings over three summers.

**What factors influenced what happened after the pines were removed?**

This is a north-facing site with poor soil, especially on bare ridges but also damp gullies.

There were few weeds growing under the forest although also few natives.

Native forest surrounding the block is a source of seed.

Goat numbers are low.

**How is on-going pine seeding and weed regrowth dealt with?**

The block is regularly patrolled for surviving pine seedlings, usually in inaccessible places which is why they were left behind. These are drilled and herbicide injected. The odd pampas and wattle seedling is encountered.

The site is surrounded by native bush with few weeds so little danger of spread. The pines that were on the adjoining property have been killed through herbicide injection and therefore pose no on-going risk of wilding spread.

**Are there ETS obligations?**

No, as the forest was felled before 2007. In any case, the site is on track to meet ETS reforestation thresholds.

## OSBORNE FAMILY, SKIDDAW, PELORUS SOUND, MARLBOROUGH

Forester Rick Osborne replanted the north-west faces of their 250 ha radiata pine forest after harvesting, from 2004-2007. His daughter Emily Osborne and her partner Mitch Bartlett moved to Skiddaw in 2012 and persuaded Rick to convert gentler southern slopes to 85ha of pasture plus native bush, rather than replant pines.

Today cattle graze among patches of native scrub growing in steep south-facing gullies and through harvesting slash.

Emily and Mitch put in some hard yards on this grazing block, hand-pulling a carpet of pine seedlings in what proved a losing battle. Eventually regrowth was helicopter-sprayed with metsulfuron.

Waxy-leaved native plants which survived the spray include putaputawētā (marble leaf), mānuka, tauhinu and whiteywood. Wineberry-makomako was knocked back but is returning.

Pine seedlings are mostly suppressed by grass and grazing. Any that survive are hand-pulled and bigger plants cut, sawed or chemically ring-barked with a squirt of Grazon plus diesel (basal barking).

The weed Spanish heath is making a comeback, covering whole faces and crowding out both pasture and natives.

“Poet’s Corner” was sprayed from a helicopter and later burned, creating a 5ha blank canvas for planting more than 3000 Marlborough Sounds species either purchased in root-trainers and propagated by the family. Mānuka and tauhinu branches were cut and stuck in the ground or waved about, to scatter seed.

Two to three years later, natives including big patches of wineberry, koromiko, kānuka, and akeake plus the odd *Olearia paniculata*, miro and rimu rise from the ashes.

“There are still heaps of pines seeding from mature trees on the neighbouring ridge,” says Emily. “We pulled at least 500 last year but there’re less each time as natives cover the ground in good growing areas.”

In a 1ha area around the barge loading site, wilding seedlings have been hand-pulled.

Rick warns, “if you harvest trees then do nothing the whole block will return to dense pine with no economic, ecological or landscape value. Converting pine forests to native is possible but requires significant time, money, hard work and determination.”

The family expects natural succession to a diverse forest to take more than 80 years with wilding control a lifelong task.



*South-facing slopes on Skiddaw four years after being sprayed and burnt showing kānuka and tauhinu regeneration well under way.*

### Rick's Regeneration Recipe

1. For several years after logging observe which native plants are coming up and where, keeping an eye out for special or rare species. This pinpoints priority restoration areas. Do not try to do too much – it will overwhelm you.
2. About one to two years after harvesting, between November and March, helicopter spray dense pine regeneration with herbicide. This may need to be repeated in two to three years depending on how many seedlings keep coming up. At the very least hand-pulling follow-up will be required. Some native species will be knocked back but many will regenerate. Or, solely rely on hand-pulling seedlings, but this is a massive task which must be repeated 2-3 times in the first 3-4 years. Bigger wildings can be basal bark sprayed or trunks sawed close to the ground with every branch and green needle removed from the remaining trunk to prevent re-growth.
3. For a clean start, about 6 months after the spray, burn the block in winter. Plant natives into ash, scatter seed or let nature do the job later adding plants to fill the gaps.
4. Wilding control will be a lifelong but reducing, task, as pine seed blown in or brought by birds continues to regenerate.



*Poets Corner" (above) after spraying and burning. Scenecio minimus and kānuka are regenerating among the logs.*

*Newly planted natives have also been established (below).*

### How was the pine plantation removed?

Commercial harvesting with logs earning a solid net profit, starting in 2004 and continuing over three years.

### What happened after the trees were removed?

Steep exposed north-west faces were replanted in pines.

Hand-pulling proved too labour-intensive on south-facing slopes being converted to pasture with patches of native bush. Helicopter-spraying with metsulfuron helped manage this situation.

A more manageable 5ha hillside was sprayed, burned, then planted in native species.

Wilding pines on 1ha around the barge loading site are hand-pulled.



### What factors influenced what happened after the pines were removed?

Skiddaw includes both north-west and south-facing slopes.

The family aims to earn income by grazing pasture.

The regenerating block is surrounded by pines but nearby native bush is a seed source also.

Seed blows and is carried by birds from mature pines on a nearby ridge.

Weedy Spanish heath is colonising hungrier soils, suppressing both pines and natives but good for bees. If passing by on a tractor poisoning gorse, it's given a spray.

Pampas is sprayed with glyphosate from a backpack sprayer. It's palatable to cattle, but often grows on steep clay banks where it is out of reach.

Goats, deer and pigs are regularly hunted.

### **How is on-going pine seeding and weed regrowth dealt with?**

A second spray could be required on the pasture-native block and after that annual hand-pulling for maintenance with bigger seedlings sawed close to the ground or basal-sprayed.

### **Are there ETS obligations?**

Much of the property is a pre-1990 forest so it must be returned to an ETS compliant forest (within 20 years for the native areas), to avoid penalties. This appears to be on track at this stage.



## FOREST LIFEFORCE – MAUNGATANIWHA, HAWKE’S BAY

The Forest Lifforce Restoration Trust is restoring more than 4000 ha of radiata pine in northern Hawke’s Bay to regenerating native forest. Three-quarters has been logged by Rayonier NZ, which owns the cutting rights.



*Harvested hill country at Maungataniwha forest, Hawke’s Bay.*



*Regenerating native vegetation in a moister gully at Maungataniwha.*

The approach is to do nothing for at least three years after harvesting, leaving a mosaic of different intensities of wilding pine. The densest wilding areas are then boom-sprayed by helicopter with metsulfuron herbicide plus penetrant. In gullies and other areas where natives predominate, experienced ground crews with chainsaws manually fell pines and chemicals are not used.

Some, but not many, native species survive spraying but regeneration has been rapid from seed left in the soil and spread by birds from surrounding native bush. Native grasses are the first to establish, suppressing pines and creating a nursery for shrubs and small trees like māhoe and wineberry then cabbage trees, kānuka and native fuchsia.

Dry areas are colonised by pines at the highest densities, especially where logging has disturbed the ground creating a seedbed. Adult pines on poor sites become stressed and produce the most seed. About 1170 goats have been shot in the forest since the project began in 2008.

Forest Lifforce land manager, Pete Shaw, expects the next step to be spot-spraying treated blocks by helicopter using a directional boom. By then, native ground cover should be dense and high.

“It can be tempting to go light on control to save natives but this will cost time and money in the long-term,” says Pete. “Don’t worry when the site looks dreadful after spraying as this’ll be temporary.”

He recommends that when there’s the option, mature pines be poisoned standing rather than harvested, making native restoration cheaper and easier. Felled trees damage any native undergrowth and spread their cones to seed again.

### **How was the pine plantation removed?**

- Cutting rights owner, Rayonier, has 12 years to harvest the trees. Three quarters have been logged in 10 years.

### **What happened after the trees were removed?**

- Three years after harvest, the most intensive wilding areas were helicopter boom-sprayed with metsulfuron herbicide plus penetrant.
- In areas where natives dominate such as gullies and south-facing slopes, experienced ground crews with chainsaws fell the few wildings present.
- Basal bark spraying was trialled but cost more than manual felling with a lower kill rate.

### **What factors influenced what happened after the pines were removed?**

- A mixed density of radiata seedlings emerged, depending on aspect and location.
- The site is 2/3 surrounded by native forest and 1/3 by pines.
- Pines colonise dry areas at the highest density, especially where logging has created a seedbed. Adult pines on poor sites become stressed and produce the most seed.
- Weeds are not a major problem as metsulfuron also kills gorse.
- Some, but not many, native species survived spraying. At high rates (500g/ha) grass was sometimes all that remained but became an effective nursery for kānuka and suppressed wilding pines.
- 1166 goats have been shot since 2008.
- This is a large-scale project so planting natives was too expensive to consider.

### **How is on-going pine seeding and weed regrowth dealt with?**

- The next step – not yet reached-is anticipated to be spot-spraying treated blocks by helicopter using a directional boom. By now native ground cover could be quite high and very dense.
- Control of scattered wildings is expected to be ongoing.

### **Are there ETS obligations?**

Yes, the forest was planted pre-1990 so the block must be returned to an ETS compliant forest (within 20 years for the native areas), to avoid penalties. This appears to be on track at this stage.

## WEBSITES

### Weed Control methods

<http://www.soundsrestoration.org.nz>

<http://www.weedbusters.org.nz>

<http://www.marlborough.govt.nz/Environment/Biosecurity/Declared-Pest-Species.aspx?page=4>

<http://www.wildingconifers.org.nz/index.php/research/control/using-herbicides>

<http://www.doc.govt.nz/nature/pests-and-threats/common-weeds/wilding-conifers/methods-of-control/>

### Planting natives

<http://www.marlborough.govt.nz/Environment/Biodiversity/Biodiversity-Publications-Reports.aspx>

<http://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/>

### Emissions Trading Scheme

<http://www.mpi.govt.nz>

<http://www.mfe.govt.nz/climate-change/reducing-greenhouse-gas-emissions/new-zealand-emissions-trading-scheme>

### Projects

<http://www.forestlifeforce.org.nz/pine.html>

