

## Rotoroa Island – Integrated weed management for biodiversity outcomes

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**Summary** Rotoroa is an 80 ha island in the Hauraki Gulf, northeast of Auckland in New Zealand. Owned by the Salvation Army it was leased to the Rotoroa Island Trust in 2007. The Trust's goal is to develop Rotoroa for visitors to enjoy the island's natural and cultural heritage values. The Trust has undertaken a significant restoration programme involving the removal and mulching of 20 000 pine trees and the replanting of 50 ha with native species. The opening up of the ground after removal of the exotic trees and retiring of pasture from grazing has created an ongoing issue with weeds. A proactive vegetation management strategy has been implemented which combines effective sustained weed control with the creation of a coastal lowland forest ecosystem. There are at least 50 species of weeds, a number of which are classified as Surveillance or Containment Plant Pests in the Auckland Council Regional Pest Management Strategy (Auckland Council 2007). A weed database has been established which identifies each species by name, photo, key features and summarises the most effective control measures. Weed control work is undertaken using a combination of techniques including herbicides and manual removal.

A native tree replanting programme was initiated in 2008. Its focus is on species that can survive in exposed coastal environments. Species such as karo (*Pittosporum crassifolium*), pohutukawa (*Metrosideros excelsa*), karamu (*Coprosma robusta*), koromiko (*Hebe stricta*) and manuka (*Leptospermum scoparium*) which create quick cover, attract native bird species, and speed up natural regeneration processes, have been progressively planted across the island. To the present date 350 000 trees have been planted. Weed control work is undertaken for three years post-planting each area to minimise competition with native species, and progressively control and where possible eradicate key invasive species.

**Keywords** Weed species, proactive vegetation management, effective control, coastal ecosystem restoration, native trees, speeding up natural processes.

### INTRODUCTION

Rotoroa Island is one of over 50 islands in the Hauraki Gulf and like many others has a long history of human settlement and farming. Its original native forest cover of predominantly coastal pohutukawa forest is now

largely restricted to small steep cliff edge pockets.

The restoration of Rotoroa's natural vegetation fits well with the island's history; for over 100 years it was the site of a drug and alcohol rehabilitation centre for Salvation Army where it restored the lives of many people. Now the Rotoroa Island Trust is restoring the natural features of the island as a place of reflection and tranquility.

In 2008, through the vision of the Plowman family, the Rotoroa Island Trust was established. A formal partnership was entered into with the Salvation Army whereby the lease for the island was paid in advance for the next 99 years and a programme established and funded to restore the island's natural environments and celebrate its rich cultural heritage.

The programme is managed by a volunteer project manager from the Trust and the work is carried out by a range of sub-contractors including logging, demolition, building, animal and plant pest control and restoration specialists.

### METHODS

A concept plan was prepared by Boffa Miskell (environmental consultants), in 2008. This included a staged process for the restoration of the island which integrated a 50 ha revegetation programme with open spaces and essential facilities (including roads, tracks, accommodation and a visitor centre) and the eventual re-opening of the island to the public (Boffa Miskell 2008).

The first major step was the removal of 20 ha of mature exotic trees (predominantly *Pinus radiata*, *Cupressus macrocarpa*, *Casuarina* and *Eucalyptus* species). These were concentrated around the coastal cliffs and accounted for around 25% of Rotoroa's total vegetation cover. The trees were felled and then chipped for future use as mulch for revegetation plantings.

The removal of the exotic trees in effect resulted in a 'blank canvas'. Ground previously shaded by mature pines was now open to the elements and provided a rich breeding ground for weed species. These established from four key sources:

- windblown e.g. mothplant (*Araujia hortorum*)
- bird deposited e.g. woolly nightshade (*Solanum mauritianum*)
- dormant seed in ground able to germinate post tree

removal e.g. gorse (*Ulex europaeus*)

- seed drop from felled trees e.g. *Pinus radiata*.
- To combat this invasion a two pronged approach was established: the re-establishment of native vegetation cover and an integrated weed control programme.

**Revegetation** The removal of the exotic tree cover created a real challenge for revegetation. At 80 ha, Rotoroa is a small island. It has little shelter from prevailing winds and no running water.

The natural vegetation cover of Hauraki Gulf Islands the size of Rotoroa would have originally been predominantly coastal pohutukawa forest comprised of hardy native species adapted to an exposed salt-laden environment. These include those with roots able to anchor into rock cracks and overhang the sea such as pohutukawa (*Metrosideros excelsa*) and karo (*Pittosporum crassifolium*); species with rough leathery leaves such as akiraho (*Olearia paniculata*) along with understorey species with waxy leaves such as taupata (*Coprosma repens*) and houpara (*Pseudopanax lessoni*), and colonisers such as koromiko (*Hebe stricta*) and manuka (*Leptospermum scoparium*).

These pioneering species formed the backbone of the revegetation programme which was initially staged over a 4 year period. The first planting involved the establishment of a coastal buffer: planting from the cliff edges inwards. After preparation by pre-plant spraying, 100 000 trees were planted in the winter of 2008.

In January 2009, the Rotoroa Island Trust contracted Treescape Limited to provide a field ecologist to assist with the practical implementation of the revegetation programme. A review of the first year's planting was undertaken. Effective site preparation of planting sites to achieve maximum survival of native plants and quick coverage of bare ground was the key learning. This was achieved in future plantings by:

- initiating weed control work 6–8 months pre-planting, particularly important for tenacious species such as kikuyu grass (*Pennisetum clandestinum*) which requires 2–3 applications of herbicide to achieve effective control,
- implementing a post-planting weed control programme to reduce competition with native species, prevent further spread of weed species and establishment of new species,
- developing a weed database with information on species identification and effective control measures,
- increasing the ratio of quick growing species with fruit attractive to native birds such as kereru (*Hemiphaga novaeseelandiae*) and tui (*Prosthemadera novaeseelandiae*) to speed up natural regeneration processes,

- developing a closer working relationship with the plant supply nursery and establishing standards for plant grade, size and vigour,
- reviewing survival rates of each successive year of planting and modifying plant selection for following years.

Since the implementation of this modified programme a further 200 000 trees have been planted by experienced contractors. Survival rates have increased dramatically from 80% to around 97%. The second stage of the revegetation programme has also been implemented. This involves the planting of more sensitive canopy tree species such as tawapou (*Pouteria costata*), puriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*) and kowhai (*Sophora chathamica*). These species are only introduced to previously planted areas after at least 2 years growth has occurred to provide the necessary shelter. This revegetation strategy is working well.

Seed is already being collected off some plantings, natural regeneration in planting areas is widespread, and canopy closure has been achieved over at least 50% of the planted area.

**Weed control programme** Like the revegetation programme, weed control on Rotoroa has relied on a combination of the use of proven techniques, adapting management techniques as a result of increasing knowledge of the island environment (e.g. microclimates) and constantly reviewing the weed database and control programme to ensure all key weeds are recorded and that control is effective.

Integrated weed control has been the key: targeting a range of key species concurrently, ensuring that control reduces and wherever possible eliminates competition with native plantings; and having a proactive long term management approach using a range of control techniques.

The first step in this programme was identifying all weed species on the island and categorising them according to their level of risk. Level of risk was defined as follows:

- potential to outcompete native plantings (particularly in the first year of planting)
- species that were listed as Total Control, Containment or Surveillance Plant Pests in the Auckland Regional Pest Management Strategy (ARPMS) (Auckland Council 2007)
- species that had the potential to spread easily, e.g. by wind, bird, self propagation.

Species which had two or more of these characteristics such as mothplant (*Araujia sericifera*) and smilax (*Asparagus asparagoides*) pose the highest risk. Over 50 species of weeds were identified

of which only about 10–15% are ARPMS listed species.

The weed database was established in tabular and visual formats to both educate Rotoroa Island Trust personnel and provide a simple field guide for those undertaking the control work.

The database lists weeds in alphabetical order and identifies proven control methods for each species. These include hand pulling, felling followed by stump treating and herbicide spraying.

The visual guide has photos of each plant species (often juvenile and mature form, what seeds, flowers look like, etc.) and a short description of its characteristics. In order to avoid confusion with native species which may have similar characteristics, photos and distinguishing features of each species are displayed side by side — important when both can easily be killed by herbicides! For example Toetoe (*Cortaderia fulvida*) a tall native grass, is often confused with introduced pampas grass (*Cortaderia selloana*, *C. jubata*). As new species are found they are added to the database and the updated information is sent out to key personnel.

Implementing the control programme on the ground has been a challenge. Working on islands that are distant from the mainland requires personnel that are prepared to work away from home for extended periods and are highly organised, careful and methodical.

The weed control programme has two distinct parts:

- pre-plant preparation
- post-plant releasing.

Pre-plant preparation normally starts around October of the year prior to planting and is relatively straightforward. Areas identified for planting are generally dominated by kikuyu grass and are blanket sprayed between October and December with a mix of glyphosate, metsulfuron-methyl and Supersil (silicon based sticking agent). Follow-up spot-sprays are undertaken between February and May with glyphosate (but no metsulfuron-methyl to ensure no residues are present at planting).

Dead kikuyu grass is very useful as it suppresses many weeds, provides highly effective mulch for young native plants, and also provides protection from wind as well as retains moisture during dry conditions.

Post-plant releasing is more complex. Each planting receives 3 years of weed control after it has been planted. Spacings of native plants vary between 1.4 m and 10 m depending on species with 1.4 m and being the most common. Careful release is essential.

Because of the scale of the plantings, herbicide control is undertaken by a team of experienced contractors 4–5 times a year. Glyphosate is the main chemical used and is generally effective on most

species. Marker dye is always used. Where weeds overtop or are too close to native plants to safely spray, hand clearing is undertaken prior to spraying.

Weather is a constant issue particularly in winter months when fine calm and dry conditions are hard to get for more than a couple of days. The team work 9–10 day stints on the island and use back pack sprayers filled from a water carrier on the back of a 4WD vehicle to save a long drive back to the island's main water source.

The use of the same team of people for the last 2 years has been beneficial as they have intimate knowledge of the island environment and are highly efficient e.g. knowing which are the more sheltered areas to leave for windy days, where the key target weeds are, which areas are likely to be weedier than others.

The first year after a planting is when native plants are the most vulnerable. Trees are planted as a Pot 1L grade (a small dense size between 30 and 50 cm in height with good root formation) and have to adapt to their new environment, compete with often tenacious weed species and get sufficient root growth and overall vigour to be able to survive the dry, hot summers of the Hauraki Gulf. Avoiding any other threats to their survival such as over-spraying is therefore essential.

A key measure is the use of spraying contractors with proven experience of safe working practices amongst native plantings and constant monitoring of plantings post-releasing to ensure these standards are being maintained. This is undertaken by the Trust ecologist after each release using an Excel spreadsheet and map produced by the contractor which details where they have been and what the main weed issues were. The Trust also periodically lets contracts aimed at targeted control of particular species. Wilding pines and gorse on coastal cliffs have been controlled in this manner.

In addition to the resident caretaker, the Trust also employs one person to control weeds in the areas which have been released from the 3 year contracted programme. Canopy closure over most of this area has significantly reduced weed issues but ongoing control of key species, particularly those that can survive under low light conditions, is still necessary. Presently this person is responsible for control over about 20 ha of the island. It is a challenging task, made more difficult by the presence of species such as moth plant which produces large number of small seedlings that establish quickly. In recent months the contracted releasing programme has been expanded to assist with this person's tasks. For example, species such as pampas grass, mothplant and gorse are targeted island-wide prior to seeding and wildings are targeted at hand pulling stage.

### CONCLUSIONS

1. Undertake revegetation planting with native species which naturally occur in similar environments.
2. Find a similar location that can act as a mirror image for the area you intend to plant. This provides confidence that the species chosen will survive and gives the client a visual idea of what the planting will look like when it is mature.
3. Concentrate on a small palate of hardy plants that achieve quick ground cover and speed up natural regeneration processes by setting seed early and attracting seed dispersing and pollinating birds.
4. Proactive and integrated weed control is essential. Wherever possible, this includes dealing with weeds when they are small and prior to setting seed.
5. Prevent the establishment of new weed species. Biosecurity is promoted **prior** to public visits to the island. Nursery plant stock is checked for weeds prior to leaving the mainland. Personnel undertaking the work are provided with identification guides to improve their knowledge of weed

species. When a new or unknown weed is found, its position is identified by GPS and a photo sent to the Trust ecologist to confirm identity.

6. Cost effective and sustained weed control in large scale native plantings is most effectively achieved with experienced, dedicated and methodical personnel.

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### REFERENCES

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