Manaaki Whenua
Landcare Research

Best-practice guidelines for managing Tradescantia threats to native biodiversity

A research collaboration between BioHeritage National Science Challenge, Manaaki Whenua - Landcare Research and Living Water, Wairua River Catchment

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Manaaki Whenua – Landcare Research

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Summary

A biodiversity field experiment incorporating biocontrol beetles and manual clearing in a range of forest remnants invaded by tradescantia (*Tradescantia fluminensis*) on the Hikurangi floodplain was conducted over a 3-year period to provide best-practice techniques to enhance native biodiversity. Results showed that the biocontrol beetles, after a slow start, were effective in reducing tradescantia biomass and promoting regeneration of native canopy forest species replacements. Removal of tradescantia by hand produced more immediate results, but this technique is much more labour intensive and requires on-going control. Guidelines for collecting, transferring, and monitoring the biocontrol beetles are provided now that source populations are available for dissemination to other sites in the wider district.

1 Introduction

The ecological health and functioning of many forest remnants in agriculturally modified landscapes are under serious threat from weed invasion. A prime example is the Hikurangi floodplain, a 'biodiversity hotspot' in Northland where regeneration of native species is being compromised by dense groundcover layers of tradescantia (*Tradescantia fluminensis*). A restoration field experiment was established in 2016 to compare two different approaches to management of tradescantia, namely three biocontrol beetle species (released as a trio), which target different parts of the plant, and hand clearing. The beetles (*Neolema ogloblini*, which feeds on the leaf, *Lema basicostata* (stem), and *Neolema abbreviata* (tip); Fig. 1) were sourced from Brazil and, following host-range testing that indicated they were safe to release in New Zealand, were approved for release by the Environmental Risk Management Authority (ERMA) of the New Zealand Government (Fowler et al. 2013). These species had previously been released separately in New Zealand; however, the Hikurangi experiment was the first release of the beetle species as a trio.

The overall goals of the restoration experiment were to:

- enhance native biodiversity in areas invaded by tradescantia
- provide best practice techniques on new ways to control tradescantia in forest remnants
- supply source populations of the biocontrol beetles for control of the plant in the wider district.

Figure 1. Biocontrol beetles: L–R: stem Lema basicostata, leaf Neolema ogloblini, tip Neolema abbreviata. Photos: Q Paynter.

2 Methods

We set up the experiment at four sites invaded by tradescantia: two in a large expanse of DOC reserve (Wairua River Government Purpose Wildlife Management Reserve (GPWMR) North, Wairua River GPWMR South) and two in forest remnants on dairy farms (Dairy Farm 1, Dairy Farm 2) (Table 1). Each site comprised three plots, which had one of three treatments: biocontrol beetles (Fig. 2), clearing manually by hand (cleared twice-yearly), and control (do nothing). The control plot was located in a different remnant from the biocontrol treatment plot and separated by a tract of grassland, to minimise contamination from the beetles. The experiment ran for 3 years, from February 2016 to

February 2019. Vegetation, environmental, and invertebrate data were collected both during the experiment and at final harvest of tradescantia biomass in late February 2019.

Table 1. Summary of sites, plot treatments and numbers of biocontrol beetles released: stem *Lema basicostata*, leaf *Neolema ogloblini*, tip *Neolema abbreviata*

Site	Plot treatment	Stem	Leaf	Tip
Dairy Farm 1	Biocontrol	150	150	75
Dairy Farm 1	Hand cleared			
Dairy Farm 1	Control			
Dairy Farm 2	Biocontrol	150	150	75
Dairy Farm 2	Hand cleared			
Dairy Farm 2	Control			
Wairua North GPWMR	Biocontrol	150	150	75
Wairua North GPWMR	Hand cleared			
Wairua North GPWMR	Control			
Wairua South GPWMR	Biocontrol	150	150	75
Wairua South GPWMR	Hand cleared			
Wairua South GPWMR	Control			

Figure 2. Biocontrol beetle release at Dairy Farm 2 February 2016. Left- right: Tony Hegh, Quentin Paynter, Corinne Watts, Danny Thornburrow, Bev Clarkson. Photo: K Hansen.

3 Results and Discussion

Monitoring of browse damage indicates establishment of all biocontrol beetle species occurred within 1 year, and widespread dispersal (more than 1 km) of at least one species (*Neolema ogloblini*) within 3 years. Decreases in tradescantia biomass occurred in all biocontrol plots by year three compared with control sites (Fig. 3), and woody seedling establishment was highest in the hand-cleared plots, second highest in the biocontrol treatments, and lowest in the control treatments (Fig. 4). This indicates the biocontrol beetles are having a positive effect in reducing the tradescantia cover, and hence promoting regeneration of forest canopy replacements. Although the experiment needs to continue for several years before noticeable ecological benefits are achieved, results so far provide early promise of the use of biocontrol beetles in slowing or reversing biodiversity decline in floodplain forest remnants.

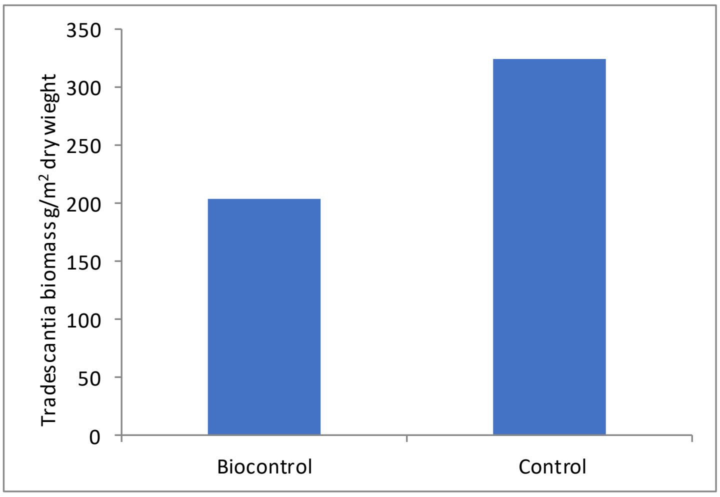

Figure 3.Tradescantia biomass (mean) at biocontrol and control sites after 3 years. The hand-cleared plots had zero tradescantia biomass.

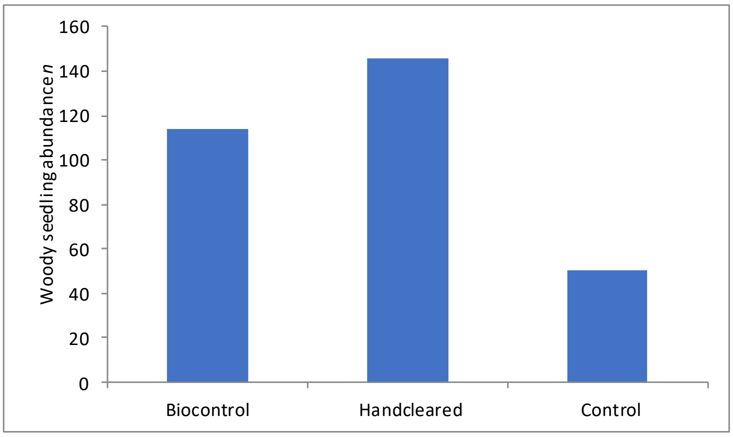

Figure 4. Number of woody seedlings at different treatment plots after 3 years.

4 Guidelines for collecting and translocating tradescantia biocontrol beetles

4.1 Establishing a population pool

A key to restoration success is to establish a biocontrol beetle population size large enough to breed up 'spares' to distribute to other sites. This has taken 3 years at the Hikurangi floodplain sites, a period incorporating several unfavourable weather events such as floods, cyclones, and unseasonably wet and cold conditions. The initial release size is also important as bigger releases should result in more rapid establishment of harvestable populations. Standard practice has been to make lots of smaller releases, rather than a few big ones as this leads to more establishments in a wider area. To date, the beetles are dispersing very well in Northland, and elsewhere (e.g. Waikato), and some populations should now be ready for harvesting.

Location details and permission to harvest the biocontrol beetle populations in the Hikurangi floodplain can be obtained from the Living Water Site Lead at the Department of Conservation, Whangarei. For elsewhere in New Zealand, contact Auckland Council (the national lead organisation for tradescantia biocontrol project), or your local regional council. Guidance for collection, translocation, and monitoring the beetles, together with other important information is provided in the Manaaki Whenua – Landcare Research handbook on biological control of weeds (Hayes 2018; https://www.landcareresearch.co.nz/publications/books/biocontrol-of-weeds-book). We summarise the main steps for Hikurangi floodplain, which should also be pertinent to other parts of New Zealand.

4.2 Recognising biocontrol beetle damage

In summer months, *N. ogloblini* and *N. abbreviata* are often conspicuously perched on the upper surface of tradescantia leaves. *Lema basicostata* adults are much harder to spot as they prefer to remain hidden in the leaf litter. Establishment of the beetles, even if they are not seen, can be detected from their feeding damage. Adult *N. ogloblini* eat along the edges of leaves, giving them a ragged look, while larvae window the leaves causing them to shrivel and turn brown (Fig. 5). Adult *N. abbreviata* and *L. basicostata* make almost identical elongated holes in the leaves, but the larvae of the former destroy the stem tips (Fig. 6) and the latter destroys the stems (Fig. 7).

Figure 5. ***Neolema ogloblini*** **adult feeding (ragged leaf edges) and larval damage (brown windowed leaves).**

Figure 6 ***Neolema abbreviata*** **adult feeding damage (left image, holes in leaves), and larval feeding damage (right image) showing dead stem tip where the larva has burrowed into the meristem.**

Figure 7. *Lema basicostata* adult feeding (left image) and larval feeding damage causing stem to collapse (right image).

4.3 Collecting and translocating the beetles

As tradescantia is classified as an 'Unwanted Organism' and listed in the National Pest Plant Accord, a permit from local councils or the Ministry for Primary Industries (MPI) is required to move any plant material around, so without this, it would technically be illegal for a member of public to collect beetles and keep them on plant material to transport them somewhere else.

Adult beetles can be collected with an aspirator or pooter (for details on how to make a simple pooter, see Factsheet 1 below), or a small net. Another method is to use a garden-leaf vacuum machine and fit an old sock or pantyhose over the end of the tube, so it forms a bag in the mouth of the tube to collect the beetles. The adults of *Lema basicostata* are harder to collect using these methods because they drop so readily. It might be easier to collect and shift damaged, infested plant material onto a tarpaulin to take to the new site (but make sure you have an exemption from MPI that allows you to do this).

Aim to collect and translocate 50–100 adults in the spring. The beetles can happily survive without food for a day or two, so it is no problem to collect some and then drive to a new location for release.

4.4 Factsheets

Factsheets on collecting, relocating and monitoring, as well as additional information the tradescantia beetle biocontrol agents are provided in Hayes (2018). The main ones are as follows:

1 Guidelines for collecting, relocating and releasing beetles (includes how to make a pooter): pooter

2 Comparison of thee three tradescantia beetle species: beetle comparisons

3 Tradescantia leaf beetle *Neolema ogloblini*: leaf beetle

4 Tradescantia tip beetle *Neolema abbreviata*: tip beetle

5 Tradescantia stem beetle *Lema basicostata*: stem beetle

6 Assessing the impact of biocontrol agents: monitoring

5 Acknowledgements

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Hayes L 2018. The biological control of weeds book – a New Zealand guide. ISBN 0-478-09306-3. Published by Manaaki Whenua – Landcare Research. 150 p. Available from: http://www.landcareresearch.co.nz/publications/books/biocontrol-of-weeds-book