Establishing native plants alongside the Sherry River, with particular emphasis on initial weed control. The Bavin's trial.

Lisa Langer, Nick Ledgard and David Henley
Scion, PO Box 29 237, Fendalton, Christchurch

1. ABSTRACT

Nine native species were used for an establishment trial in a riparian area alongside the Sherry River in the Motueka catchment. Weed growth in the area can be prolific, so the major trial treatments involved controlling weeds using chemicals or herbicides, and 'mulches' of carpet and weedmat. Native seedling survival after 2 years with no weed control was 64% and, although this was significantly poorer than in the chemical control treatment (80%), it was not significantly different from survival in the weedmat (67%) and carpet (69%) treatments. Height growth and surface area covered by seedlings was best under the 'mulch' treatments of carpet and weedmat, especially the latter. The cheapest means of controlling weeds proved to be chemicals or herbicides (at \$1.89/m^2), but the difference was only 13 cents when compared to the cost of weedmat (6% more expensive at \$2.02/m^2) and carpet (7% more expensive at \$2.04/m^2). The species which grew tallest and covered the most surface area were cabbage tree, lowland ribbnwood, kohuhu and karamu. Other issues involved the regular applications by a skilled operator for chemical control and the requirement of flat surfaces for carpet and weedmat. The authors conclude that there is no simple solution for successfully establishing native species in weedy environments, such as exist alongside the Sherry river. The use of fast-growing species planted as quality seedlings, followed up with good weed control by means of herbicides, and mulches of carpet and weedmat, will assist early survival and growth rates over the first 2 years. However, further weed control is most likely to be required before adequate and long-term native species dominance of the site is achieved

2. INTRODUCTION

The Sherry River is a tributary of the Wangapeka River in the Motueka River catchment, south of Nelson in the northern South Island. It flows over a distance of approximately 20 km from headwaters which have large areas of plantation forest, with indigenous shrubs and forest above the plantation level in riparian zones, down to 10 kms of farmed flats - before it reaches its junction with the Wangapeka River. Although the flat land has been used agriculturally for many decades, it is only recently that farming has become more intensive with the arrival of dairying. Paul and Nicky Bavin are dairy farmers on 'Atholbrook' alongside the Sherry River.

3. BACKGROUND

In response to water quality monitoring which found high bacterial contamination in the Motueka River catchment, a Sherry River farmer's group was formed in July 2001 – a short while later forming itself into a Landcare group. As part of its focus on water quality issues, the Group decided to initiate a process for trying to rehabilitate the riparian margins of the Sherry River. The farmers were keen to see simple trials established using a variety of native plants and techniques, to determine the best way of achieving bank stability, improved biodiversity, habitat provision, and weed suppression. The trial on the Bavin's property was the first experimental riparian planting involving native species on the Sherry River.

4. OBJECTIVE

To explore basic options for cost-effective establishment of native plants in riparian zone alongside the Sherry River – with particular emphasis on weed control.

5. METHOD

5.1 Site

The planting site occupies an area of approximately 580 m^2 of the Sherry riverbank at Matariki, on the south side of the river, opposite the home of Paul and Nicky Bavin. The soils are fine, fertile alluvial silts of over 1m in depth. Rainfall is between 1300-1400 mm, which coupled with high sunshine hours, makes for excellent growing conditions. However, at 180m asl, winters can be cold with damaging frosts occuring quite frequently, especially in early spring.

With regard to potential weeds (apart from grasses), the most serious threats come from gorse and broom and sprawling vines such as old man's beard, convolvulus, ivy, blackberry and honeysuckle, as well as from long-established and spreading willows.

5.2 Site preparation

In the year prior to the trial's establishment (September, 2005), the existing cover of crack willows, grasses and numerous weed species, were removed by bulldozer – resulting in bare soils over much of the area. The site was then left for a year to allow weed seeds to germinate. In the autumn prior to planting, a blanket spray mix of glyphosate/tordon/pulse (360 mls Roundup, 200 mls Tordon Brush Killer, and 200 mls Pulse per 100 litre) was applied to kill resident weeds.

5.3 Treatments

The main focus was on weed control, involving four treatments:

A. Control (no further weed control)
B. Chemical control (herbicides), plus on-going weed control for 2 years
C. Carpet (woollen)
D. Weedmat (synthetic)

One month after planting, the whole site was sprayed with a mixture of Roundup (glyphosate) @ 150 ml /l; Versatil (clopyralid) @ 20 ml/l and Pulse @ 20 ml/l per 15 l knapsack.

Chemical control: Spraying was carried out every 2 months between October and April in years 1 and 2 (i.e., on 8 occasions). A glyphosate, clopyralid and Pulse mix was used before planting, but after two such applications, just glyphosate and Pulse at 150mls and 30 mls respectively in a 15 l knapsack (unless woody weeds were considered a threat, in which case clopyralid was added). Considerable care was taken to make sure that no chemical reached the native seedlings i.e., no spraying in windy conditions, using low pressure and any rank grass trodden away from seedlings.

Carpet: Rolls of second-hand wool carpet with minimal colour dies were obtained at no cost from the Nelson Recycling Centre and Richmond Carpets. After slots were cut to accommodate the seedlings, the carpet was laid within 1 month after planting in lengths approximately 7 m long and 0.9m wide, around the seedlings in the carpet-treatment rows. Pegs, rocks and small logs were used to weigh down the carpet margins.

Weed mat: Commercially available (Butlers) weedmat (0.9m wide) was bought and applied in the same way as the carpet.

Animal control: The site was stock fenced prior to planting, plus all seedlings were sprayed with egg-based repellent immediately after planting. Rabbit, hare and possum shooting was also carried out at intervals for the first year.

5.4 Species planted

In mid-September, 2005, seven native species (sixty seedlings of each) were planted in the main trial. Another five species were included in the surrounds and on the bank alongside the river:

a. Species in main trial (420 seedlings):

Cordyline australis	cabbage tree
Kunzea ericoides	kanuka
Plagianthus regius	lowland ribbonwood
Aristotelia serrata	makomako/wineberry
Podocarpus totara	totara
Coprosma robusta	karamu
Pittosporum tenuifolium	kohuhu

b. Species planted in trial surround (approximately 400 seedlings):

All the above and below, except purei, and with the addition of South Island koromiko *(Hebe salicifolia)*

c. Species planted on bank alongside river (approximately 120 seedlings):

Phormiun tenax	flax
Cortaderia richardii	South Island toitoi
Carex secta	purei

All species were planted as 1-year-old seedlings, grown in rootrainers (RX90s), supplied by Titoki Nurseries at Wakefield. Most seedlings met the size specifications given in Appendix 1.

5.5 Trial layout

Treatments were arranged in randomised row plots with 10 replications of each plot. Within the rows, species were planted randomly at 1 m x 1 m spacings. In order to reduce edge effects between treatments, every second row was the same treatment - treatment B, which received 2-monthly weed control. The remaining three treatments were randomly located within each plot. Excess seedlings were planted in any spare space left over after the 10 replicates had been allocated to the most uniform planting sites (5.4 b), and on the bank alongside the river (5.4 c).

5.6 Assessments:

Interim assessments were carried out at the end of Year 1, with a final assessment the end of Year 2 . Only the Year 2 assessment is included in this report. Measurements were taken of survival, height and crown diameter growth. Estimates were made of costs/m2 for each treatment.

5.7 Analysis

Means were calculated for each treatment, followed by an ANOVA to test statistical significance.

6. RESULTS

6.1 Survival

Survival after 2 years was significantly better in the chemically weeded treatment (80%) than in the control (64%) (p=0.05), but the carpet (69%) and weed mat (67%) treatments were not significantly different to the other treatments (Figure 1).

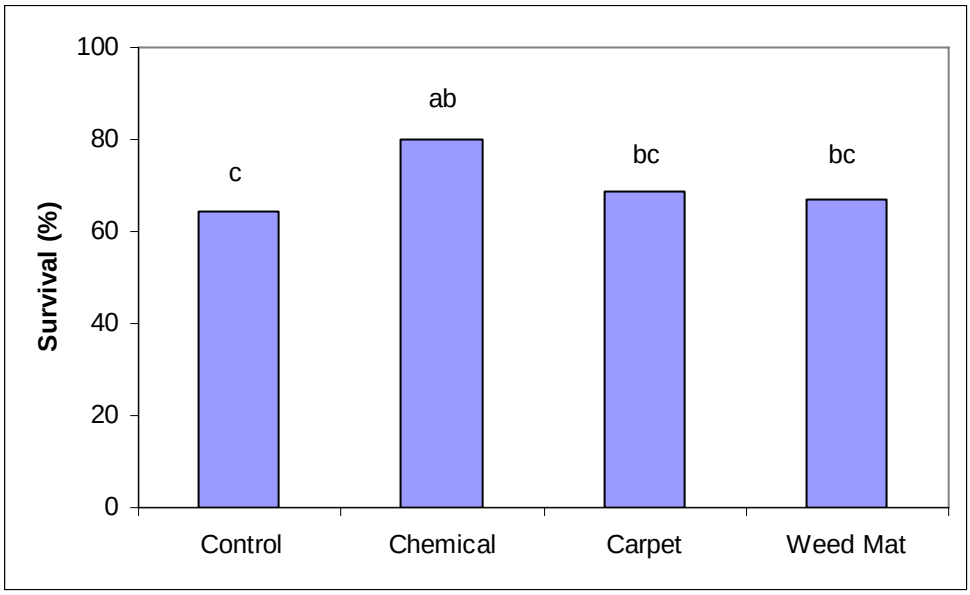

Figure 1. Survival of native seedlings relative to weed control treatments after 2 years

The response of individual species to the four treatments varied (Figure 2). Apart from the poorer survival of wineberry and karamu, due to frosting, no obvious trends were apparent.

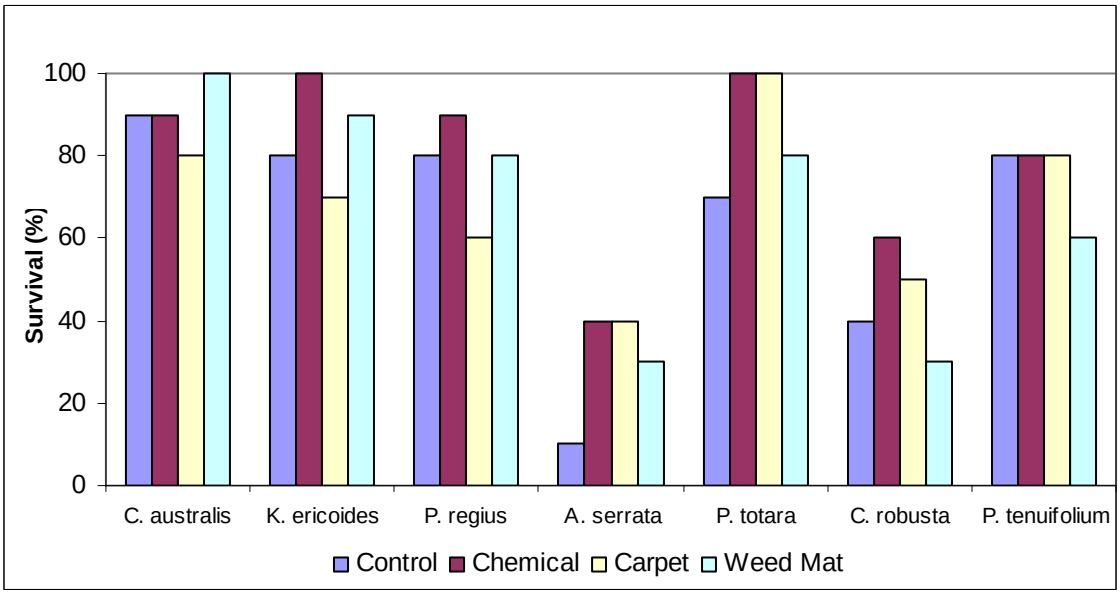

Figure 2. Mean survival of native species after 2 years with no weed control and control by means of chemicals, carpet and weedmat

6.2 Height growth

Height growth over 2 years after planting was significantly less in the control (140 mm) and chemical (196 mm) treatments than in the weed mat (256 mm) (p=0.05). The carpet treatment (203 mm) was not statistically different from the others (Figure 3).

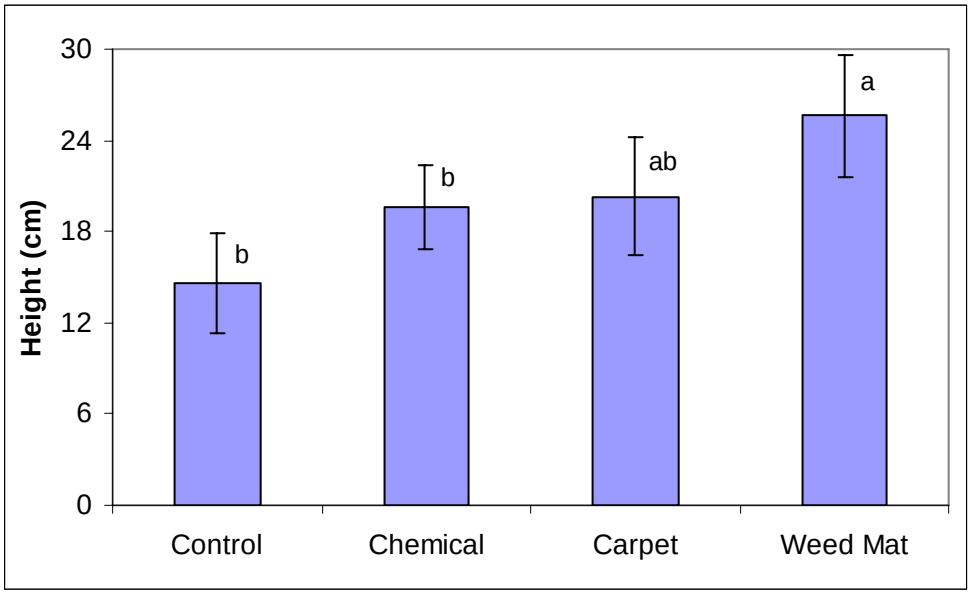

Figure 3. Height increment over 2 years of native seedlings relative to weed control treatments

The height growth of individual species relative to the four treatments varied (Figure 4), with no obvious trend apparent.

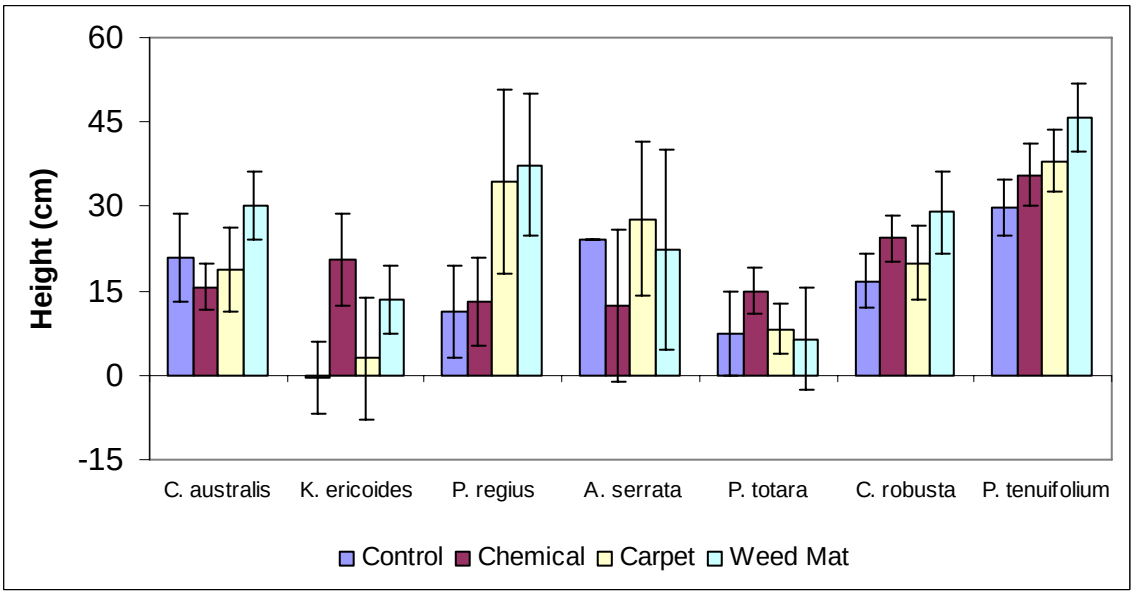

Figure 4. Height growth of individual species over 2 years relative to weed control treatments

6.3 Canopy or surface area coverage

After 2 years, there were significant differences between the canopy, and hence ground surface, covered by native seedlings, relative to weed control treatments (Figure 5). The carpet and weed mat treatments were similar, but were both significantly better than the control and chemical treatments.

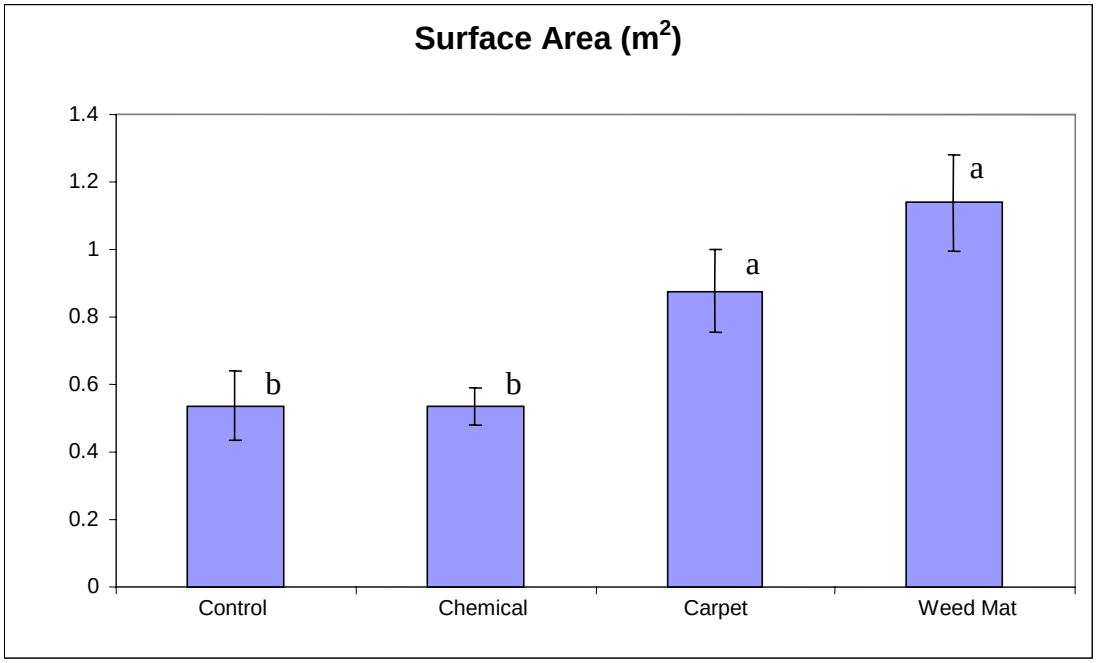

Figure 5. Canopy or ground surface coverage of native seedlings relative to weed control treatments 2 years after planting

Relative to individual species, cabbage trees had significantly larger canopies (mean of 1.45 m^2) than all other species (p=0.05), and the mountain ribbonwood (0.81m^2) canopy was significantly larger than kanuka (0.32 m2) and totara (0.31 m2) (p=0.05). There was no statistically significant difference between the others (Figure 6). as

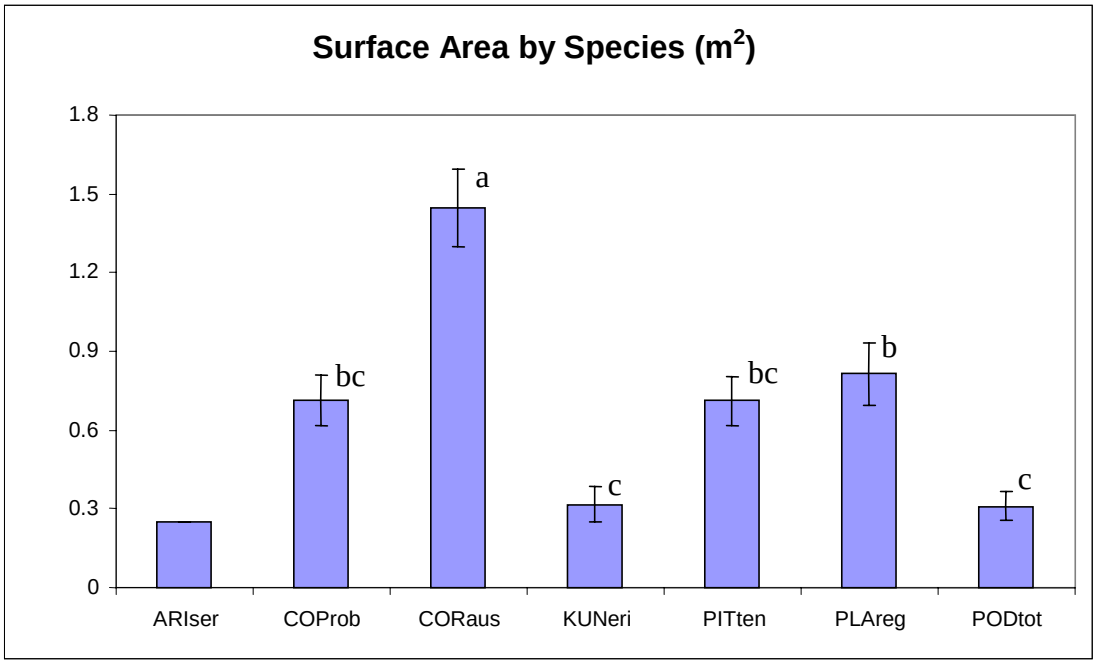

Figure 6. Canopy or surface area coverage of seven native species after 2 years

6.4 Costs

The costs of weed control relative to treatments over 2 years are given in Table 1. Despite the fact that carpet was obtained free of charge, it was similar in cost to the weedmat and chemical control. This was mainly due to the extra labour needed to install and keep it in place. Weedmat was easier to lay down and maintain than carpet, and therefore very slightly cheaper. The cheapest treatment, once again by a small margin, was the chemical or herbicide, but this involved a regular and skilled labour input throughout the 2 years.

Table 1. Costs of weed control / m^2 over 2 years using chemicals, weedmat and carpet, based on initial purchase of $70m^2$ of mat and carpet

Treatment	Material	Sub-total	Pegs	Sub-total	Installation	Sub-total	Maintenance	Sub-total	Total
		($/m2)	(5c each)	($/m2)	(@$30/hr)	($/m2)	(@$30/hr)	($/m2)	($/m2)
Control	0	0	0	0	0	0	0	0	0
Chemical	25.20	0.18	0	0	0.5	0.21	3.5	1.50	1.89
Weedmat	63.20	0.90	4	0.20	2	0.86	0.15	0.06	2.02
Carpet	0	0	4	0.20	4	1.71	0.3	0.13	2.04

7. DISCUSSION

The Sherry River environment, with its good soils, high rainfall and relatively mild temperatures, is good for vegetation growth. This means that native plants can grow fast, but so also can weeds, and if these are not controlled, they can easily dominate and completely suppress newly planted native seedlings. In this respect, the most threatening weed species are the sprawling vines, such as old man's beard, convolvulus, passion fruit and blackberry, which are common in the area. Therefore, it could be deduced that good weed control is likely to be essential for the successful establishment and growth of native species in the riparian areas of the Sherry River.

However, the Bavin trial does question this hypothesis, as native seedling survival after 2 years with no weed control was still 64% and, although this was significantly poorer than in the chemical control treatment (80%), it was not significantly different from survival in the weedmat (67%) and carpet (69%) treatments. Therefore, seedlings can survive without weed control alongside the Sherry River – at least for 2 years.

The height growth and surface area covered by seedlings was best under the 'mulch' treatments of carpet and weedmat, especially the latter. The reason for this is unknown, but the additional height and crown diameter growth obtained from the mulches could be significant relative to the native plants managing to suppress weeds in future years. In this respect, it is also important to plant good quality seedlings (see Appendix 1) in order to maximise opportunities for growth. At the Bavin's, all seedlings were supplied in rootrainers (RX90s) and most met height and root collar specifications. However, RX90s have limited rooting area, and compacted root systems may have contributed to the variable early growth of some species.

The cheapest means of controlling weeds proved to be chemicals or herbicides (at $\$1.89/m^2$), but the difference was only 13 cents when compared to the cost of weedmat (6% more expensive at $\$2.02/m^2$) and carpet (7% more expensive at $\$2.04/m^2$). However, herbicides require regular applications to be effective – in the Bavin trial, four were applied annually. If 'own' labour is used at no charge, the chemical treatment becomes more attractive. Herbicide application should be by an experienced operator and only carried out in the right (wind-still) conditions, as spray-drift can be very damaging to native seedlings. In comparison, there are no chemical risks associated with weedmat and carpet, and for the 2-year duration of the trial they were 'one-off' treatments which did not need to be repeated. If 'own' labour is used at no charge, the chemical treatment becomes more attractive.

Even though, there are advantages to using weedmat or carpet, these two 'mulches' are laborious to install and are only practical on flat, smooth surfaces. In addition, if not properly prepared (slots cut for seedlings) and held in place by weights or pegs, they can move over young trees, or lift and allow weeds to establish. Over time, weed growth can be prolific around edges and in the central hole and the slit leading to it. If these are allowed to reach maturity and release seed, the local seed bank in the soil is continually being renewed, whereas with chemicals no weeds can reach maturity and hence the soil seed bank is eventually exhausted – although many weed seeds are disseminated by wind, which can blow them considerable distances.

The Bavin trial has been monitored, with chemical control maintained, for 2 years, after which time many native plants were well over 1 m in height. No more control is intended after this time, and indications are that they might struggle to survive if weed growth continues unchecked. Some plants may grow tall enough to outcompete the grasses, but climbing/sprawling weeds and vigorous woody species such as broom could well remain a problem, and there may be no option but to remove these manually every few years.

Species choice is going to be important in sites with such rapid weed growth, and the faster-growing, more dominant native plants are most likely to succeed. Of the species used at Bavins, the tallest after two years were kohuhu, followed by mountain ribbonwood, cabbage tree and karamu. These four species also had the largest crowns and covered the most ground surface area – and hence had the best chance of dominating the site and suppressing weeds over time. Karamu is a well-known 'nurse' species for early site domination and later underplanting with slower-growing, longer-term species, but it has shown itself to be susceptible to hard and/or late winter frosts, which can occur in the Sherry catchment. The same was true for koromiko, and especially wineberry, with the result that many plants were hard hit during the first winter.

In conclusion, there is no simple solution for successfully establishing native species in weedy environments, such as exist alongside the Sherry River. The use of fast-growing species planted as high quality seedlings, followed up with good weed control by means of herbicides, and mulches of carpet and weedmat, will assist early survival and growth rates over the first 2 years. However, further weed control is most likely to be required before adequate and long-term native species dominance of the site is achieved.

8. ACKNOWLEDGMENTS

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APPENDIX 1 – Native species seedling specifications

Species	Minimum height required (cm)	Minimum RCD * required (mm)
Cortaderia richardii	20	NA
Phormium tenax	25	NA
Cordyline australis	25	NA
Coprosma robusta	25	6
Hebe salicifolia	25	6
Kunzea ericoides	30	5
Pittosporum tenuifolium	25	5
Plagianthus regius	30	5
Podocarpus totara	30	6

* RCD = Root collar diameter