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Part 3 Giles Creek - Forest description, and establishment of native trees and shrubs on mine overburden

Abstract

A survey of the forest of the main terrace at the Giles Creek mine site was made to characterise the forest destined to be removed by the mining operation. The forest was cut over in the early 1980s for red beech, podocarps (principally rimu and miro), and some silver beech, but a forest structure was still present. Beech species dominated the canopy and sub-canopy tiers, with silver beech being the dominant species, but red and mountain beech were also prominent. In adjoining unlogged terrace forest, red and silver beech were co-dominant, and mountain beech was much less prominent. The three species, plus prominent species in the lower tiers of both forest types, including lancewood, wineberry, pepperwood, *Coprosma* sp. aff. *parviflora,* mountain toatoa, and Hall's totara, should all be considered as potential rehabilitation species at Giles Creek. Broadleaf was also prominent in the lower tiers, but is too palatable to be recommended for use in rehabilitation works.

A field trial was undertaken to provide information on the survival and growth of a range of native tree and shrub species on an existing overburden dump which had minimum soil replacement and which had been revegetated with pasture species by the mining operation. Plant mortality was high in most species, and surviving plants grew poorly. The high mortality and low growth rates are attributed to a combination of poor drainage, low soil fertility, browsing by hares, and, for one species, poor quality of planting stock. The results illustrate the difficulty of establishing native tree and shrub species on unmodified mine spoils, and indicate the necessity for correct site preparation techniques to overcome such factors as poor drainage and substrate infertility. The results also illustrate the desirability of including a relatively wide range of species in a study such as this, of testing species both inside and outside animal exclosures, and of long-term monitoring of trials.

Survival was highest in kahikatea, indicating a tolerance of this species to poorly drained, infertile substrates. Two species, broadleaf and karamu, survived well in a fenced plot, but these species were severely browsed in an adjoining unfenced plot. It is concluded that use of palatable species such as these should be avoided in rehabilitation programmes, unless adequate animal control is possible. Survival of red, silver, and mountain beech on the overburden dump was poor, and it is concluded that further work is necessary to determine causes of failure and successful establishment practices for these species. Six of the ten species were planted as both bare-root and container-grown stock. For most

species bare-root stock performed as well as container plants; the former have advantages in terms of cost of stock, handling logistics, and cost of planting. Transplants of small silver beech from nearby forest fared almost as well as nursery-raised stock.

1. Introduction

Techniques for revegetating land disturbed by mining in indigenous forest areas in the West Coast region were investigated by the Forest Management and Productivity Section, New Zealand Forest Research Institute, Rangiora and Christchurch, for the Department of Conservation. The work was carried out on a DoC mining lease at Giles Creek, near Reefton, where Dunollie Coal Mines Ltd were extracting coal by opencast mining from a terrace site covered by beech forest.

The project was initiated in 1990 when a reconnaissance description of the indigenous forest ahead of the mining front was made and two field trials were established on an existing overburden dump formed by the mining operation. Results from one of the field trials, a study of the effect of fertiliser on the growth of the native shrub *Coprosma robusta* are reported in Part 2 of this publication (Davis & Langer 1997). The results of the forest description and the second field trial are reported here. The main aim of this field trial was to provide information on the survival and growth of a range of native tree and shrub species on an existing overburden dump which had minimum soil replacement and which had been revegetated with pasture species by the mining operation. The trial included a comparison of bare-root and container-grown stock. Native tree and shrub species are normally grown in containers, but the Forest Research Institute nursery at Rangiora has found that it is possible to grow a range of species as bare-root stock in open nursery beds. Bare-root stock have advantages over container stock in terms of cost of stock, handling logistics, and cost of planting. It was therefore considered desirable to compare the performance of the two stock types in a mineland rehabilitation environment. A third aim of the trial was to provide information on the need for wild animal control measures for plantings of native species at Giles Creek. Finally, it was considered that experience gained from the present trial would be helpful in the establishment of a subsequent larger-scale field trial at Giles Creek, which aimed to examine the effects of soil replacement techniques on the growth of a range of native forest species in a mineland rehabilitation environment.

2. Forest description

2.1 OBJECTIVE

To determine the species composition of forest destined for removal in the mining operation at Giles Creek.

2.2 METHODS

Forest reconnaissance descriptions were made of 11 plots located along a traverse in cut-over forest destined for mining, using the method described by Allen & McLennan (1983). The traverse was located at approximately right angles to the mine access road on the main river terrace on a compass bearing of 120^0 magnetic. The forest descriptions were centred on soil survey plots established at the time the descriptions were made. The plots were located at 50 m intervals along the 500 m long traverse. Three of the plots were located on a lower terrace at the Giles Creek end of the transact. Soils on the main terrace are dominantly Ahaura series, with Maimai soils occurring on poorly drained sites, while Ikamatua soils occur on the lower, younger terrace (C. Ross, pers. comm.). Additional plots were located in unlogged terrace forest at the south-eastern end of the mine area, and also in seral vegetation on previously disturbed areas near the access road. A species list for the three sites is appended (Section 6.1).

2.3 RESULTS

Cut-over forest

The forest ahead of the mining operation was cut in the early 1980s. Red beech (*Nothofagus fusca*), podocarps, mainly miro (*Prumnopitys ferrugineus*) and rimu (*Dacrydium cupressinum*), and some silver beech (*N. menziesii*) were extracted, but a cut-over forest structure remained between skid tracks. The sites described were all on a terrace with good surface stability and generally adequate drainage.

The canopy of the remaining cut-over forest was predominantly silver beech in a mixture with red and mountain beech (*N. solandri* var. *cliffortioides*), with the occasional cedar (*Libocedrus bidwillii*). The mean top height varied between 15 and 25 m, and the diameters ranged from 25 to 55 cm dbh (diameter at breast height). The canopy cover was generally about 40%, but varied from 20 to 65%. The beeches were also present in the sub-canopy (5–12 m), with silver beech again predominant. Mountain toatoa (*Phyllocladus aspleniifolius* var. *alpinus*) was also often dominant in this generally low-density understorey tier. Lancewood (*Pseudopanax crassifolius*), Hall's totara (*Podocarpus hallii*), pokaka (*Elaeocarpus hookerianus*), miro, rimu, silver pine (*Lagarostrobus* *colensoi*), and wineberry (*Aristotelia serrata*) were all present, but generally as isolated individual specimens.

The shrub understorey, below 5 m, had an array of species, varying in abundance at each site. Dominant species included the three beech species, mountain toatoa, pepperwood (*Pseudowintera colorata*), rohutu (*Neomyrtus pedunculata*), and *Coprosma* sp. aff. *parviflora*. Pink pine, kahikatea (*Dacrycarpus dacrydioides*), and *Podocarpus acutifolius* were present as individual saplings, and manuka (*Leptospermum scoparium*) was dominant at one site.

The vascular plant ground cover was even more diverse, with an abundance of ferns, including bracken (*Pteridium esculentum*). Ground cover varied from 10 to 80%. Seedlings of beech species were present in moderate numbers, and podocarp seedlings were generally also present in the vicinity of seed trees. Moss ground cover varied from 20 to 70%, and exposed soil and broken rock formed less than 5% of the surface cover.

Unlogged forest

The terrace forest adjoining the south-eastern end of the mined area has not been logged in recent years. The forest had a red/silver beech mixture with red beech sometimes dominant. The emergent beech extended to about 38 m in height and 80 cm dbh. A mixed beech canopy, with red and silver beech co-dominant, was about 20–30 m in height and 25–60 cm dbh. The overall canopy cover was about 45–60%.

The understorey was diverse, although the 5–12 m tier was of low density with both beech species, lancewood, wineberry, and broadleaf (*Griselinia littoralis*) present. The shrub tier was predominantly pepperwood and *Coprosma* sp. aff. *parviflora*, with other species similar to those found in the cut-over forest. The vascular plant ground cover was generally high (50–60%) and diverse, and beech, miro, and kahikatea were usually present. A notable species found in this unlogged area but not in the cut-over forest was a native broom (*Carmichaelia angustata*). Moss ground cover was minimal (<10%) and there was virtually no bare soil or broken rock exposed on the surface.

Seral vegetation

The disturbed areas of well drained and reasonably stable granite gravel mounds formed from drainage cuts alongside the access road had a 10–40% ground cover of vascular plants. Himalaya honeysuckle (*Leycesteria formosa*) predominated and extended to about 3 m in height. Other species present included silver beech, wineberry, mountain toatoa, bracken, rush species (*Juncus* spp.), ferns, and some grasses. Gorse (*Ulex europaeus*) was generally absent from disturbed sites in the area. The sites had 40–60% rock (loose rock <30 cm) and up to 20% bare soil, over and above the vascular plant ground cover, and minimal litter deposits.

2.4 CONCLUSIONS

Beech species dominated the canopy and sub-canopy tiers of cut-over forest on the main river terrace ahead of the mining front. Silver beech was the dominant species, but red and mountain beech were also prominent. In unlogged forest, red and silver beech were co-dominant, but mountain beech was much less prominent. The three species, and prominent species in the lower tiers of both forest types, including lancewood, wineberry, pepperwood, *Coprosma sp. aff. parviflora*, mountain toatoa, and Hall's totara, should all be considered as potential rehabilitation species after mining at Giles Creek. Broadleaf was also prominent in the lower tiers, but is too palatable to be recommended for use in rehabilitation works (see results of field trial). The occurrence of three of these species, namely silver beech, wineberry, and mountain toatoa, in seral vegetation on disturbed sites suggests that they may be particularly useful rehabilitation species. The occurrence of the exotic shrub, Himalaya honesuckle, on the same sites indicates that it is likely to become a prominent weed species on post-mining landforms at Giles Creek.

3. Field trial

3.1 OBJECTIVES

The main objective of the trial was to provide information on the survival and growth of a range of native tree and shrub species on an existing overburden dump which had minimum soil replacement and which had previously been revegetated with pasture species by the mining operation. Additional objectives were to compare bare-root and container-grown stock, and to examine the need for animal control measures for plantings of native species in a mineland rehabilitation situation at Giles Creek.

3.2 METHODS

The trial was established in August 1990 on an overburden dump at Giles Creek. The material capping the dump was composed mainly of finely weathered material from the granite gravels that overlay the coal seam, but included forest soil horizon and sandstone interburden material. The material was moderately acid (pH, 5.4), had low or very low levels of organic carbon (0.8%), total nitrogen (0.15%), available phosphorus (Olsen-extractable phosphorus, 3 ppm), and exchangeable cations (potassium, 0.13 me/100 g; calcium, 0.87 me/100 g; magnesium, 0.82 me/100 g) and a low cation exchange capacity (7.3 me/100 g). Annual precipitation at Maimai, approximately 5 km south of the trial site, was 2600 mm. The elevation of the trial site was approximately 200 m.

Prior to establishment of the trial the area had a herbaceous vegetation cover dominated by rush (*Juncus* spp), lotus (*Lotus pedunculatus*), and Yorkshire fog

(*Holcus lanatus*). This cover was removed by spraying with herbicide consisting of a mixture of glyphosate (Roundup®, 5 1/ha), terbuthylazine (Gardoprim®, 20 1/ha), and clopyralid (Versatil®, 3.3 1/ha), in late July 1990. Regenerating vegetation was controlled with release sprays consisting of glyphosate (2.5 1/ha) and clopyralid (0.3 1/ha), applied in May 1991, and glyphosate (2.5 1/ha), applied in December 1992.

Ten tree and shrub species were planted in the trial (Table 1). Of these, six were planted as both bare-root and container-grown stock, and the remainder were planted as bare-root stock only. The stock available at the time of planting were not grown specifically for the trial, and stock types of some species varied considerably in size (Table 1), largely because of differences in age. Two sizes of container-grown red beech were available and compared in the trial, namely small (19 cm height, 1 year old), and large (80 cm height, 2.5 years old). For silver beech, in addition to bare-root and container stock, wild plants were transplanted from near the mining site for comparison with nursery-grown stock. This technique has been used with some success by the mining company at Giles Creek. Rautawhiri plants were close to 1 m tall, and cut back to half this height at planting. Container-grown broadleaf stock were small and had poorly developed root systems. Ribbonwood plants were also noted to have poorly developed roots, but all other stock appeared to have good root systems.

A single tree of each species and stock-type combination was planted randomly in each of ten blocks (each block consisting of two adjacent rows) in a fenced plot, and also in an adjacent unfenced plot (20 blocks in total). The fenced/unfenced comparison was used to provide information on animal browsing. The plants were spaced at 1 m intervals along rows one metre apart. Plant survival and heights were measured in autumn for three years to determine treatment effects. The final assessment was made in April 1994.

TABLE 1. PLANT SPECIES AND MEAN HEIGHTS OF PLANTING STOCK USED IN THE FIELD TRIAL.

Species	Common name	Height at planting (cm)	
		bare-root	container
Nothofagus fusca	red beech	41	80[1] 19[2]
N. menziesii	silver beech	52[3] 47[4]	54
N. solandri var. *cliffortioides*	mountain beech	82	-
Podocarpus totara	totara	41	42
Dacrycarpus dacridioides	kahikatea	52	67
Griselinea littoralis	broadleaf	46	15
Coprosma robusta	karamu	34	-
Pittosporum colensoi	rautawhiri	47	-
Coriaria arborea	tree tutu	24	-
Plagianthus betulinus	ribbonwood	91	50

[1] 2.5 year old stock
[2] 1 year old stock
[3] nursery-grown stock
[4] transplanted from forest

3.3 RESULTS

Species performance

Species survival four years after planting varied from 100% in kahikatea to 1% in red beech (Table 2). Survival was also low (20% or less) in mountain and silver beech, tree tutu, and ribbonwood, somewhat better (35–50%) in rautawhiri, broadleaf, and karamu, and good in totara. Despite being located on the top of an overburden dump, the site was poorly drained, and surface water lay in low-lying microsites for long periods after rain. Rush species established in these waterlogged areas. The better survival of kahikatea compared with the other species is almost certainly due to its ability to tolerate the poorly drained conditions. Conversely the poor survival of tree tutu may be attributed to its low tolerance of such conditions (Pollock 1986). In natural situations the beeches as a group are considered to be relatively tolerant of poor drainage (Wardle 1984), which indicates that the poor survival of these species, in comparison with species such as totara, broadleaf, and karamu, may be due to other factors. On the other hand, planted beech seedlings are known to be highly susceptible to root rots, especially under poorly drained conditions (D.A. Franklin, pers. comm.). Poor stock quality is likely to have contributed to the poor survival of ribbonwood.

Height growth was poor in most species, ranging from nil in ribbonwood to a maximum of 16 cm/year in karamu and rautawhiri (Table 2). The temporal pattern of height growth of the species with the best survival is shown in Fig. 1. Kahikatea increased in height slowly but steadily almost from planting, whereas the remaining species showed virtually no growth in the first year. Kahikatea did not put on height growth in the third year; this is thought to be due to herbicide (clopyralid) damage which was observed in both kahikatea and totara after the second release spray was applied in December 1992. No damage was observed in the other species, indicating that podocarps may be particularly

TABLE 2: SURVIVAL AND HEIGHT GROWTH OF NATIVE TREE AND SHRUB SPECIES FOUR YEARS AFTER PLANTING ON AN OVERBURDEN DUMP AT GILES CREEK.

All values are means of bare-root and container stock. Values for survivals are means of fenced and unfenced plots, those for height growth are from the fenced plot only.

Species	Survival (%)	Height growth (cm/year)
Red beech	1	-
Silver beech	20	8
Mountain beech	5	3
Totara	75	3
Kahikatea	100	5
Broadleaf	42	3
Karamu	50	16
Rautawhiri	35	16
Tree tutu	10	4
Ribbonwood	17	-1

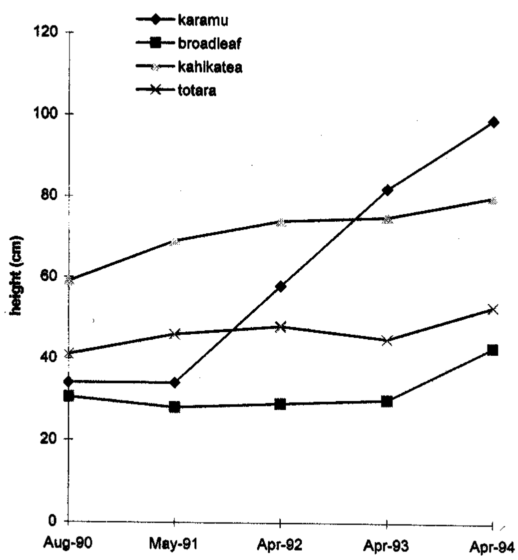

FIGURE 1: MEAN HEIGHT GROWTH OF THE FOUR SPECIES WITH HIGHEST SURVIVAL IN THE FENCED PLOT AT GILES CREEK.

sensitive to clopyralid. Karamu grew reasonably well after the establishment year, while totara and broadleaf showed no growth until the fourth year. Two species with poorer survival (silver beech and rautawhiri) exhibited similar growth patterns to karamu. In an adjoining fertiliser trial, karamu responded well to nitrogen fertiliser (Davis & Langer 1997), so that in addition to poor drainage, plant growth would have been limited by nitrogen deficiency. Pronounced N-deficiency symptoms were seen in broadleaf (yellowing of leaves) and red beech (reddening of leaves).

Effect of browsing

Species survival at the final assessment (April 1994) was significantly ($p<0.05$) lower in the unfenced plot than in the fenced plot. Because of lack of replication of the fencing treatments, the reduced survivals in the unfenced plot (Fig. 2) cannot be attributed directly to browsing. However, the effects of light

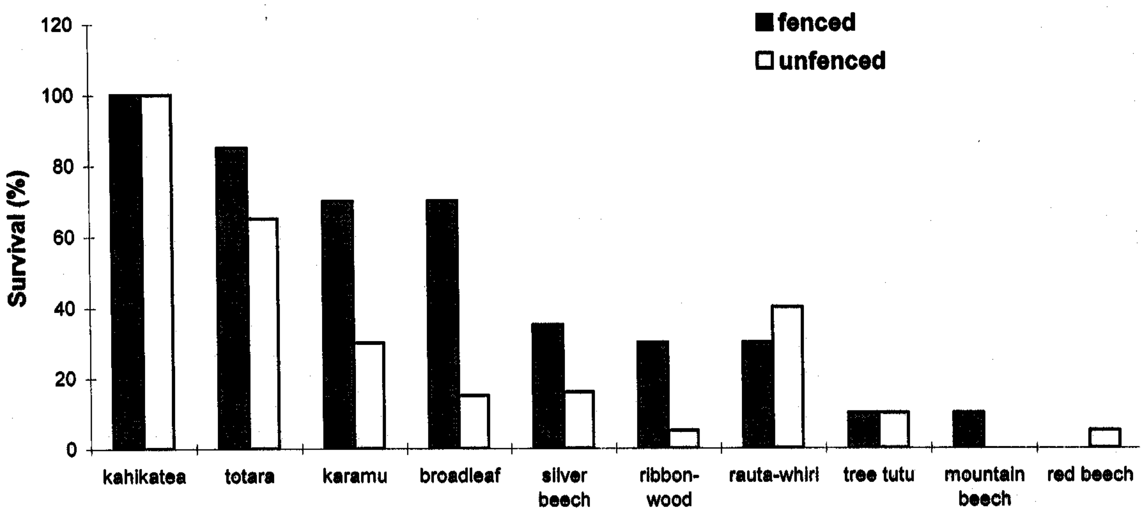

FIGURE 2. SPECIES SURVIVAL IN FENCED AND UNFENCED PLOTS, APRIL 1994.

browsing, mainly by hares, were observed in the unfenced plot at the end of the first growing season in tree tutu, broadleaf and karamu, and heavy browsing was noted in the latter two species in the following spring (one year after planting). Particularly heavy browsing by hares on broadleaf and karamu in the unfenced plot was noted in autumn 1993, and the survival of both species was substantially reduced in the following year (Fig. 3). These observations strongly suggest that the reduced survivals in the unfenced plot, particularly of karamu and broadleaf, were due to browsing. At various times during the trial limited browsing damage was observed on rautawhiri, totara and ribbonwood. No browsing damage was noted on kahikatea or any of the beech species.

At the final assessment, the height of surviving plants of broadleaf, karamu, and rautawhiri was substantially lower in the unfenced plot than in the fenced plot, but the differences were significant only in broadleaf and karamu (Table 3). The height of the podocarps and silver beech was similar in the two plots. Data for

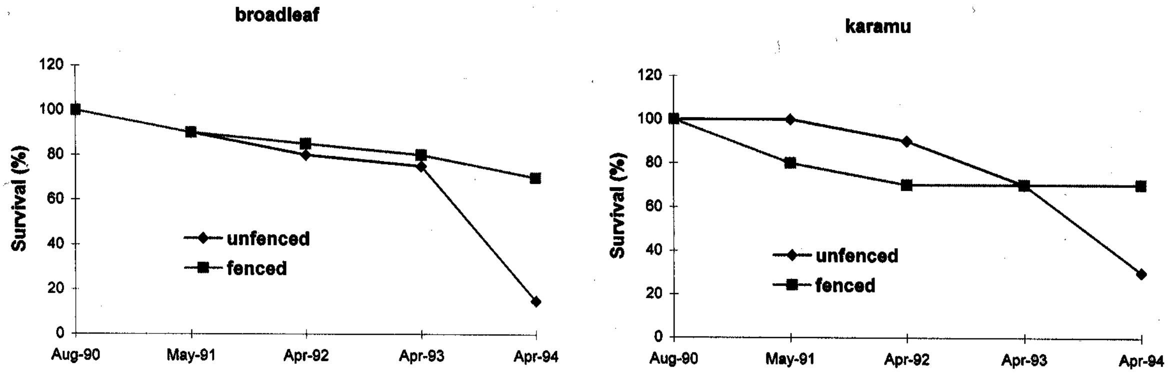

FIG 3. SURVIVAL OF BROADLEAF AND KARAMU IN FENCED AND UNFENCED PLOTS.

TABLE 3. MEAN PLANT HEIGHT (CM) OF SEVEN SPECIES IN FENCED AND UNFENCED PLOTS, APRIL 1994.

Species	Fenced	Unfenced	Significance
Silver beech	84	98	ns
Totara	53	59	ns
Kahikatea	80	84	ns
Broadleaf	43	25	*
Karamu	99	23	*
Rautawhiri	111	65	ns
Ribbonwood	64	71	ns

ns = not significant
* = significant at $p<0.05$

red beech, mountain beech, and tree tutu are not presented in Table 3 because of low survival of these species.

Effect of type of plant stock

There were no significant differences in survival between the different planting stocks at the final assessment. Differences in height between stock types were apparent in kahikatea and ribbonwood (Table 4), but these were present at planting (Table 1) and were not significant. However, height growth of container-grown broadleaf stock was superior to bare-root stock (Fig. 4), despite the initial small size and poor root systems of the plants. A similar situation occurred in red beech where the small container-grown stock initially fared better than the larger container-grown and bare-root stock, both in terms of height growth and survival, but ultimately most plants of all stock types of this species died. Thus for all species except broadleaf, and possibly red and silver beech, there appeared to be little advantage in using container-grown stock over bare-root stock. Forest transplants of small silver beech fared almost as well as nursery-raised stock in terms of both survival and height growth.

TABLE 4. EFFECT OF TYPE OF PLANTING STOCK ON PLANT SURVIVAL MEAN HEIGHT AT THE APRIL 1994 ASSESSMENT

	Survival (%)		Height (cm)	
	bare-root	container	bare-root	container
Red beech	0	0[1]	-	-
Silver beech	30, 20[2]	40	86, 87[2]	96
Totara	80	90	55	57
Kahikatea	100	100	71	91
Broadleaf	80	60	36	38
Ribbonwood	30	30	88	55

[1] includes both 1 year old and 2.5 year old stock

[2] transplanted from forest

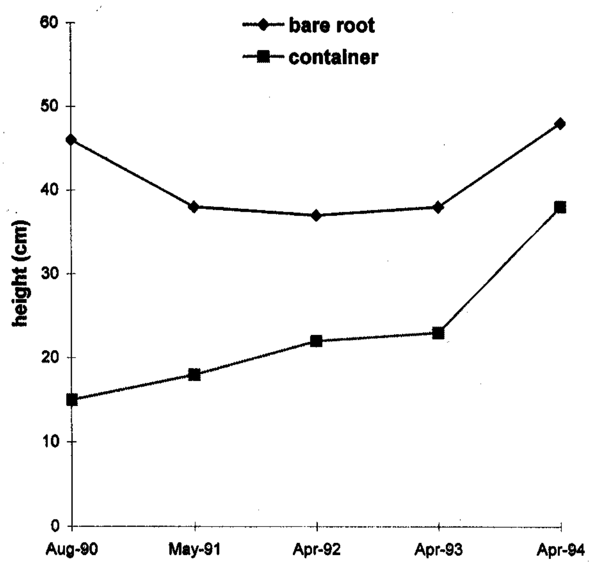

FIG. 4. MEAN HEIGHT GROWTH OF CONTAINER-GROWN AND BARE-ROOT STOCK OF BROADLEAF IN THE FENCED PLOT.

3.4 DISCUSSION AND CONCLUSIONS

The field trial was characterised by high mortality in most species, and slow growth rates in surviving plants of all species. The high mortality and slow growth rates are attributed to a combination of factors, including poor drainage, soil infertility (particularly nitrogen deficiency), browsing by hares, and in the case of ribbonwood, poor quality of planting stock. The results illustrate the difficulty of establishing native tree and shrub species on unmodified mine spoils where there has been minimal soil replacement, and indicate the necessity for correct site preparation techniques to overcome such factors as poor drainage and substrate infertility.

Survival was highest in kahikatea, indicating a tolerance of this species to poorly drained infertile substrates. Broadleaf and karamu survived well in the fenced plot, but these species were severely browsed in the unfenced plot. Where possible, use of palatable species such as these should be avoided in rehabilitation programmes unless adequate animal control is possible. Severe browsing of both species occurred in the third year of the trial, indicating that, to be successful, animal control work would need to be maintained over a long time period.

Survival of the beech species relative to other species was poor. Difficulties have been experienced with establishment of beeches by other workers (Wardle 1984), with failures being attributed to smothering by grass, browsing by rabbits and hares, drought during the first summer, and unseasonable frosts. Planted beech seedlings are also known to be highly susceptible to root rots, especially in poorly drained conditions (D.A. Franklin, pers. comm.), and this seems the most likely explanation for their poor survival in the present tiral. Further work is necessary to determine causes of failure and appropriate establishment methods for these species.

A range of pioneer shrub, small tree and tall forest tree species were included for testing in the present trial. In larger-scale operations, pioneer shrub and small trees species, which have more rapid crown diameter growth than tall tree species, should form the basis of rehabilitation programmes to provide early site occupancy, establish a forest microclimate, and reduce invasion of unwanted species. Such an approach should initiate a succession which would allow the subsequent invasion by tall forest tree and other climax species. The pioneer shrubs and small trees should include berry-producing species to attract birds, particularly if intact native forest exists in the vicinity of the restoration site; bird distribution of seed from existing stands will assist the colonisation process.

The results from the present trial indicate that, for many species, bare-root plants may perform as well as container stock in mineland rehabilitation situations. This result is useful, since bare-root plants are normally less expensive to purchase and plant than container-grown plants and have advantages in terms of transport and handling on the planting site. For silver beech, transplanting of plants from the forest in the vicinity of the trial site proved to be almost as successful as planting nursery-grown stock. However, there were too few surviving plants to recommend transplanting without further testing. While suitable wilding plants may not always be available from forest which is destined for removal in the vicinity of mine sites, the technique has obvious advantages in terms of cost savings. Transplanting of other species could be explored.

The present study was essentially a pilot trial designed to test the performance of species in a mineland rehabilitation environment. The results of the trial illustrate the desirability of including a relatively wide range of species in such a study, and of long-term monitoring of trials. The results also indicate the desirability of testing species both inside and outside animal exclosures, though trial design should allow for greater replication of treatments than was included here.

4. References

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6. Appendix

6.1 SPECIES LIST FOR TERRACE BEECH FOREST, GILES CREEK

Lycopods

Lycopodium volubile	climbing clubmoss

Ferns

Asplenium bulbiferum	hen and chicken fern
A. flaccidum	hanging spleenwort
Blechnum colensoi	
B. discolor	crown fern
B. fluviatile	kiwakiwa
B. "large kiokio"	
B. "procerum"	
Cyathea colensoi	
C. smithii	soft tree fern
Gleichenia microphylla	parasol fern
Grammitis billardieri	
Histiopteris incisa	water fern
Hypolepis rufobarbata	
Leptopteris superba	Prince of Wales Feathers
Paesia scaberula	lace fern
Polystichum vestitum	prickly sheild fern
Pteridium esculentum	bracken
Rumohra adiantiformis	leathery sheild fern
Sticherus cunninghamii	umbrella fern

Gymnosperms

Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Halocarpus biformis	pink pine
Lagarostrobus colensoi	silver pine
Libocedrus bidwillii	pahautea, cedar
Phylloclaudus aspleniifolius var. *alpinus*	mountain toatoa
Podocarpus acutifolius	
P. hallii	Hall's totara
Prumnopitys ferrugineus	miro

Monocotyledons

Agrostis stolonifera	creeping bent
Astelia sp.	
Cortaderia richardii	toetoe
Gahnia pauciflora	
Holcus lanatus	Yorkshire fog
Juncus sp.	rush
Microlaena avenacea	bush rice grass
Uncinia species	hook grass

Dicotyledons

Aristotelia serrata	makomako, wineberry
Cardamine sp.	bittercress
Carmichaelia angustata	
Carpodetus serratus	putaputaweta,marble leaf
Cirsium vulgare	scotch thistle
Coprosma ciliata	
C. colensoi	
C. foetidissima	
C. pseudocuneata	
C. rhamnoides	
C. rotundifolia	
C. sp. aff. *parviflora*	
Cyathodes fasciculata	mingimingi
C. juniperina	
Cytisus scoparius	broom
Digitalis purpurea	foxglove
Elaeocarpus hookerianus	pokaka
Fuchsia excorticata	kotukutuku, tree fuchsia
Gautheria depressa	snowberry
Griselinia littoralis	broadleaf
Hebe salicifolia	koromiko
Hypochaeris radicata	catsear
Leptospermum scoparium	manuka
Leycesteria formosa	Himalaya honeysuckle
Myrsine divaricata	weeping mapou
Neomyrtus pedunculata	rohutu
Nertera depressa	
Nothofagus fusca	red beech
N. menzeisii	silver beech
N. solandri var. *cliffortioides*	mountain beech
Parsonsia heterophylla	kaiwhiria
Pennantia corymbosa	kaikomako
Pseudopanax anomalus	
P. crassifolius	horoeka, lancewood
Rubus australis	horopito, pepperwood
R. cissoides	bush lawyer
Schefflera digitata	pate
Senecio jacobaea	ragwort
S. quadridentatus	
Viola lyallii	