Another site that has revealed surprise after surprise in the High Plains Ecological District is the western end of Leaches Road near Windwhistle. Here, *Heirochloe redolens*, *Aciphylla subflabellata*, *A. aurea*, *Bulbinella angustifolia*, and the occasional *Melicytus alpinus* line the road. The plant community at this site is almost certainly a product of the large rocks that were dumped on the road berm some time ago, thus making it impossible to mow.

## RESTORATION PLANTING – ARE WE SAVING OR SABOTAGING OUR PRECIOUS NATIVE REMNANTS?

**Miles Giller**

Practically everyone enjoys planting trees. In today's carbon-aware society it almost seems like a personal contribution to saving the planet, though there are many perhaps less noble motives. Trees can provide spiritual and physical sustenance through their beauty, shade, shelter, fruit and timber. We are not the only beneficiaries. Trees provide habitat for a myriad of wildlife, from conspicuous birds to near-invisible invertebrates plus a vast array of microbial associates.

In a country where people have taken a significant toll on our formerly extensive native forests, New Zealanders are becoming more aware of the plight of our native trees and shrubs. Our flora is increasingly celebrated in our parks and gardens, enough to support a healthy native plant focus in our nursery industry. Once perceived largely as a source of cheap timber to exploit or as an impediment to agricultural production or exotic forestry, our native plants are increasingly regarded as symbols of the New Zealand identity, something to be celebrated - or at least tolerated. However, the change in perception is far from universal. Whilst increasing numbers of landowners actively protect our botanical heritage, precious fragments are still succumbing.

Only a few decades ago central and local government were providing incentives to clear residual native vegetation, yet many of those agencies are now providing incentives to protect and 'enhance' them. Most district councils have schedules of sites with residual native flora and habitats for fauna, intended to provide these sites with a level of protection. These, along with changing public perceptions, have led to numerous areas of residual native

vegetation being actively cared for, some also gaining long-term legal protection through reserve or covenant arrangements.

Around three quarters of New Zealand's original forests have been destroyed since the arrival of people, with the remaining areas biased towards the wetter and steeper terrain of the high mountains and land to their west. The eastern coast of the South Island has lost the vast majority of its former forest cover, lowland parts of Marlborough, Canterbury and Otago faring particularly poorly. It can now be challenging to see any residual native vegetation when travelling across parts of the Canterbury plains. Any that does remain is likely to occur as individual plants or as secondary associations, isolated from similar remnants and modified by a history of suppression or indifference. An array of exotic species often threatens to dominate, both visually and ecologically. This is usually to the ultimate detriment of the native survivors, though just occasionally some exotics can act as surrogate companions. The more vulnerable or palatable elements are often suppressed or even absent, and ecological processes such as seed dispersal and recruitment can be dysfunctional. Thankfully, however, there are still places in Canterbury where significant remnants of native vegetation can still be found, especially where rough terrain or unproductive soils have provided refuge from fires, livestock or other sources of disturbance.

Those fortunate enough to own land still supporting such fragments have a personal opportunity to protect these. For those who feel so inclined, the instinctive response is to want to replace exotic imposters with natives, and to restore the species assemblages back to their original state, preferably as quickly as they can. For most of us, this probably conjures visions of planting.

However, experience has shown that nature can often achieve the recovery we might seek, provided the necessary sources of recruitment are still present and the impediments to regeneration processes are not too great. Nature has its own mechanism for recovery: natural regeneration.

The process of natural regeneration can seem slow. High rainfall does tend to hasten things, but we cannot control our weather. Thankfully there are other constraints that can often be managed to significant advantage.

Fencing out livestock can provide dramatic benefits for degraded forest associations, as most forest species are vulnerable to browsing and cannot recruit under prolonged browsing pressure (Figs 1-6). Some non-forest associations, such as tussocklands, can benefit from a degree of ongoing grazing, depending on species composition and our long-term aspirations. Whilst good fences should be capable of excluding livestock, wild animals tend to be more difficult to manage. Native fauna can be closely involved in seed production and dispersal, and therefore they too need to be protected from pest animals. Many pest animals are individually small although their cumulative impact can be considerable.

**Figure 1** May 2009: A previously grazed area of secondary semi-coastal forest immediately after fencing and de-stocking. Lower tiers are still dominated by unpalatable or browse-resistant species.

**Figure 2** December 2010: In the absence of livestock, palatable species are beginning to volunteer.

**Figure 3** October 2011: The early recovery of palatable species is set back after livestock break in.

**Figure 4** November 2014: Fences are repaired, livestock are evicted, and palatable species again begin to recover.

**Figure 5** August 2015: A severe drought constrains the recovery process.

**Figure 6** August 2017: A wet period again allows the recovery of lower tiers to advance.

Exotic plants compete for resources and are generally regarded as unwanted weeds. Small stature weeds, especially if intolerant of shade, can often be suppressed and eventually even excluded by the development of a continuous taller native canopy. However shade-tolerant and taller weed species sometimes need to be actively managed in the longer term to limit their impact. Many exotic grasses are particularly competitive during native seedling establishment. Both trials and general experience have demonstrated that effective suppression of grasses can have a very strong bearing on rates of native plant recruitment (Fig. 7). Thankfully the need for active management of many weeds does diminish as taller native species assert increasing site dominance.

**Figure 7** Exotic cocksfoot grass (*Dactylis glomerata*) completely dominant under a sparse canopy of plains kanuka (*Kunzea serotina*).

Nevertheless, it may take decades for natural regeneration to reach a point where native species become visually dominant and where ecological processes become sufficiently functional to underpin sustainability. That is a long time relative to a human life-span, so it is not surprising that many are tempted to 'speed things up' a little by carrying out some active planting. However, it is worth first considering the wider implications.

Nature is far from random. Naturally occurring vegetation sorts itself out according to ecological patterns and processes. Various species occupy particular niches. Some are generalists and others are quite specific in terms of where they will or won't flourish. Different species have differing preferences or tolerances of soil types, aspect, rainfall, drainage, fertility, temperatures and shade, and juxtapose themselves in time and space accordingly. Canterbury

has a broad range of habitat opportunities, stemming especially from its broad ranges of landforms and climates. Quite subtle site differences can have a strong bearing on what species prevail where.

Plants often establish through a successional process. Some species are tough pioneers capable of prospering under exposed conditions, while others require a protective framework of associated species. Composition is rarely static, as plant associations at any place can change with time, with additional species recruiting and others dropping out. Interdependence can occur at unseen levels: mycorrhizal and faunal associations can be pivotal in determining the health and survival of certain plant species.

Differences also occur at the genetic level, with plants at each site evolving local characteristics reflecting local selective pressures. For some species like kowhai (*Sophora microphylla*) this has led to quite distinct local forms.

Each remnant provides a vignette-like representation of the former vegetation patterns at that particular site, at both species and genetic levels. Each is subtly unique, and if we are to truly respect and protect their ecological integrity we need to avoid actions that might compromise them.

If we are to do any planting, the species selection, placement and timing needs to be very accurately managed. It can be argued that non-local native species or provenances are just as problematic as exotic weeds, as any such plant simply takes up space and resources that might otherwise be occupied by a representative local species. This can be especially problematic if the non-local species is fecund, as their progeny can occasionally become aggressive volunteers. At least non-local species can usually be identified and removed. However, if they hybridise with local species or are otherwise difficult to distinguish they can be very difficult to manage. The North Island lacebark (*Hoheria sexstylosa*) has caused major problems in several South Island sites, volunteering aggressively and hybridising with the local *Hoheria angustifolia* where present, all at the expense of representative local species.

The practice of restricting plant selection to local provenances goes some way to addressing the issue. However, the presence of a species at one locality does not necessarily mean that it is suitable for a nearby locality, as the two sites may have quite different habitat characteristics. Further, the importance of selecting local provenances is inconsistently recognised and applied. Some nurseries, advisors and planters are keen advocates whilst others are ambivalent. The ideal provenances are not always available when wanted, and substitution with alternative species or provenances is not uncommon. There is often a temptation to purchase plants on price rather than provenance, as we can get greater numbers from cheaper lines, allowing us to achieve greater coverage.

Probably the greatest challenge, however, is determining with certainty just what species to plant, especially those to concentrate on. Even with the best of intentions, it can be very difficult restricting plant selection to species and

provenances reliably known to be representative of a particular site. There is always a temptation to include or even concentrate on fast-growing or easy-care species, on rare or iconic species, and on species which we might otherwise find attractive. Species such as lowland ribbonwood (*Plagianthus regius*) and kohuhu (*Pittosporum tenuifolium*) often form the mainstay of restoration species selections, regardless of whether either was likely to have been a major component of the original vegetation. This is largely because these hardy and fast-growing species satisfy our desire for rapid results, but whether either is ecologically representative or makes a positive contribution to underlying ecosystem values or successional development can be questionable (Fig. 8). Their competitiveness is an advantage when establishing them, although this trait can also make them poor nurse or companion plants. If planted in bulk they tend to dominate at the expense of most other species, to the point of forming near monocultures (Fig. 9, p. 15). Similarly the popular shrub *Muehlenbeckia astonii* seems to pop up in numerous so-called restoration plantings well outside its natural distribution. Whilst it might be argued that there is value in planting a naturally rare species that has a reputation for providing excellent habitat for invertebrates, this nevertheless compromises ecological integrity. Local invertebrates should ideally be provided with their local host species.

**Figure 8** Margins of competitive kohuhu (*Pittosporum tenuifolium*) and a canopy of lowland ribbonwood (*Plagianthus regius*) and narrow-leaved houhere (*Hoheria angustifolia*) have provided rapid cover, although there is little diversification or recruitment of other species 40 years after planting.

**Figure 9** Mass plantings of kohuhu (*Pittosporum tenuifolium*) can dominate for decades at the expense of virtually all other plants.

The greater the proportion of unrepresentative species or provenances we introduce, the greater the risk of compromising what we started with. Restoration involves the sympathetic and ideally seamless integration of quite specific plants into an existing ecological framework. If we introduce the incorrect plants, or do not match them to their preferred niches, then our efforts might instead be regarded as intrusive and inappropriate impositions.

It is sometimes simplistically argued that non-local species and provenances can be included, and that nature might somehow 'sort itself out' in due course. If such plants serve a useful short-term function such as nursing the establishment of local species, then perhaps there are grounds for them to be temporarily accommodated. In such cases it is highly preferable that such plants are short lived and cannot reproduce or hybridise, effectively giving them in-built obsolescence. Unfortunately very few species are this accommodating. Many non-local species and provenances are likely to persist through recruitment processes and are unlikely to provide any long-term ecological benefit. Nature is most unlikely to 'sort this out' in the way we want. Instead, a control programme will be required, making such plants little more than an unnecessary and potentially expensive weed burden. If we don't carry out the control, then the non-local species are likely to permanently compromise our remnant's ecological values.

The argument that non-local plants might be providing a useful nursing function is often cited as an excuse for the inclusion or retention of non-local species. However, a nurse plant is primarily intended to be a short-term means to an end. All too often sentimentality gets in the way and the nurse

plants are allowed to remain. Somehow nurses all too often look more appealing than their patients.

It is sometimes argued that local provenances of local species always perform better. However this depends on one's objectives. The growth rates of non-local species or provenances can sometimes outperform those of local species or provenances. One contributing factor is that local invertebrates can lack tolerance to a non-local plant's chemical defences, meaning that the non-local plant suffers less from invertebrate damage. Following on from this, failure to provide suitable habitat for the local invertebrates means these and other local fauna that depend on them can be disadvantaged. At Matawai Park in Rangiora a copse of *Plagianthus regius* sourced from South Westland grows lushly, the foliage barely affected by grubs. A few metres away trees in a copse sourced locally from Banks Peninsula are smaller and periodically appear tatty, because they support local invertebrates (Fig. 10). A gardener might regard the non-local provenance as better, but from a conservation perspective the local selection is performing far better – the local provenance provides habitat for local invertebrates and ultimately for local insectivorous birds. The value or success of restoration plantings is not judged just on the performance and appearance of the visually dominant plants, but also on the contributions those plants provide through their interactions with associated flora and fauna.

**Figure 10** Lowland ribbonwood (*Plagianthus regius*) sourced from South Westland (to right) are scarcely damaged by local invertebrates, while the same species sourced from Banks Peninsula (to left) periodically supports a good array of local invertebrates.

Just occasionally there may be valid grounds for introducing a not-so-local provenance. Very small and isolated populations of some species occasionally lack the genetic diversity to produce healthy offspring, and the introduction of a fresh genotype from elsewhere can help to overcome this recruitment bottleneck. This 'genetic enrichment' argument does not, however, validate bringing in non-local selections of those species that already have an adequately broad genetic base, as that would unnecessarily dilute the genetic integrity of that species already at the site. Conservation is about protecting what we have, it provides no mandate for us to try to create something different that we might somehow regard as better. Conservation, gardening and plant breeding have very different objectives.

Similarly, some naturally occurring ecosystems are dominated by just a small suite of species. Again there is unlikely to be conservation advantage in extending species diversity by introducing non-local species, as these are likely to prosper at the ultimate expense of the representative local species. The value of a remnant is not so much determined by the tally of different species present, as by the representativeness of the species present. Remnants do not need to be embellished.

The long term survival of various species tends to be determined by site extremes. Factors like the coldest or latest frosts, the hottest temperatures, or the driest or wettest the soils get will often determine survival. Some plantings may persist for a period but eventually get eliminated by one or more of a site's extremes. Certainly this can occur in nature, but nature usually has sufficient abundance to accommodate this. When it happens to large numbers of planted stock, which may have taken a significant investment up to that point, this can represent a major waste of resources.

Remnants of native vegetation on the Canterbury plains are very scarce. Therefore they assume particularly high value, even if they are relatively degraded. They are often the 'last crumbs' and can act as important historical and ecological touch-stones of the former native vegetation, even accepting that some former species are likely to now be absent. Preventing further loss and protecting what we already have are our top priorities. Where such high values remain, a precautionary approach seems warranted, whereby any reintroduction of suppressed or supposedly missing species needs to be treated with considerable caution, lest we unwittingly compromise what we already have. A strategic planting programme may possibly have benefits, but before embarking on this it is worth determining whether other less obtrusive forms of intervention may be sufficient to overcome recruitment hurdles. For example, simply suppressing exotic grasses with selective herbicides, and some minor soil scarification has been shown to facilitate the recruitment of plains kanuka (*Kunzea serotina*) and of several associated species in some Canterbury Plains dryland sites (Fig. 11, p. 18).

If there is no native vegetation whatsoever remaining, and we wish to establish a brand new example of supposedly representative vegetation, then

this will need to be done from scratch. In the absence of natural or introduced seed sources, a planting programme is the only available option. Provided there is a clear understanding of which plant species are ecologically appropriate for each site, these projects offer the opportunity to recreate useful representations of former plant communities that will hopefully provide linkages and habitat opportunities for some associated biota to eventually utilise. Whether they will eventually gain anything like the full suite of originally associated biota is unknown, though there are encouraging examples of most unexpected plants and animals which have somehow arrived and taken up residence in artificial plantings.

**Figure 11** Plains kanuka (*Kunzea serotina*), the olive-coloured 'clumps', regenerating prolifically after exotic grasses have been suppressed with a selective herbicide.

Planting natives for amenity purposes implies that we need not be so concerned about existing flora. However, amenity plantings are quite capable of proliferating and spreading into nearby remnants, so again a precautionary approach to species selection may be warranted.

If planting within remnants, we want to be assured that our efforts will contribute to the protection of the ecological values already present. Potential benefits include the re-establishment of formerly important species which have been lost (especially if there are no longer any natural seed sources available), the bolstering of forest margins to provide protection from edge effects, and more rapid suppression of problematic weeds. However, it is not uncommon to see examples where so-called restoration plantings provide few if any ecological benefits, and compromise the values of remnant vegetation

rather than complementing them. If so, then our well-meaning interference is arguably counter-productive. On the other hand, natural regeneration is likely to be ecologically tuned (especially if all the appropriate seed sources are available), but the process generally takes far longer and can sometimes be less assured. Whether one or the other option is chosen, or perhaps a mix of the two, depends on setting clear goals at the outset.

Most of the potential pitfalls associated with planting can be avoided by having a thorough understanding of which species belong where – and sticking to these. Unfortunately this sometimes appears to be rather too demanding a requirement. There are simply so many factors involved and lessons to be learned. It seems that the more we know, the more we realise we don't know – nature can be confoundedly complicated. There are useful maps and guides to aid the enthusiast in species selection, albeit that they tend to be somewhat broad-brush. Some plant nurseries have promoted so-called 'restoration packs'. However, whether the species included in such 'one mix fits all' selections will have much relevance to their eventual planting site is unassured.

With limited resources at our disposal, our inputs towards restoration need to be strategically directed. Purchasing, planting and tending nursery-grown stock is very expensive and time consuming, and establishment practices can easily disturb existing values (Fig. 12).

**Figure 12** Zealous weed control around planted stock may promote the establishment of these plantings, but can also damage pre-existing values.

Whilst it is often possible to get volunteers to assist with planting, it is usually far more difficult to get suitably skilled assistance for the necessary weed control, pest control and moisture management practices that are frequently required to get those vulnerable plants through to independence. Without appropriate aftercare, there is a risk of achieving low establishment rates. The natural regeneration process is much less likely to disturb existing ecological values. It too will usually benefit from good weed control and pest control. However, with patience and good seed availability this is usually less demanding, though possibly more prolonged.

We are often encouraged to plant more natives. Planting is perceived as a positive action and as a good way of fostering community awareness and involvement in other facets of conservation. Indeed, planting natives can sometimes become spiritually rewarding to the point of becoming almost addictive. We need to remind ourselves that any such planting within remnants needs first to be justified on ecological grounds, any personal feel-good being merely a useful bonus.

What we plant and where we plant it is paramount. There are potentially serious implications for our precious remnants if we get it wrong. Perhaps we need to take more care deciding where planting might be appropriate - or indeed inappropriate. Given enough time and a little encouragement in the form of pest and weed control, maybe nature can deliver the best results. This is not a new concept. The majority of reserves and covenants rely exclusively on the healing powers of nature, Banks Peninsula's Hinewai Reserve being among the best known local examples.

It should be remembered that much of lowland Canterbury's best protected native vegetation includes significant secondary elements that have recovered following earlier disturbances – sometimes within living memory and frequently despite the best efforts of our forebears to prevent that recovery. We all too often underestimate nature's resilience, and perhaps overestimate our own ability to deliver the best conservation outcomes.

Sometimes it might be safer to be patient and just allow nature to take the lead. It is a pity that for something that is free, patience always seems to be in such short supply.

**Acknowledgements**

Thanks to several fellow Canterbury Botanical Society members who have shared with me their thoughts and experiences regarding the effects of some restoration planting programmes.