MATAWAI PARK – REGENERATION 44 YEARS ON

Geoff Henderson and Miles Giller
Matawai Park Advisory Group

In 1968 the Rangiora Borough Council purchased 4.8 ha of bare farm land in Southbrook, on the southern outskirts of Rangiora township. The purpose of the purchase was perhaps inauspicious, the Council foremost wanted a convenient site to deposit large amounts of spoil that needed to be excavated from nearby Percival Street during its reconstruction. The site was regarded as suitable because of its proximity and because of its limited development potential - the land was considered too soft and low-lying for housing or other development. It was also recognised that there were few public parks in the locality, and that the area might subsequently be developed as a park of some sort for public amenity purposes.

The upgrade of Percival Street proceeded, and by 1972 the landform of the park had been greatly modified to include a small central pond, several drains, and extensive mounds of material, some up to 3 m high. That material included some topsoil, but also considerable quantities of peat and clay, plus occasional remains of the original Percival Street infrastructure including hunks of concrete kerbing, tar-seal, old sewer pipes and road foundation material.

In a rather enlightened move for the times, it was decided to plant the park in New Zealand native trees and shrubs. This decision was made well before native plants had become as extensively planted in public areas as they are now. The site had been virtually devoid of native vegetation, though early records indicated that the locality had originally supported wetland podocarp forest akin to present-day Riccarton Bush (Fig. 1). The name Matawai means

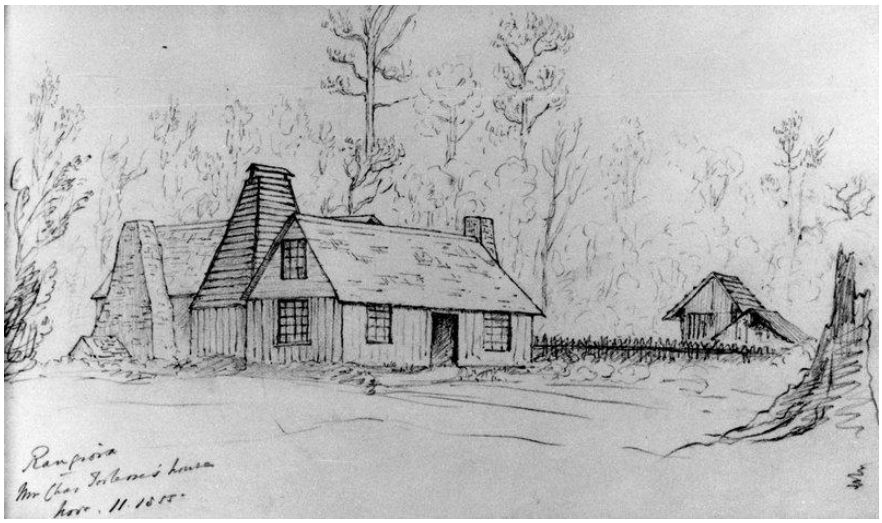

Figure 1 The Torlesse home on the northern outskirts of Rangiora Bush, as sketched by W.J.W. Hamilton on 11th November 1855. Note the large kahikatea trees in the background, roughly where Matawai Park is now located. Picture courtesy of Canterbury Museum ref: 14008.

source of springs, alluding to several springs that, despite ditches, periodically saturated lower lying parts of the park.

Matawai Park was conceived largely before modern ecological restoration principles and practices had evolved. There was no intention to recreate or represent the original Rangiora Bush, simply a wish to base the plantings around the native plants of New Zealand. The nearest naturally occurring native vegetation remnants of any substance were fragments of black beech forest in Ashley Forest and Mount Grey, some 10 km or more to the north.

The process of digging, moving and redistributing the mounded material had resulted in a high level of compaction, which subsequently posed a significant constraint on plant establishment and had ongoing ramifications. Large quantities of dried sewage sludge were spread and cultivated into the mounds in an attempt to reduce compaction and aid root penetration. This certainly improved the structure and fertility of the surface material, although exotic twitch (*Elytrigia repens*) took particular advantage of this, and soon dominated many areas. A wing-tined ripper was used to break the compacted soils to a greater depth, and plant establishment was increasingly carried out in accordance with the best practice techniques of the forestry industry. All this was before the development of the systemic herbicides available today, and a lack of effective weed control proved to be another major impediment during early plant establishment.

Planting was concentrated on the raised mounds, while the relatively intact soils of remaining flat areas were generally kept as grassed open space for public access and recreational activities (Fig. 2, p. 34). The main planted areas present today were established primarily between 1972 and the mid-1980s, though there has been a programme of regular consolidation and enrichment planting carried out since then. Unsurprisingly, initial plantings were somewhat eclectic, and several early plantings failed to survive. Plant selection was gradually refined, taking into account lessons from past successes and failures, with increasing emphasis on those native species that grew well at the site, especially those that could cope with weed competition and that were relatively cheap and easy to produce in large numbers. Consequently the plantings tended to centre around “best bets” such as kohuhu (*Pittosporum tenuifolium*), *Pittosporum colensoi*, lacebarks (*Hoheria angustifolia* and *H. sexstylosa*), lowland totara (*Podocarpus totara*), black beech (*Fuscospora solandri*) and lowland ribbonwood (*Plagianthus regius*). These were often planted densely in order to achieve dominance over exotic weeds, and (excepting lowland ribbonwood) were capable of rapidly shading out most competitors through the development of a dense canopy, though the down side was that they eventually also tended to arrest natural regeneration. In some areas they grew to form virtual monocultures, and even 40 years later

still support very restricted lower tiers and have limited natural recruitment or evidence of successional development. A range of less vigorous or less competitive species were included in early plantings, though generally in low abundances as their establishment and upkeep was initially too risky or demanding.

The emphasis on performance meant that non-local species and provenances were freely used – there was no intention to restrict plant selection to local species and provenances. Interestingly, some non-local species or

Figure 2 A range of ecologically-based plant communities have been established on the built-up areas of the park.

provenances have outperformed local selections. A non-local provenance of *Plagianthus regius* sourced from South Westland has clearly grown faster than a local provenance sourced from Banks Peninsula, probably due in part to its apparent resistance to utilisation by local invertebrates. Similarly, hybrid *Pseudopanax* plants (showing some degree of non-local *P*. *lessonii* parentage) recruit freely in the park from nearby gardens, while the local species *P*. *arboreus* and *P*. *crassifolius* currently show very limited propensity to recruit.

Silvereye / tauhou was the only native frugivorous bird regularly present, though blackbirds, starlings and thrushes probably provided some service as alternative vectors for native seed dispersal, even if they also brought the seeds of several weeds into the park from nearby properties.

Weed control at Matawai Park evolved as new techniques and products became available. The early practices of paper mulching and physical weed suppression were gradually superseded by the use of modern herbicides.

However, by the late 1980s the approach of council staff was still largely akin to the gardening approach applied to most other urban parks. This resulted in reactive subjugation of weeds, but rarely achieved much long term control or elimination of weeds, and management practices frequently impacted severely on any natural regeneration that might be occurring.

By the late 1980s the concept of ecological restoration and the significance of representativeness were becoming better appreciated, and some members of the public began latching onto the novel idea that perhaps Matawai Park could in some way be developed to represent the wetland podocarp forest that originally grew in the area. Whilst the idea had obvious appeal, the substantial changes to the landform and hydrology, and the prior establishment of a relatively wide range of native species meant that this was no longer achievable across the whole park.

In 1990 Matawai Park was officially opened by Margaret Austin MP, eighteen years after planting had begun. Recognising that much of the park's development had been achieved by volunteers from the wider Rangiora public, Waimakariri District Council established a group to develop a formal management plan to set policies that might guide the park's future development.

The concept of somehow securing some degree of representativeness was strongly promoted, and a pragmatic (albeit compromise) solution was eventually adopted: Matawai Park was to be developed to represent the flora of Canterbury, from the mountains to the sea. This fitted quite well with the patterns of existing plantings, which fortuitously were based on associations which could be adapted without too much difficulty to loosely reflect several of Canterbury's main plant communities.

After ratification of the management plan in 1993, a Matawai Park Advisory Group was convened, to guide the implementation of the plan. The Matawai Park Management Plan sets out the objectives and policies governing Matawai Park. The Major Management Objective is:

To provide and preserve Matawai Park as an area of native vegetation managed for historical, botanical, aesthetic, recreational, conservation and education purposes for the use and enjoyment of the public.

The emphasis on the native flora of Canterbury and Rangiora Bush was expressed in the Vegetation objective:

To develop and maintain a programme of planting and managing native species to enhance the general environment of the park and to reflect the native flora of the Canterbury region, in particular the original Rangiora Bush.

The Matawai Park Advisory Group soon realised that although many initial plantings were doing well, ecological processes were scarcely functional in the park, and that exotic weeds, especially twitch and other grasses, were still a major constraint. In order to deliver the objectives of the management plan efficiently, the group devised a series of standards, which included both ecological and practical considerations.

One of these, Managing for Self-sustainability, sets out how management could allow Matawai Park to mirror the natural processes that occur in appropriate Canterbury native plant communities. This approach was designed to create conditions that would promote natural regeneration and was used as a tool to encourage appropriate biodiversity as well as minimising management requirements and costs.

As planting developed since 1972, canopy shade from nurse plants suppressed weeds and the development of a modern range of systemic herbicides progressively allowed remaining dominant weeds to be more effectively controlled. Canopy closure reduced the need for weed control but sometimes also resulted in a single-age cohort that excluded light from the floor, thus preventing natural regeneration from the limited seed source present (Fig. 3). However, as the canopy nurse species senesced, or as some nurse species were removed for enrichment planting, the increased light

Figure 3 Largely vacant understorey and groundcover resulting from a longstanding dense canopy of kohuhu (*Pittosporum tenuifolium*).

required for regeneration processes also recreated conditions where weeds as well as native plants thrived (Fig. 4). A cohesive approach was clearly needed to achieve Management Plan outcomes.

Figure 4 Vigorous growth of weeds accompanying a group of podocarps and hardwood associates planted in a recently created light well.

The ecological principles that underpin the Managing for Self-sustainability standard are those that occur in nature: plant interdependence, dynamism, succession, disturbance, site specificity and variation. These ecological principles were used in Matawai Park to create representations of several feasible plant communities: Beech Forest, Lowland Podocarp/Hardwood Forest, Successional Broadleaved Scrub, Forest Margin, Wetland/Swamp, Stream/Pond side, Tussock/Grassland and Coastal. Even areas of open lawn provide opportunities, e.g. several herbs such as *Leptinella squalida* have been encouraged to spread through the mown grass.

Whilst it will never be possible to include all species associated with each community, attempts have been made to include the most representative species for each. These practical community classifications are dynamic and are loosely defined by a mixture of physical and biological factors. Although biological dynamism means that plant community boundaries can never be rigidly maintained, community concepts have been helpful in guiding enrichment planting list choices. Within constraints, the self-sustainability

approach fosters a degree of ecological integrity, by creating a range of community-based native flora and fauna relationships similar to those of natural ecosystems in the most appropriate physical environments the park can offer.

This approach, however, does not preclude intervention. Value judgements, guided by plant community composition and species relationships, were made to promote natural ecological succession where this was wanted. At times, this meant selective removal of the nurse canopy to allow a greater diversity of species to thrive. A good example of this occurred after it was decided that all further plantings in Matawai Park should be of Canterbury provenance, when several hundred North Island lacebark (*Hoheria sexstylosa*) were drilled and poisoned. Remaining logs then provided habitat for fungi and invertebrates, whilst the canopy gaps created an opportunity to include plants that had previously been too tender to establish, such as mahoe (*Melicytus ramiflorus*), and wineberry (*Aristotelia serrata*).

The attempt to establish representations of several native plant communities in an artificial context, and to retain each of these *in situ* does pose problems. Some plants volunteer out of context, and some communities require a degree of disturbance or manipulation if they are to be retained. Intervention is occasionally required to arrest successional development, such as the routine removal of lowland ribbonwood seedlings volunteering in the Tussock/Grassland or Forest Margin communities.

Later, in 1999, as the self-sustainability model developed, Matawai Park was formally gazetted as a Scenic Reserve, as it was felt this designation was most appropriate for the park's values. Matawai Park does, however, have a strong people focus as well, meaning the park cannot simply be managed as a succession back to mature forest. Open grassed areas and picnic facilities are an integral feature of the park.

Most urban parks are managed more on a gardening approach, which inhibits development of ecological regenerative processes, such as litter accumulation and natural recruitment. Native seedlings or even enrichment plantings can be inhibited, damaged or destroyed unless particular care is taken. However, despite various weed control issues, the conditions for seedling germination and growth have improved markedly over the years in Matawai Park under self-sustainability management. As plantings have matured, there is an increasing diversity of seed produced within the park. Much of this is bird dispersed fruit, though dry seeded species such as kowhai (*Sophora microphylla*) are regenerating well.

Some appropriate native plants, such as pohuehue (*Muehlenbeckia australis*) have been introduced from outside the park by birds. This is a plant of edges

and disturbed sites and now occurs abundantly in the park. Apart from being a valuable host plant for a range of invertebrates, it also supports a variety of insectivorous and frugivorous birds. Since Matawai Park is a confined area, lianes are controlled near boundaries or where they compromise desirable canopy species.

At the same time as this increasing seed production, a mosaic of niches for germination and growth of seedlings continues to develop. These favourable niches are created by a range of dynamic processes that create the conditions required for seed dispersal and recruitment. Natural recruitment also provides a representative range of age classes of each species, as often occurs in nature. The development of duff and litter has encouraged an increasing range of flora and fauna to develop. Some attempt has also been made to introduce relevant mycorrhizae with local forest duff and some transplants of ferns, which may have aided both health and recruitment.

Light from canopy disturbance supports successful germinators and margin plantings reduce desiccating edge effects, bringing about more favourable seedling niches. As species enrichment continues, new niches appear, but some others close down as resources and space are used. A good example of this was during a beech community expansion to mitigate against edge effects, when bare ground was sprayed and ripped before planting. A few black beech (*Fucospora solandri*) seedlings appeared and persisted for a couple of years, but all were later lost due to lack of light as a canopy formed.

Some areas of artificial soil mounds still retain highly compacted soils that continue to limit both recruitment of some seedlings and the survival of established trees, especially during drought events. Despite the best of intentions these sites have therefore tended to be relatively dynamic, sustaining only the toughest of trees and shrubs plus a strong component of lianes, such as *Muehlenbeckia australis*. The less tolerant trees such as black beech (*Fucospora solandri*) and tarata (*Pittosporum eugenioides*) are dying out. This is not necessarily a problem, as adaptive management is leading instead to a dry shrubland association, which is perceived to be just as valid as the less site-tolerant tall forest associations.

The improving regenerative conditions also favour a range of undesirable exotic plants. Typically, many of these are bird dispersed and include blackberry, ivy, honeysuckle, spindleberry, cherries and hawthorn. These have required careful, timely management to minimise their influence.

Differences in distribution also appear. Some seedlings, such as those of kahikatea (*Dacrycarpus dacrydioides*) tend to volunteer near the parent plants and can form dense seedling growth under parent trees (Fig. 5, p. 40). This is perhaps unexpected as another podocarp, totara (*Podocarpus totara*) with

similar fruit structure, has its seedlings very widely spread throughout the park.

Figure 5 A carpet of kahikatea seedlings volunteering beneath an emergent female tree.

Many forest margin and successional species, such as *Coprosma propinqua* and *C. virescens*, are also widely dispersed throughout all communities. A range of sedges and ferns is now germinating along the watercourse banks where the combination of damp clay soil and an appropriate light regime exists (Fig. 6, p. 41). Most ferns cannot grow in very low light, so, again there is a weed control issue where the light is sufficient. Care had to be taken to distinguish the desirable fern species from the invasive exotic male fern (*Dryopteris filix-mas*).

The park now periodically attracts native fauna, both birdlife and invertebrates. Silvereye / tauhou have been joined by grey warbler / riroriro and bellbird / korimako as either resident or increasingly regular visitors, along with a range of exotic birds. Blackbirds are very active in turning over the rich litter layer, though it is unknown what effect if any this has on plant recruitment.

A survey in 2006 using a malaise trap sampled insects and other arthropods in the park. The late John Ward kindly organised this survey and coordinated the identification process. The report identified at least 46 native species and 10 introduced species living in the park. Another survey in 2008 using a UV light trap identified several additional Lepidoptera (moths and butterflies),

Figure 6 Sedges and ferns volunteering abundantly along a lightly shaded watercourse.

with the two surveys identifying a combined 51 moths, 46 of which were native. Large weta have been observed living in cavities or crevices of beech and kohuhu, and as trees mature more of these niches are becoming available.

The ultimate test of the self-sustainability management model, however, is whether or not natural processes are beginning to drive the sought-after recruitment within each plant community. Relatively full records of the various plantings at Matawai Park have been kept. However, the degree, location and timing of natural recruitment of the various species is largely anecdotal. The following table (Table 1, p. 44) lists those Canterbury species observed to have successfully recruited in the park during the last 44 years, along with estimates of the frequency, dispersal and timing of that recruitment. These estimates are based on a fairly thorough inspection, which is more likely to detect the sometimes very localised and infrequent recruitment than might be obtained from random plots.

There are written records of at least 176 species native to Canterbury having been planted in Matawai Park, though some probably did not survive long enough to set seed, let alone successfully recruit. A further 10 species without records of deliberate introduction have been recorded as now recruiting, apparently having volunteered either from pre-existing populations, from neighbouring properties, from introduced duff, as piggy-back transplants, or by naturally occurring long range dispersal. Of all the Canterbury species currently recorded in Matawai Park, 70 (38%) have since been observed as seedlings that have survived and progressed as a new generation.

It is hoped that as the plantings mature, a more diverse and abundant seed rain will become available and more suitable environments for seedling establishment will evolve. This should lead to other species also recruiting by natural means, to the point that each of the plant communities can become as far as possible self-sustaining.

There seems reasonable informal evidence that the encouragement of ecological patterns and processes has promoted natural regeneration of native plants, which in turn helps create the ecological and visual character commonly seen in naturally occurring native communities (Fig. 7).

Figure 7 Arranging plants according to discrete communities also provides visual depth and interest. Here a Forest Margin community dominated by wetland shrubs buffers a taller Lowland Podocarp/Hardwood Forest community dominated by houhere, kohuhu and emerging kahikatea.

Acknowledgements

Particular thanks to Dudley Franklin who was the driving force behind much of the early plant establishment at Matawai Park. Thanks must go to the many volunteers who contributed to planting, and who have served on the Matawai Park Advisory Group. Kevin Platt assisted with the identification of recruiting sedges. Thanks also to the Rangiora Borough Council and subsequent Waimakariri District Council staff and various contractors who have contributed over the 48 years since the park's inception.

References

Fox BW, Henderson GW, Ward JB, Ward GM 2009. Lepidoptera of Matawai Park, Canterbury. Records of the Canterbury Museum 23, 11–14.

Franklin DA, Thompson S 1983. Matawai Park. The Landscape 18, 7–10.

Henderson GW, Giller MT 1994. Managing for self sustainability – Matawai Park. Waimakariri District Council.

Henderson GW 2003. Re-establishing native plant communities from scratch: lessons from Matawai Park. Canterbury Botanical Society Journal 37, 15–20.

Spittal J et al. 1993. Matawai Park Reserve Management Plan. Waimakariri District Council.

Stewart GH, Woods D 1995. A second generation at Matawai Park. In: Proceedings of a Workshop on Scientific Issues in Ecological Restoration, Landcare Research Science Series No. 14, MC Smale and CD Meurk (Eds.). Christchurch, New Zealand: Manaaki Whenua Press, pp 62–63.

Table 1 Overall abundances of successful recruitment of Canterbury species (**A**bundant, **O**ccasional or **R**are), the predominant range of recruitment from parent plants (**L**ocal or **W**idespread), and the timing of main recruitment since initial introduction (**E**arly or **T**ardy). Species believed to have volunteered without having been deliberately planted are denoted by an asterisk (*****).

Regenerating Species	**Overall abundance**	**Dispersal range**	**Recruitment timing**
Gymnosperms			
Dacrycarpus dacrydioides	O	L	T
Podocarpus totara	A	W	E
Prumnopitys taxifolia	R	L	T
Angiosperms			
Dicotyledons			
Aristotelia serrata	R	W	L
Clematis paniculata	R	L	E
Coprosma crassifolia	O	W	E
Coprosma linariifolia	O	W	E
Coprosma lucida	R	L	T
Coprosma obconica	R	W	E
Coprosma pedicellata	R	L	E
Coprosma propinqua	A	W	E
Coprosma rhamnoides	R	L	E
Coprosma rigida	A	W	E
Coprosma robusta	A	W	E
Coprosma rotundifolia	O	W	E
Coprosma virescens	A	W	E
Coprosma × cunninghamii	A	W	E
Corokia cotoneaster	R	L	T
Dodonaea viscosa	O	W	T
Griselinia littoralis	O	W	E
Hebe salicifolia	R	L	T
Hebe traversii	R	L	T

Regenerating Species	Overall abundance	Dispersal range	Recruitment timing
Hoheria angustifolia	O	W	E
*Hydrocotyle heteromeria**	O	L	E
Kunzea serotina	R	L	T
Lophomyrtus obcordata	R	W	T
Melicytus alpinus	O	W	E
Melicytus ramiflorus	R	L	T
Muehlenbeckia astonii	O	W	E
*Muehlenbeckia australis**	A	W	E
Myrsine australis	R	W	T
Olearia paniculata	R	W	T
Parsonsia heterophylla	R	W	T
Pittosporum eugenioides	A	W	E
Pittosporum tenuifolium	A	W	E
Plagianthus regius	A	W	E
*Pseudognaphalium luteoalbum**	R	W	T
Pseudopanax arboreus	R	W	T
Pseudopanax crassifolius	R	L	T
*Senecio minimus**	O	W	T
*Solanum laciniatum**	O	W	E
Sophora microphylla	O	L	E
Teucridium parvifolium	R	L	E
Monocotyledons			
Poa cita	O	L	E
Anemanthele lessoniana	O	W	E
Astelia fragrans	R	L	T
Carex forsteri	O	L	E
*Carex geminata**	R	L	E
Carex healyi	R	L	E
*Carex maorica**	R	L	E
*Carex megalepis**	R	L	E

Regenerating Species	Overall abundance	Dispersal range	Recruitment timing
Carex secta	O	L	E
Carex solandri	R	L	E
Carex uncinata	O	L	E
Carex virgata	R	L	E
Cordyline australis	A	W	E
Microlaena avenacea	R	L	E
Libertia ixioides	R	L	T
Phormium tenax	R	L	E
*Pterostylis areolata**	R	W	T
Typha orientalis	R	L	E
Ferns and Fern Allies			
Asplenium gracillimum	R	L	T
*Asplenium lyallii**	R	W	T
Blechnum chambersii	O	L	E
Blechnum fluviatile	R	L	T
Blechnum minus	O	L	E
Blechnum penna-marina	R	L	T
Histiopteris incisa	R	L	T
Hypolepis ambigua	O	W	E
Polystichum vestitum	R	L	T