Restoring Makara Foreshore Reserve—An update

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INTRODUCTION

Mitcalfe & Horne (2002, 2005) described Makara Foreshore Reserve's ecosystem, summarised its history, listed what we saw as priorities for its management, featured some botanical discoveries made there, and described a range of issues which were of concern to us. The information in this article covers the period since Mitcalfe & Horne (2005), and is largely based on our unpublished report for Wellington City Council (WCC) (Mitcalfe & Horne 2010). Realising there was no official system for monitoring and reporting on this ecologically significant site, other than the voluntary log we have submitted to WCC with each invoice ever since we began weeding there in 1997, we gained their approval in 2010 to survey the reserve and report on its condition. To gather data for the twenty-two page, illustrated, unpublished report (Mitcalfe & Horne 2010), we re-used the transects that we had laid down in our original, 1997 vegetation-mapping exercise (Mitcalfe & Horne 1997), thus enabling the quadrats enclosed by the transects to be re-examined after a thirteen year interval (Fig. 1, 2).

Figure 1. Lots at Makara Foreshore Reserve. The speckled Lots are the subjects of this study. Image prepared by WCC, and used with their permission.

A brief history of Makara Foreshore Reserve introduced the report, with references to our 1997 vegetation mapping. We described all indigenous taxa known in the reserve, their condition, and whether they were increasing

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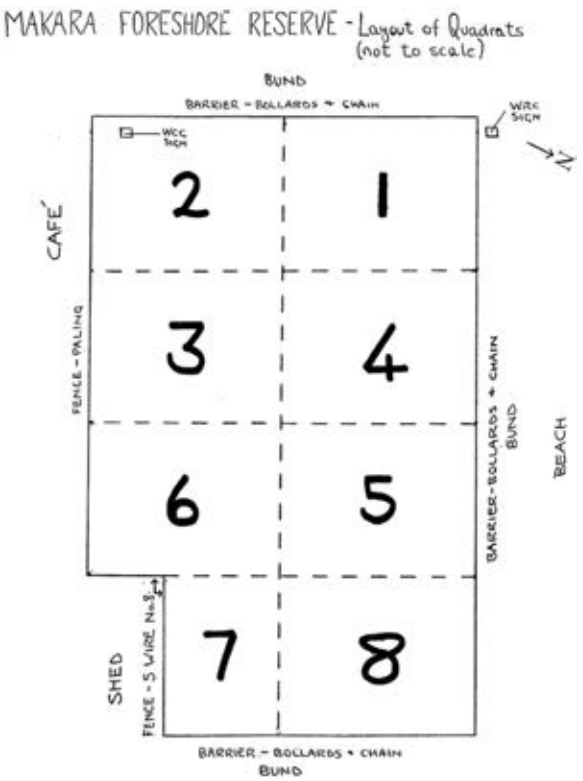

Figure 2. Layout of quadrats used for vegetation monitoring at Makara Foreshore Reserve (Mitcalfe & Horne 1997).

or decreasing. All adventive taxa known in the reserve were then listed, the threats which they posed to the indigenous ecosystem, and whether they were increasing or decreasing. In a set of eight tables, one per quadrat, we listed all taxa seen in the reserve during the survey, and noted the percentage area covered by each. Continuing management problems were identified and recommendations made to address them. A set of photographs of the reserve was included.

The report's recommendations included:

- WCC to gazette Lot 4 and Lot 6 as reserve, under the Reserves Act 1977 (see below).
- WCC to consolidate Lots 4 and 6, with Lot 3 and Lot 5, which are already Recreational Reserve, as one reserve under the Reserves Act 1977.
- WCC to acknowledge the ecological significance of the consolidated reserve by elevating its status from Recreational Reserve to Open Scientific Reserve, open to the public without permit, as is Mana Island.

- In consultation with the Department of Conservation's (DOC) Wellington Hawke's Bay Conservancy, WCC to draft a change to the District Plan to enable listing the reserve as a Conservation Site.
- WCC to incorporate scheduled periods of ecological maintenance of the reserve into its Parks & Gardens horticulture apprentice-training programme. This work should be supervised by staff, or by contractors familiar with and able to train the apprentices in the reserve's history and significance, the care needed for its special native plants, and its management programme, based on the original reasons for the establishment of the reserve.
- WCC to arrange for a survey and report on the reserve, every five years, from the winter of 2010.
- WCC to prioritise funding for replacing the decrepit fence on the southern side of the reserve, the cost to be shared by the neighbouring parties.
- WCC to include in its spraying programme the reserve's surrounding bunds, the carpark and the planted strip north of the toilet block, these being prime sources of re-infestation by weeds.

LEGAL STATUS

The title "reserve" is not in fact appropriate for Makara Foreshore Reserve. Our research shows that this site, c. 70 m × 40 m, comprises several Lots held by WCC under two designations:

- four Lots of Recreation Reserve, *subject to the Reserves Act 1977*, and
- three Lots taken for recreation and community purposes *but not subject to the Act*.

The present "reserve" comprises only Lots 3, 4 and 5, plus ⅔ of Lot 6, because in the early 1980s Lots 1, 2 and 7 were taken for parking (Fig. 1). The other ⅓ of Lot 6 is private property.

WCC File 23/156, July 1980, refers to the reserve as an area "of special scientific interest", citing a statement from the Botany Department, Victoria University, and Botany Division, Department of Scientific and Industrial Research, that the foreshore area had significant natural values. In 2012, WCC is reviewing the status of the lands it manages. We hope that the entire site will be gazetted as an Open Scientific Reserve under the Reserves Act 1997, thereby guaranteeing its protection in perpetuity as a community of uncommon indigenous coastal plants growing on a raised gravel beach, which is not a common landform in Wellington. Wind-blown sand appears to have been slowly accumulating on this raised gravel beach.

NATIVE PLANTS

Table 1 lists the native taxa with a national conservation status that are naturally occurring in the reserve. Table 2 lists the native plants with no national threat status that occur in the reserve. *Ranunculus acaulis* and the threatened *Crassula mataikona* (Fig. 3) are examples of tiny, cryptic species easily overlooked in a plant community such as at the reserve.

Table 1. Threatened native plant taxa in Makara Foreshore Reserve.

Taxon	Current national threat status
Crassula mataikona	Naturally Uncommon
Ficinia (= *Desmoschoenus*) *spiralis*	Relict
Melicytus crassifolius agg.	Declining
Poa billardierei (= *Austrofestuca littoralis*)	Declining
Raoulia aff. *hookeri* (AK 239529)	Declining
Sonchus kirkii	Relict
Trisetum antarcticum	Declining

Table 2. Native plants without a national threat status that occur in Makara Foreshore Reserve.

* denotes where an existing population of a species has been supplemented by ecosourced plants of the same species, propagated by WCC's Berhampore Nursery, from Makara Foreshore Reserve stock.

Botanical name	Common name	Change in reserve since 2005
Apium prostratum	shore celery	increasing
Calystegia soldanella	shore bindweed	increasing
Colobanthus muelleri	a colobanthus species	increasing
Coprosma propinqua	a coprosma species	increasing
Coprosma repens	taupata	decreasing (see WCC request under Native Plants text)
Crassula sieberiana	a crassula species	increasing
Disphyma australe	New Zealand ice plant	increasing
Einadia triandra	berry saltbush	increasing
* *Ficinia nodosa*	leafless sedge	increasing
Lachnagrostis billardierei	sand wind grass	increasing

Botanical name	Common name	Change in reserve since 2005
Muehlenbeckia complexa	pōhuehue	stable
Olearia solandri	coastal tree daisy	stable, one plant only
Ozothamnus leptophyllus	tauhinu	increasing (see WCC request under Native Plants text)
Phormium cookianum	coastal flax	stable, one plant only
Pimelea prostrata	New Zealand daphne	increasing
Pseudognaphalium luteoalbum	Jersey cudweed	increasing
Ranunculus acaulis	sand buttercup	increasing
Selliera radicans	remuremu	increasing
Senecio lautus	shore groundsel	increasing
* *Spinifex sericeus*	silvery sand grass	increasing
Tetragonia implexicoma	New Zealand spinach	increasing
Thelymitra sp.	a sun orchid species	ephemeral
Trisetum antarcticum	a trisetum species	increasing

Figure 3. Compare the tiny size of *Crassula mataikona* with New Zealand ice plant (left).

In the report (Mitcalfe & Horne 2010), we explained that we removed seedlings of colonising native shrubs such as tauhinu, because they could rapidly outgrow and shade out the mat-plant and sand-binding plant communities which the reserve was deliberately set aside in the 1970s to protect. However, WCC have now asked us not to weed out native shrub seedlings such as tauhinu, "… so that their long-term impact can be assessed." We are complying with this request. Nevertheless, in our opinion, taupata seedlings should be an exception to this requirement, because our 1997 research and our subsequent observations suggest that they are

still germinating from the seeds of taupata of horticultural origin planted by WCC on the reserve margin in the early 1980s, and are therefore not naturally occurring. In 2003, WCC employed a contractor with a digger, to root out and dispose of these old, battered shrubs with their gnarled, prostrate trunks up to 20 cm diameter.

As a result of our long-term involvement with the reserve, we do not consider seedlings of *Coprosma propinqua* or thick-leaved māhoe to be threats, because in the harsh conditions of the site, their chances of surviving, let alone thriving, and shading out the mat plants and sand-binding plants, are poor.

In our report (Mitcalfe & Horne 2010), we listed native plant species that have arrived in the reserve, some self-sown, some planted, since Mitcalfe & Horne (2005).

Native species self-sown since Mitcalfe & Horne (2005):

- *Muehlenbeckia complexa*: several seedlings appeared in September 2005, and are growing.
- *Melicytus crassifolius* agg.: a tiny self-sown seedling appeared in 2004 but died in the summer of 2006. Another appeared in 2008 and is surviving.
- *Coprosma propinqua*: seedlings appeared on the western boundary in June 2007, and are thriving.
- *Lachnagrostis* sp.: this grass appeared in January 2008, and has established, forming several clumps of c. 40 cm in diameter. Previously listed by us as *L. filiformis*, it is almost certainly *L. billardierei*.
- *Sonchus kirkii*: one plant of the endemic sow thistle appeared in the spring of 2009. It flowered, seeded, and produced several seedlings (Fig. 4).

Figure 4. Four self-sown plants of *Sonchus kirkii* now grow on the site.

- *Thelymitra* sp.: in 2006 a tiny leaf appeared, then soon disappeared, probably browsed by rabbits or hares. Over the years, this has happened in two places in the reserve.

Native species planted since Mitcalfe & Horne (2005):

- *Poa billardierei* (= *Austrofestuca littoralis*) / sand tussock: in July 2005 and 2006, we planted c. 30 plants raised from seed collected from the one plant which we had discovered in the reserve in 1997 (Mitcalfe & Horne 1997). This seed was mixed with seed from plants on Wellington Peninsula's south coast, as recommended by DOC, and grown on by WCC's Berhampore Nursery. In 2007 we planted thirty-four more. This tough taxon produces abundant seed, but not as many seedlings as might have been expected. Perhaps the extremely harsh local conditions are responsible for this, underlining how fortuitous it was that there were any sand tussocks at all remaining in the reserve in 1997. The present tally is thirty-six, including some seedlings. Edgar & Connor (2000) do not specify whether this species is an annual or a perennial, but at Makara it behaves as a perennial, declining after several years. We note that it seems to prefer bare, sandy areas where it will not be overrun by New Zealand ice plant.
- *Trisetum antarcticum*: after consultation with WCC and Wellington Conservancy, DOC, in December 2005, we made a small trial planting, using seed from a naturally occurring plant on the foreshore just north of the reserve, subsequently propagated by WCC's Berhampore Nursery. Only two plants survived the extremely droughty conditions, but they seeded freely. In September 2006, we planted 150 more, from the same seed source, as an insurance population, near the southeast corner of the reserve. The species is now well established and spreading.
- *Spinifex sericeus* / silvery sand grass: in June 2006 we planted 52 spinifex, grown from seed collected in the reserve. Spinifex is not easily propagated, being susceptible to fungal infection. However, as a result of WCC sending a Berhampore Nursery staff member to a conference of the Coastal Dune Vegetation Network, a new system learnt there was trialled. To maximise the chances of getting at least one successful germination, they sowed three seeds instead of only one in each root trainer. Followed by regular monitoring and light watering by hand, this proved successful. After being planted in the reserve the seedlings were slow to acclimatise but later began to thrive and send out runners.
- *Ficinia* (= *Desmoschoenus*) *spiralis* / pīngao: in June 2006, we planted 52 pīngao propagated from seed from the reserve. This sedge has established well, and this winter (2012) we shall plant more.

- *Melicytus crassifolius* agg. / thick-leaved māhoe: in August 2006 we did a trial planting of three plants, cutting-grown in 2004 from the only plant in the vicinity, then growing on the privately-owned one-third of Lot 6. We planted three more in a sheltered site at 1089 Makara Road, opposite the reserve, and four in the strip north of the toilet block, a very exposed site. Only one of those has survived, by adopting a prostrate habit. Having observed the lethal salt-blast damage which the others suffered**,** we planted the last six in October 2006, near the southeast corner of the reserve in the lee of dense clumps of leafless sedge. To our great relief, they are thriving, having adopted the same semi-prostrate habit (Fig. 5). At least one of these has produced fruit this summer (2011/2012).

Figure 5. A planted *Melicytus crassifolius* in a sheltered spot.

- *Ficinia nodosa* (= *Isolepis nodosa*) / wīwī: in September 2009 we planted ten of this hardy sedge species, raised from seed collected from the reserve and grown-on by WCC's Berhampore Nursery, filling in some of the weedy spaces between existing plants. We have ordered more of these from the nursery, for planting this winter (2012).

WEED MANAGEMENT

Table 3 lists the exotic weeds in the reserve. With weeds such as annual mouse-ear chickweed and allseed reaching plague proportions, we realised we needed help (Fig. 6). BotSoccers may remember that in early spring 2008, we asked WCC for help with weeding the reserve because we could no longer control the intensified weed invasion, particularly allseed. In answer to our SOS, on Election Day 2008, the WCC ranger, a Makara Beach resident and twenty-three BotSoccers joined us in a four-hour, volunteer, nose-to-the-ground, effort to weed allseed (Figs. 7, 8). But weed infestation continued to worsen, so reluctantly we consulted WCC about

the possibility of a spray programme to complement our hand weeding. This was eventually agreed, with trialling to avoid damage to non-target species, and finally implemented in 2010 by a qualified contractor. But it was too late to be effective, and the problem was exacerbated when weather conditions in the windy, wet spring of 2011 prevented any spraying.

Figure 6. The authors weeding.
Photo: Tanya Mitcalfe.

Figure 7. The BotSoc workbee, November 2008.

Figure 8. Julia White removing onion weed.

Table 3. Exotic weeds in the Makara Foreshore Reserve.

Botanical name	Common name
Allium triquetrum	onion weed
Ammophila arenaria	marram grass
Anagallis arvensis	scarlet pimpernel
Cerastium fontanum	mouse-ear chickweed
Cerastium glomeratum	annual mouse-ear chickweed
Chrysanthemoides monilifera	boneseed
Cirsium vulgare	scotch thistle
Conyza sumatrensis	broad-leaved fleabane
Crassula decumbens	Cape crassula
Dactylis glomerata	cocksfoot
Ehrharta erecta	veld grass
Gazania rigens	gazania
Holcus lanatus	Yorkshire fog
Hypochaeris radicata	catsear
Lagurus ovatus	harestail
Lupinus arboreus	tree lupin
Malva dendromorpha	tree mallow
Medicago nigra	bur medick
Parapholis incurva	sickle grass
Parietaria judaica	pellitory-of-the-wall
Plantago coronopus	buck's-horn plantain
Polycarpon tetraphyllum	allseed
Schedonorus phoenix	tall fescue
Senecio elegans	purple groundsel
Sonchus oleraceus	pūha
Stellaria media	chickweed
Stenostaphrum secundatum	buffalo grass
Trifolium dubium	suckling clover

The worst weeds continue to infest the *Raoulia* mats, where allseed, bur medick, suckling clover, and buck's-horn plantain have again taken over where for years we had succeeded in keeping them under control. The berms and carparks, which are WCC property, but lie outside the reserve's boundary, are continuing sources of infestation. Furthermore, marram

grass has re-appeared, and along with buffalo grass, tree lupin, tree mallow and veld grass, continues to invade from neighbouring properties. The spray programme was a success in that some species (e.g., adult allseed and bur medick) were killed, but because the selected herbicide is not inter-generational, it does not kill the seeds, necessitating spraying at least once again during the spring weed flush. Another factor in the weed control programme is that, in keeping with WCC's overall financial constraints, our hours of ecological maintenance at the reserve have been reduced in order to stay within the revised budget.

By August 2005**,** parts of the reserve had become overwhelmed by *Crassula decumbens* (Cape crassula), a tiny, herbaceous weed, new to the reserve. Within weeks there were thousands of them, seeding and spreading uncontrollably in the vicinity of the threatened native *C. mataikona* (Fig. 9). After consultation with WCC, on 6 September 2006 we covered the most densely infested area, c. 10 m × 4 m, with weed mat which they supplied (Fig. 10). We hoped that this, plus a short life in the seed bank, would kill the main infestation of this plant pest. We are now considering whether to remove the weed mat, to see if it has been effective. This would entail lifting the many tangled metres of New Zealand ice plant stems that have straggled across it, and rooting out the determined buck's-horn plantains etc. which have grown right through it.

Figure 9. A planted *Crassula mataikona* (centre) being infested by the faster-growing, self-seeded *C. decumbens*.

Figure 10. Barbara laying weed mat.

In Wassilieff (1992) the vegetation map showed that c. two-thirds of Makara Foreshore Reserve comprised marram grassland and c. one-third, raoulia herbfield. This was what we were faced with when we began our survey and weeding contract for WCC in 1997.

In 2001/2002, WCC's spray programme killed the metre-high top-growth of the marram grass, but it was not until 2003 that a digger was hired to eradicate the deeply-buried rhizomes, and building rubble. In preparation for this, we had uplifted and stored New Zealand ice plant, and a few tiny patches of *Raoulia hookeri* (Figs. 11, 12). Replanted, both species soon began re-colonising the site, and some of the raoulia mats are now up to 3 m in diameter. Now and then a few marram tillers still appear so we mark them for the next spray programme to target.

Figure 11. *Raoulia* mat with New Zealand ice plant.

Figure 12. New Zealand ice plant in flower.

VISITORS TO THE RESERVE

- Makara Foreshore Reserve was one of the sites studied during Landcare Research's survey of gravel beaches (Wiser et al. 2010). On 17 November 2006, botanists Bev Clarkson, Peter Williams, and Mark Smale, accompanied by an arachnologist and a technician, visited the reserve in a nor-westerly gale, a feature of this site.
- Staff from WCC's Berhampore Nursery collect seed usually in autumn.

- Staff from WCC's Otari-Wilton's Bush visited in 2011 to learn more about the natural habitat of some of the coastal species which they grow in bedding displays at Otari.
- WCC officer Carol Leach visited in December 2011 with WCC's Parks and Gardens apprentices, to study the ecological values of the reserve; they generously stayed to help us weed.
- In 2008, Dacia Herbulock, of National Radio's *Te Ao Hurihuri, Our Changing World*, visited to record our commentary which was later broadcast.
- Other visitors include tourists, who sometimes stop to observe our work and enquire about the plants.
- Unwelcome visitors include overseas tourists in October 2006 who camped on a bed of lush New Zealand ice plant (Fig. 13). As a result, at our request, WCC erected a "no-camping" icon on a post carrying other information for visitors to the reserve and the beach. A helicopter operator once landed on the reserve, and we heard he had been reprimanded. We regret we were not there to do it ourselves!

Figure 13. Illegal campers having breakfast.

CONCLUSIONS

As a result of our hand-weeding, the weed-spraying work by WCC's contractors, and our planting of eco-sourced plants skilfully propagated by Berhampore Nursery, both the naturally-occurring and the planted native species are now occupying a markedly increased proportion of the site. Our intention in planting material sourced from the reserve has always been to facilitate the development of a naturally functioning ecosystem. New Zealand ice plant and shore bindweed are thriving, their pink flowers a striking feature in spring (Fig. 14). Shore groundsel puts on a spectacular display in summer. Other native plants whose flowers make a picturesque display include sand wind grass, New Zealand daphne, pīngao, raoulia, sand tussock, and silvery sand grass. A successful seed-set then ensures that areas freed of weeds, have a much-improved chance of being re-colonised by native species.

Figure 14. Shore bindweed.

WCC's continuing investment in the maintenance of this conservation-dependent reserve, a repository of uncommon native biota, makes a significant contribution to the implementation of WCC's Biodiversity Action Plan 2009. Without this investment, the indigenous plant community would soon be overwhelmed again by weeds, a process expected to be accentuated by climate change, with its increased precipitation and higher average annual temperatures.

ACKNOWLEDGEMENTS

The botanical community owes a debt of gratitude to those staff of the former Botany Division, D.S.I.R., and Botany Department, Victoria University, who in the 1970s publicised the need to protect the Makara foreshore site because of its ecological values. We thank Maggy Wassilieff (1992) for her foresight and initiative in recommending that "WCC should produce a management plan for the reserve … (and) instigate an authoritative study of the vegetation in the *Raoulia* area".

We thank WCC officers Mike Oates, Amber Bill, Nicky OliverSmith, Laureen Bamford, Paulo Fuiono**,** and former officers Jonathan Bussell and Justin McCarthy, for their long-standing interest and support in maintaining the ecological values of this reserve; Peter de Lange and Jeremy Rolfe, DOC, and Susan Wiser and Bev Clarkson, Landcare Research, for advice.

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