Coastal Vegetation of Wellington

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INTRODUCTION

From Waikanae River mouth to Turakirae Head there is 200 km of coastline and five islands (excluding Kapiti Island). On this rugged and exposed coastline some 350 native vascular plants are to be found. These species include some which are especially adapted to the coastal environment, and in particular are capable of growing on sites that have high salinities. Plants that can tolerate prolonged exposure to salt in the soil are termed halophytes. There are other plants of the coast that are less well adapted to high salt levels, but if they are above the splash zone or tidal influence, they can cope well with the nutrient poor soils of sand dunes, rocky beaches, or cliffs; high solar levels; seasonal drought; and gale force conditions that are some of the harsh environmental factors experienced around the Cook Strait coast.

It is convenient to classify coastal communities on the basis of their substrata. Around Wellington, coastal habitats are: salt marshes, sand dunes, rocky and gravel beaches, greywacke cliffs, and islands. Apart from the steepest reaches of some of the coastal cliffs, all coastal habitats carry a modified vegetation. Fire, grazing, and human settlement have all influenced coastal communities.

VEGETATION OF SALT MARSHES

Salt marsh vegetation is found at Waikanae River Estuary, Pauatahanui Inlet, and Makara Estuary. Halophytic vegetation colonises the upper reaches of extensive mudflats at these sites. A pronounced zonation of the vegetation develops on a salt marsh. The lowermost zone, exposed only at low tides, is occupied by the eel grass, *Zostera muelleri*. Extensive beds of eel grass are found at the eastern end of Pauatahanui Inlet. Although eel grass is the only flowering plant able to withstand long periods of tidal submergence at Pauatahanui, there are a few algal species which are commonly associated with eel grass beds; they include the green algae: sea lettuce (*Ulva*), sea emerald (*Chaetomorpha*), *Enteromorpha*, and on shady sites the red agar-producing alga *Gracilaria* may be present.

Eel grass is a perennial grass-like herb which has creeping rhizomes along which vegetative shoots develop at nodes. In time, eel grass forms thick swards of foliage which help to trap and stabilise the silt and mud of the lower marsh. Another flowering plant which withstands tidal inundation is found at Waikanae Estuary in a coastal lagoon. This is the horse's mane weed (*Ruppia megacarpa*). It is a relatively uncommon plant, seldom seen by most people.

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Further back from the eel grass zone at Pauatahanui is bare ground, no native flowering plant is capable of colonising this zone, although the introduced cord grasses (*Spartina*) can extend into this bare zone. Some clumps of *Spartina townsendii* are present at Waikanae Estuary.

Further landwards on the marsh, prostrate succulent and semi-succulent herbs colonise the silt and mud. This zone is inundated at nearly every flood tide. The succulent form of the herbs is an adaptation to the saline conditions in which they grow. When plants are covered by the tide they are in conditions of high osmotic pressure and when there has been much evaporation from the marsh in hot summer months there is a concentration of mineral salts in the marsh soils. Under these conditions the plants may suffer physiological drought. Thus, although water is present on the marsh, it may not be readily absorbed by the salt marsh plants because of its high salt content. The succulent and semi-succulent plants on the marsh store water in cells (aqueous tissue) near the centre of the plant.

The glasswort (*Sarcocornia quinqueflora*) is the dominant plant of the low marsh, as this zone is termed. Glasswort consists of a jointed series of succulent, oppositely arranged leaves which completely ensheath the woody stems. It is sometimes grey-green in colour; other times (especially in late summer and autumn) it is red tinged. Glasswort forms extensive turfy patches and is often associated with two creeping herbs: remuremu (*Selliera radicans*) and shore primrose (*Samolus repens*). The shore primrose has tough, slender stems along which arise small, leathery leaves. A profusion of white flowers is produced in mid-summer. The remuremu has a stout creeping stem, shiny green and rather fleshy leaves which can reach up to 4 cm in length. Mats of remuremu are easily identified when flowering as the flower appears to be split in half. The petals are all turned to one side and this gives the flower an incomplete appearance.

Above the zone of creeping herbs is a poorly drained zone, infrequently covered by spring tides, which is occupied by tall rushes. Sea rush (*Juncus maritimus* var. *australiensis*) and jointed rush (oioi, *Leptocarpus similis*) are dominant. Beneath them may be found a ground cover of the creeping herbs, often adopting a more etiolated form in the shelter of the rushes. Breaks in the rush cover are also occupied by glasswort, shore primrose and remuremu, as well as herbs not encountered further seaward. These plants include batchelor's button (*Cotula coronopifolia*), a bright yellow-flowered daisy, once considered to be indigenous in New Zealand, but now thought to have been introduced; slender forms of native celery (*Apium australe*); and occasionally the beautiful mauve-flowered native musk (*Mimulus repens*).

On higher or better drained sites on the high marsh, the salt-tolerant shrub marsh ribbonwood (*Plagianthus divaricatus*) is common. It is often present along the banks of freshwater streams which feed in to estuaries. The salinity levels of marsh soils are usually low near to the streams and here sedges, raupo, and flax

may be found. Beyond the influence of the tide, the marshes probably supported manuka scrub and kahikatea forest. Such estuarine vegetation is very uncommon now in the Wellington area, for the very low salinity marsh soils were easily converted to pasture. A small secondary remnant of manuka-kahikatea scrub is present in pasture on the north-eastern side of Pauatahanui Inlet.

SAND DUNE VEGETATION

The southern extent of the west coast dune system just reaches the Wellington region. From Paekakariki to the Waikanae River mouth, mobile and fixed sand dunes occur. Three stages of dune development have been recognised on this sand country. The oldest dunes that can be traced along the coast north of Paekakariki to Waikanae have been dated by recognising Taupo Eruption pumice (130 A.D.) in them. Between the beach and the oldest dune there are two sets of younger dunes; one is related to Maori destruction of the coastal vegetation and is dated as 1,000–500 years old; the more recent dunes have developed since European settlement (Stevens 1974).

The introduced grass, marram, forms the dominant stabilising cover on the fore-dunes. Associated native sand binders, the grass, spinifex, and the golden sedge, pingao, are also to be found. The introduced daisy *Senecio elegans*, conspicuous in summer with its bright purple ray florets, is common. Two native shrubs, the sand coprosma and tauhinu, are often found on the sheltered side of the dunes. The sand dune environment is harsh, and few plants can withstand the conditions. Sand dune vegetation must withstand prolonged periods of drought, strong desiccating winds which carry salt and abrasive sand grains, and highly fluctuating temperatures.

Marram, spinifex, and pingao are well adapted to living in a constantly moving substrate which covers leaves and uncovers roots. In fact, these three species require a moving substrate for continuous growth. In areas where sea walls have been erected (e.g., Island Bay, Lyall Bay, and Petone foreshore) they are absent. Marram, spinifex, and pingao are perennials, capable of growing when buried by sand. Fresh growth from rhizomes takes place when sand is deposited over the leaves. With marram, a network of rhizomes and fine roots develops at different layers throughout the dune; this assists in the formation and stabilisation of the dune. Spinifex sends strong runner stems along the dune; these can root and send off side shoots of new growth. Spinifex plants are of separate sexes. The female plants produce large seed heads which possess long, soft spines; they are often seen bowling along the beach in a storm. Pingao possess a thick, stout rhizome capable of growing many metres in length. At frequent intervals the rhizome roots and gives rise to new stems with tufts of new leaves.

Plants of the sand dunes possess xerophytic features which assist with water conservation. A thick leaf cuticle (present in marram, spinifex, and pingao) prevents excessive transpiration and helps protect the leaf from damage by wind-

blown sand grains. In the case of marram, the rolled leaf possesses longitudinal corrugations on the inner surface. Scattered stomata are restricted to the inner surface and occur in the furrows of the corrugations. If the plant is subjected to water stress, it loses water from cells at the base of each furrow; these cells act as hinges: when they lose water, the inner surface of the rolled leaf contracts and the outer edges fold in completely and form a tube. When water is plentiful, the hinge cells swell and the leaf blade flattens out. Spinifex has a leaf blade that can also roll inwards when the plant is water-stressed. The leaf has a dense cover of silky hairs which are a very efficient xerophytic adaptation.

The sand coprosma is a low creeping shrub with highly divaricating branches and small leathery leaves. Its very flexible branching form is an obvious advantage in strong wind conditions. Although there are different theories as to the origins of the divaricating habit (the theory that divaricating shrubs have evolved in New Zealand as a response to moa browsing has received much attention over the last decade), there are advantages in being small-leaved and highly branched in a moisture- and wind-stressed environment.

On the leeward side of the foredune other shrubs such as sand daphne and tauhinu may be found with sand coprosma. Between the foredune and semi-consolidated secondary dune are troughs where the sand has been blown away. The water table is close to the surface in these troughs and a number of other plants come into the community. Toetoe, jointed sedge, noded sedge, shore selliera, hare's tail grass, *Parapholis incurva*, buck's horn plantain, Solander's tree daisy, shore convolvulus, and sand carex may be found here.

Smaller areas of sand dune are found south of Paekakariki, but all have experienced severe modification through sand mining, rock quarrying, urban encroachment, weed invasion and off-road vehicle damage. Pingao forms patches on the south-western coast at Long Gully. Sand dunes and their associated plants were destroyed between Owhiro Bay and Red Rocks in 1974 by quarrying. Some clumps of pingao were rescued and are now to be seen growing in the grass garden at Otari Native Botanic Garden.

East of Pencarrow Head are coarse sand and gravel dunes where the sea holly (*Eryngium vesciculosum*) may be found. Sand mining activities at the mouth of Lake Kohangatera have been responsible for the modification of this dune land. At Fitzroy Bay the stabilised dunes have been colonised by the leguminous shrub, tree lupin. This plant, like gorse and the clovers, is a nitrogen-fixer and is at a distinct advantage in exploiting the nitrogen-poor sands, and it quickly gains a competitive advantage over native shrubs. Spinifex and marram are common with lupin on the exposed side of the dunes. Solander's tree daisy, shore ribbonwood, and toetoe are present in wet depressions between the dunes and the road at the foot of the coastal cliffs.

SHINGLE AND GRAVEL BEACHES

The 1855 earthquake raised a narrow wave-cut platform of rocks and boulders around the southern coast of the North Island. This earthquake was centred on the West Wairarapa Fault and is estimated to have been about 8 on the Richter Scale. An uplift of 2.5 m occurred at Turakirae Head, 2 m at Eastbourne, and about 1.5 m at Island Bay.

The coarse sands and gravels associated with the raised beach near Red Rocks were occupied by blue-green circular mats of an unnamed scabweed (*Raoulia* sp.), a prostrate native daphne (*Pimelea prostrata*), and a tutu (*Coriaria sarmentosa*). Quarrying and roading have disrupted much of the raised beach community, but all three species are still to be found on gravelly substrate on cliff ledges or at the foot of the coastal cliff. A small area of the unnamed Cook Strait *Raoulia* is reserved on fine gravels at Makara beach.

Exotic weeds are a feature of the raised platform that skirts most of Wellington Harbour from Owhiro Bay to Eastbourne. Members of the cabbage family (Brassicaceae) are prominent and include: the large herbs wild turnip, sea radish, and hedge mustard, as well as three garden escapes: scented stock, wall flower, and sweet alyssum. Two low-growing herbs: twin cress and shepherd's purse are also common brassicas in disturbed coastal shingle beds.

A few shrubs and trees can establish in this zone. The native taupata is common, as are the two divaricating shrubs *Coprosma propinqua* and *Melicytus crassifolius*. Two trees native to northern New Zealand and not indigenous to Wellington are sometimes found on the sheltered edge of shingle beaches: they are karo and pohutukawa, both species capable of seeding and establishing themselves around the coast.

The most prominent shrub is the biennial tree mallow (*Lavatera arborea*). This tall, rapidly growing plant reaches 2–3 m in its first summer, has large mauve flowers the following summer, and dies back in autumn, leaving dead stems standing through winter.

The horned poppy (*Glaucium flavum*), a blue-green spreading herb, is especially conspicuous on gravel beaches around Wellington in summer when its large orange-yellow flowers are on show, but it is not too common elsewhere around New Zealand. The native shore groundsel (*Senecio lautus*) is a slightly succulent herb with a very variable leaf form, and which can be erect or prostrate depending on site conditions and degree of exposure.

It is at Turakirae Head that the vegetation of the gravel and shingle beaches can be seen at its best. Five raised beaches and associated beach ridges are present, and represent uplifts from 6,500 years ago to the 1855 earthquake. Bagnall (1975) described the vegetation pattern on the raised beaches and related the distribution of the vegetation to major environmental factors. The following is a brief summary of his findings.

There is little in the way of plant cover on the gravel beach which forms the present shore. The beach uplifted by the 1855 earthquake supports horned poppy and shore ribbonwood. On the ridges between beaches two and four a dense divaricating scrubland dominated by *Coprosma propinqua* (usually interlaced with the liane *Muehlenbeckia complexa*) and *Melicytus crassifolius* is found. On finer-grained sites, where alluvial fans spill down onto the beaches, tauhinu dominates.

The beach platforms develop into peat mires after uplift. The youngest mires support jointed rush reedland; then, with time, there is development to raupo and flax swamps which are bordered by manuka shrublands.

An arresting feature of the raised beaches is the presence of large emergent boulders up to 4 m in diameter. On and around these boulders a distinctive vegetation is found. The seaward boulders support lichen species, taupata, and ice plant. On large boulders on the older beaches, typically epiphytic orchids are a feature, e.g., *Bulbophyllum pygmaeum*, *Dendrobium cunninghamii*, *Earina mucronata*, *E. autumnalis*, as well as two terrestrial species, *Acianthus fornicatus* and *Thelymitra longifolia*. Ferns are also common on the monoliths. Bagnall records 10 species, of which *Asplenium terrestre*, *Phymatosorus pustulatus*, and *Pyrrosia eleagnifolia* are the most common.

These boulders were once much more common at Turakirae Head. Most of the largest monoliths were removed and crushed to provide metal for construction of the Hutt Motorway until public concern at the destruction of Turakirae's unique geological features led to the protection of the area. The unusual plant communities were saved with the remaining monoliths, but this distinctive vegetation has only recently been acknowledged as an important natural feature of the area.

CLIFF VEGETATION

Coastal flax (whaririki) is the most conspicuous plant of Wellington's coastal cliffs. This hardy plant colonises nooks and crannies in the greywacke and the species is capable of clothing entire cliff faces to the virtual exclusion of other species. Botanists recognise different forms of whaririki and plants around Cook Strait have characters that are intermediate between those of South Island and North Island mountain populations, and northern North Island lowland populations. The Cook Strait whaririki has drooping leaves, pendent and twisted seed pods, and flower tepals which can have a full range of colour between red and yellow-green.

More common than pure coastal flaxlands are mixed communities of flax, shrubs, grasses, herbs, and ferns on Wellington's coastal cliffs. *Hebe stricta* var. *macroura*, the shorter and fatter-leaved coastal variety of koromiko, is common on steep rocky outcrops. On less exposed cliff sites, the common Wellington koromiko (*H. stricta* var. *atkinsonii*) is also present. On coastal cliffs at Titahi

Bay *H. elliptica* var. *crassifolia* maintains itself as a vulnerable population.

The speargrass (*Aciphylla squarrosa*) is still common enough to warrant caution for people who grab a clump of foliage for support while botanising around the cliffs. This sharp-pointed plant is not a grass but a member of the carrot family. It is the food plant of the rare speargrass weevil (*Lyperobius huttoni*). On the south Wellington coast its habitat has been reduced in recent years by quarrying activities, and fire and goats are ever present threats to the remaining few colonies. Plantings of speargrass seedlings near the mouth of Karori Stream have been undertaken with the aim of increasing the food supply of the weevil.

Where there has been an accumulation of soil on cliff slopes, silver tussock (*Poa cita*) is to be found. Silver tussock is a fast growing, attractive tussock with needle-like leaves reaching 100 cm tall. Another conspicuous native grass on damp coastal cliffs is *Poa anceps* var. *anceps*, a wider-leaved grass than silver tussock. *Poa anceps* forms swards which droop down the cliff face; the blue-green colour of the foliage is distinctive (although bright green foliage can also be found).

A fairly rich herb and fern flora can still be found on many coastal cliffs: *Luzula banksiana* var. *banksiana*, *Crassula sieberiana*, *Scleranthus biflorus*, *Craspedia uniflora* var. *grandis*, *Pseudognaphalium luteo-album*, *Senecio lautus*, *Vittadinia australis*, and *Disphyma australe* are fairly characteristic of dry exposed cliffs. On damp or sheltered coastal cliffs many other species come in, including: the lianes, *Clematis forsteri*, *Metrosideros perforata*, and *Tetragonia trigyna*; the orchids, *Bulbophyllum pygmaeum*, *Corybas orbiculata*, *Microtis unifolia*, *Pterostylis banksii* var. *banksii*, and *Thelymitra longifolia*; the herbs, *Arthropodium candidum*, *Brachyglottis lagopus*, *Leptinella squalida*, *Apium prostratum*, *Dichondra repens*, *Epilobium* species, *Haloragis erecta*, *Linum monogynum*, *Lobelia anceps*, *Oxalis* species, and *Wahlenbergia marginata*; and the ferns *Adiantum cunninghamii*, *Asplenium flabellifolium*, *A. terrestre* ssp. *maritimum*, *Blechnum penna-marina*, *Pellaea calidirupium*, *Phymatosorus pustulatus*, *Polystichum richardii*, and *Pyrrosia eleagnifolia*.

The rare divaricating shrub *Muehlenbeckia astonii* was recently discovered on cliffs of the south coast. Some plants were damaged in a fire soon after discovery, and the Wellington Botanical Society is actively involved in a recovery programme for the species at this site.

Increasingly the coastal cliffs are carrying a cover of introduced shrubs, herbs, and grasses. The coastal cliffs around Wellington Harbour support a diverse assemblage of plants that appear to be capable of forming permanent communities. Further north between Paraparaumu and Paekakariki the coastal escarpment runs alongside State Highway 1 and the traveller can always be guaranteed a show of some exotic plant in flower.

Two South African adventives dominate much of the coastal cliff land of

Wellington Harbour. The bone-seed (*Chrysanthemoides monilifera*) is a shrub which favours weathered, crumbling greywacke sites. Isolated plants can grow into spreading shrubs up to 3 m tall, or it can occur as a lower, more compact plant when growing in close proximity to other shrubs. It forms nearly pure stands on the cliffs around Shelly Bay. In late winter–early spring small yellow daisy flowers are produced; at this time stands of bone-seed are easily distinguished at a distance from stands of gorse and broom which have darker shades of yellow in their flowers. A small fleshy fruit containing a round, hard seed is produced. The seed is distributed by birds.

In recent years the South African veld grass (*Ehrharta erecta*) has become a rampant weed around Wellington. The grass is a prolific seeder and, with its hardy, fast growing habit, it has the potential to pre-empt sites around the coastal cliffs that would be favoured by native herbs and ferns. It has been sighted on all the coastal cliffs around Wellington Harbour, on the escarpment above Paraparaumu–Paekakariki, and on Mana Island.

ISLAND VEGETATION

Mana Island is the largest of the Wellington Region. It is 217 ha in extent and is located 4 km west of the Titahi Bay coast. The island is an uplifted peneplain remnant and is notable for its flat, table-like appearance. Cliffs rise 75–120 m on all sides of the island. There is a shingle beach on the north-eastern side.

The original vegetation of Mana was burnt in pre-European times. The island has been settled since at least 1820 and was farmed intensively from 1840 to 1986. Ryegrass and white clover grassland is the principal cover of the flat table-land. There is a small remnant of secondary kanuka forest in a valley on the north-east side of the island. Tauhinu scrub clothes much of the cliffs and is beginning to spread onto the open grasslands. On the shore there is a shrubland of climbing pohuehue and *Coprosma propinqua* which forms a narrow band between the cliffs and the sea.

Since the removal of stock from the island, Mana is managed as a scientific reserve, and the Department of Conservation has begun revegetation work to restore the island to scrub and forest cover. Natural successions will proceed over much of the island and, with time, and if fire is prevented, tauhinu, manuka, and kanuka will become prominent in the first stage of succession back to forest.

In 1987, Timmins et al. reported that nearly half of the vascular plants on Mana were adventive species, and of the native flora, many species were known from only a few individuals. Amongst the uncommon Wellington plants which find a refuge on Mana are Cook's scurvy grass (*Lepidium oleraceum*), Jersey fern (*Anogramma leptophylla*), *Arthropodium cirratum*, large-leaved milk tree (*Paratrophis banksii*), and *Melicytus obovatus*.

Somes, Mokopuna and Ward Islands lie in Wellington Harbour. Somes (Matiu) Island is the largest at 35 ha and rises to 75 m. A small rock stack called

Mokopuna Island is located some 70 m north of its northern tip.

Somes has been farmed (cattle and sheep) and used as a quarantine station for years. Grassland dominates the centre of the island. The Lower Hutt Branch of the Royal Forest and Bird Protection Society has been responsible for an extensive revegetation programme on the western and northern slopes since 1974. An akiraho shrubland is located on the southern end of the island. It has been subject to grazing by sheep and there has been little understorey development. An area of pohutukawa forest is located on the north-east end of the island; broadleaved shrubs are common in the understorey. With the withdrawal of the Ministry of Agriculture and Fisheries from the island, the Department of Conservation is now responsible for its management. As it is one of the few rodent-free islands in New Zealand it has great ecological significance and could be managed as an island sanctuary similar to that of Mana and Kapiti Islands, whereby public admission is permitted, but restricted to a daily maximum, and threatened species introductions are undertaken.

Mokopuna Island supports taupata scrub on its cliff sides, with mahoe and flax communities on the small summit area. A patch of boxthorn is present on the northern end of the island.

Ward Island supports taupata scrub on its flat summit along with a small area of pohutukawa forest. Taupata, bone-seed, pohutukawa, and flax are common on the cliff faces.

Taputeranga Island is located in Island Bay on the southern coast, some 22 m from shore. The island is 2 ha and rises to 40 m; it is separated into two parts by a narrow channel. The larger part contains a rock stack and a large rock platform. The central rock stack supports a coastal scrub of taupata, pohutukawa, karo, lupin, and bone-seed. Coastal flax, silver tussock, and adventive grasses are also present. A low shrub-herbland of taupata, *Melicytus crassifolius*, pohuehue, karo, and cruciferous plants is present on the rock platform. Halophytic vegetation is well represented and there is a large area of glasswort herbfield. Two regionally uncommon plants, *Suaeda novae-zelandiae* and *Melicytus obovatus*, are present on the island.

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