

3.2 ECOLOGY

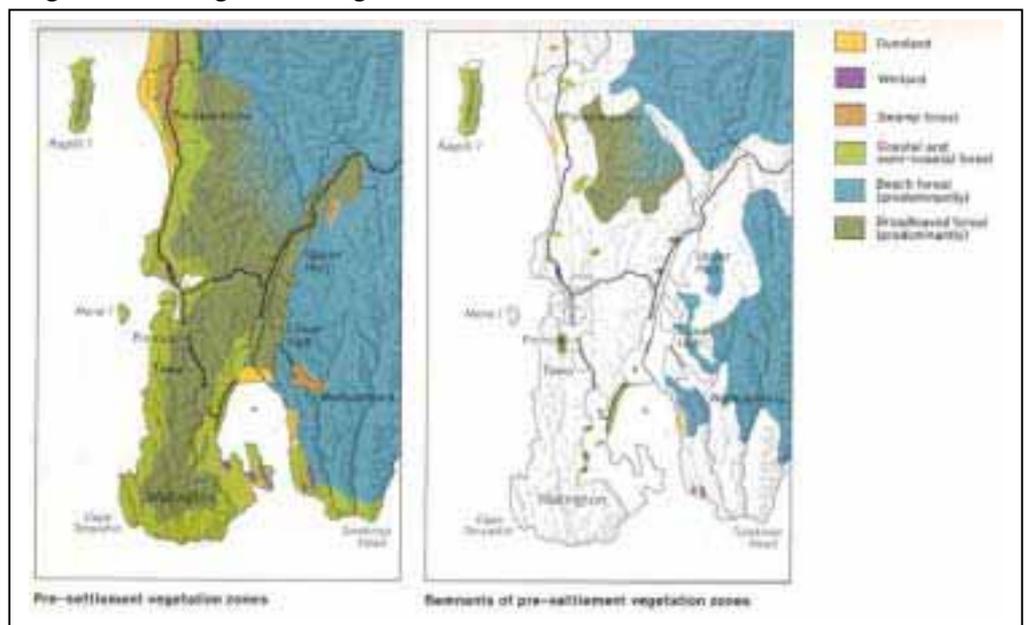
3.2.1 PRE-SETTLEMENT ECOSYSTEMS

Pre-settlement vegetation

There are many sources of information on past ecological character, but the principal sources used here are a report on early historical records of Wellington's vegetation⁸, *Wellington's Living Cloak* by Isobel Gabites⁹ and a recent analysis and depiction of ecodevelopments in Wellington¹⁰. Ecodevelopments are delineated according to biogeoclimatic factors such as wind, sunshine and temperature which would have influenced original patterns of soils and vegetation, and many of these characteristics remain the same, despite significant changes (e.g. vegetation clearance). An analysis specifically of the soil and substrate composition can be found in *Land Types of Wellington City, 1998*¹¹.

A good account of the modification and loss of the original vegetation is provided in *Wellington's Living Cloak*. Figure 3, copied from this book, shows the dramatic disappearance of most of the original native forests cover, wetlands and dunelands.

Figure 3. Wellington's Living Cloak



(image reproduced with author's permission)

Pre-settlement vegetation of the Outer Green Belt was broadleaved forest (predominantly) for most of the area, with coastal or semi-coastal forest at the southern and eastern margins. An almost continuous forest cover was likely and signs of this can still be seen in the form of tree stumps and weathered pieces of wood on the grassy tops of even the highest areas.

⁸ Boffa Miskell, 1998

⁹ Gabites, I., 1993

¹⁰ Boffa Miskell, 2002

¹¹ Landcare Research, 1998

The Outer Green Belt spans four of the 10 principle ecodevelopments described for Wellington (refer Map 2b):

Domain 5: This is a high-energy domain comprising rocky foreshore with steep, shingle beaches, bluffs and steep, stable hillslopes. The South Coast stretch is exposed to salt-laden southerly winds which are mostly turbulent through the hills and gullies, but which flow more smoothly and faster through large valleys aligned north-south. Steep topography and deep gullies create a heterogeneous environment with significant variation in microclimates.

Valleys: Expected pre-settlement vegetation would be high species diversity single tier coastal forest. Even regenerating shrubland and scrub has high species diversity because of the conditions.

Steep land: Expected pre-settlement vegetation would be low diversity coastal forest and shrubland-grassland-flaxland on rock outcrops.

Domain 8: Bands of low hill country experiencing year-round humidity and mild temperatures lying between areas affected by salt laden coastal winds and inland frosts. Pre-settlement vegetation in this domain, which includes Otari-Wilton's Bush, would have been typified by nikau groves in the gullies and tall podocarps emergent over a canopy dominated by tawa, kohekohe and hinau.

Domain 9: Inland hill country and basins covering the majority of the Wellington Peninsula, including most of the Outer Green Belt. This domain has two sub-zones: Tawa-Judgeford area with generally lower altitude and more moderate hill slopes, and the south Wellington Peninsula area dominated by high, steep hills and ridgelines typical of the Outer Green Belt. These areas are highly varied, but share relatively consistent annual rainfall, temperature and winds. They experience more frosts than lower or coastal areas (particularly in the valleys) but are away from the effect of salt laden coastal winds.

Pre-settlement vegetation in these areas would have varied considerably according to aspect and location, but typically included tall conifers and rata over a tawa dominated canopy with moisture-demanding or frost tolerant species such as kahikatea, pukatea and tree ferns in the wetter and more frost-prone valleys.

Domain 10: High peaks and peneplain remnants affected by strong winds, high rainfall and cool temperatures. These areas have skeletal, leached soils and montane vegetation typical of slightly higher altitudes in other parts of the North Island. The pre-settlement vegetation would probably have been devoid of some of the emergents and canopy trees seen in lower altitudes (rata, tawa and hinau) and may have had a greater presence of kamahi-toro canopy on the northern slopes, and miro and halls totara as emergent species (no remnants of this type remain).

As with the rest of the Wellington Peninsula, the original vegetation was almost completely removed and even the small number of isolated remnants were subject to some degree of modification, including removal of the largest and best tall trees. Those areas that could be farmed were, and for many years supported by favourable economic conditions and government subsidies.

These economic conditions began to deteriorate from the 1960s and this led to the gradual decline in the level of pasture management, particularly in the southern parts

of the peninsula (sub-domain 9b), and complete retirement from farming in some areas. Areas that were protected or retired relatively early in the city's history (eg. Otari-Wilton's Bush) show the benefit of many years of indigenous forest regeneration.

Pre-settlement fauna

This description of Wellington's original fauna is based on a combination of early diaries, fossil records, and knowledge of the habitats present^{12,13,14}. The early birdlife is best known. Our early bat, lizard, frog, invertebrate and fish fauna was poorly described and are known mainly through fossil remains and middens. Our knowledge of sea mammals comes from the whaling and sealing industry.

Wellington would have once had a fauna as diverse and abundant as any other coastal site in the lower North Island. With no large rivers or estuaries and relatively few freshwater wetlands, the wildlife would have reflected the predominantly coastal and lowland-forest character of the peninsula. Before Maori arrival, several species of moa, giant swans, pelicans and geese are likely to have been present but all were extinct by the time of the European settlement.

Written records begin in the 1830s and 40s. Early European settlers and naturalists wrote often of the birdlife and described a number of birds which are now locally or nationally extinct including; saddleback, piopio, robin, kokako, stitchbird, banded rail, little spotted kiwi, weka, and huia. Taine described local Maori bringing kereru and kaka to the Thorndon village for barter. Parakeets were prolific in the Karori area. In total 50 species of forest bird would have been present, and perhaps a further 100 species of coastal and marine bird.

However, it was not simply the presence of these species, but their sometimes-overwhelming abundance that impressed the settlers. Near Korokoro Stream, John Pierce wrote:

“there I sat down amidst the most luxuriant foliage, inhaling the fragrance of a thousand wildflowers and blooming shrubs, listening to a concert of a thousand different choristers of the wild woods and gazing upon the beautiful plumage of hundreds of parrots and parroquets together with the mocking or parsons birds”.

The saltmarsh, dunes and dry rolling hills areas of the Miramar isthmus attracted prolific birdlife including “the indigenous quail, plover (banded dotterel), and oyster catcher”. The two main wetland areas, Te Rotojuia Lagoon (“Burnham Water”) and the Basin Reserve wetlands, were dominated by flax, rush, raupo and cabbage tree and were “abounding in eel and wild ducks including flocks of Paradise ducks”.

Geckos and skinks were abundant in the forests and within the coastal shrublands, grasslands, open screes and boulder banks. Native frogs inhabited dark forested streambeds, or hid under logs and in rock piles on damp slopes.

In summer the forest would have been deafening with several species of cicada (kihikihi), and alive with winged insects, the many butterflies (pepe), beetles, native

¹² Boffa Miskell, 1998

¹³ Parrish, G.R. 1984

¹⁴ Stephenson, G. 1977

bees, wasps, flies and swarming ants. Near open water, damselflies (kihitarā) and dragonflies (kapokapowai) would have dodged the beaks of falcon, fantail, and kingfisher. At night, the giant puriri moth and the huhu beetle would have joined the many insects being hunted by morepork (ruru) and laughing owl (whekau). The calls of brown and little spotted kiwi would have echoed throughout the forests and open country of the peninsula.

The major Wellington stream systems, the Karori, Makara, Ohariu, Owhiro, Kaiwharawhara, and Takapu, had abundant eel, koaro, bullies, koura, various galaxiid species and summer swarms of mayflies and other freshwater insects.

The narrow rocky coastline of the South Coast was the winter haulout for large congregations of male fur seal. Weka cruised the beaches investigating seaweed and driftwood. Large numbers of little blue penguin would have emerged from the surf each night and scrambled into the low coastal forest to roost. The summits of the coastal ranges would have been honeycombed with the burrows of sooty and fluttering shearwaters. Tuatara would have scurried through the open coastal forests feeding on large insects, small lizards and sea bird eggs.

The coastal waters and harbour would have supported a great abundance and diversity of fish. In 1839 Dieffenback wrote “fish of many kinds is taken at Kapiti in great abundance, and will become one day an important article of commerce . . . Herrings, mackerels, gurnets, flatfish, several kinds of skate, and a variety of other fish, may be caught here in any quantity”. From time to time the harbour would have been visited by small whales, dolphins and porpoises.

3.2.2 PRESENT ECOLOGICAL VALUES AND CHARACTER

This section provides only a summary of the existing vegetation and the ecological conditions influencing this vegetation and its management.

Present ecological conditions

Apart from minor changes in climate, the biogeoclimatic conditions that form the basis for the ecodevelopments remain largely unchanged from pre-settlement times. However, many hilltops and slopes around Wellington have been subject to topsoil mining and this may have affected some parts of the Outer Green Belt.

In protected areas, the ecology is also now affected by an array of introduced plants and animals which hinder natural regeneration, and by the effects of human activity within and near these areas. Fire has been a major hindrance to regeneration, particular in the scrub phase.

Current vegetation and condition

All Wellington City Council owned lands in the Outer Green Belt have been mapped according to vegetation type and this information is shown on the maps in Section 5. This section aims to give only an overview, particularly in respect to the extent of actual native forest and the key areas of interest.

Map Two shows the areas identified as primary and secondary remnants in the 1999 survey. These areas encompass well known forested areas – as well as the many less significant ones on public and private land. The survey sought to identify and delineate every stand (area) of vegetation within the city boundary in which canopy

Primary remnant:

Any site containing a stand of forest that appears, from the canopy species present, and/or from its ecological character, to constitute a remnant trace of pre-settlement indigenous forest.

Secondary remnant:

Any site with secondary forest within which canopy species characteristic of the pre-settlement forest, are present within the canopy.

There are 1,017 hectares (433 sites) of primary forest remnant in Wellington.

532 hectares (84 sites) are in the Outer Green Belt.

390 hectares (49 sites) are currently protected by District Plan Open Space or Conservation zoning.

tree species characteristic of the district's primary forests are naturally occurring. The survey distinguishes between primary and secondary forest remnants.

Between these remnants on public land there are considerable areas in earlier stages of regeneration. These areas include important early successional forests which are transforming some hillsides and gullies into large green swathes where once there was only gorse. In other areas, more recently retired from farming, there are significant areas of gorse and, in increasingly greater abundance, Darwin's barberry (*Berberis Darwinii*), or various combinations of these alien species and native scrub. Within this pattern there are occasional pine plantations, and small copses or lone pines from earlier plantings.

Private land in the Outer Green Belt also contains a range of vegetation, from significant remnants to large open areas of pasture. Sector 2: Bests Ridge, in particular is characterised by an open pasture condition and is almost completely devoid of tall vegetation.

Sites of botanical interest or importance

Where sites of interest or importance for particular species exist, they are identified and discussed in Section 5.

3.2.3 FUTURE ECOLOGY

Vegetation trends

The significance of the forest remnants is clear if we consider that the core of the Outer Green Belt vision includes the restoration of a continuous corridor of native vegetation along the western edge of the city. It is from these remnants that the main potential exists for the recreation of this extensive band of forest – partly through their natural expansion, and partly as a source of seeds for planting programmes and dispersal by kereru and other native birds.

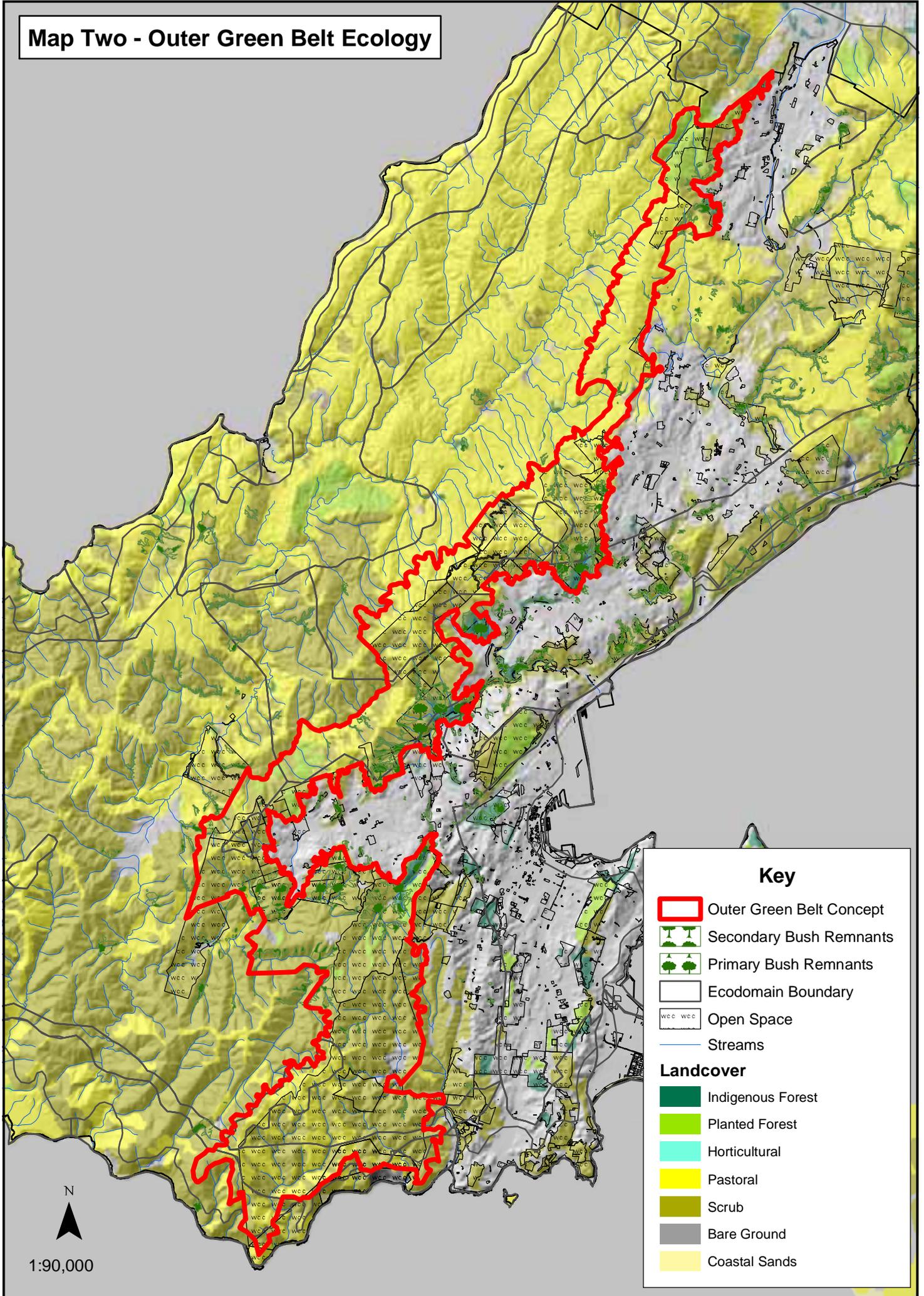
Some remnants are like islands of vegetation within a mostly grassed landscape. Whether fenced or not, these areas will not expand unless some of the surrounding areas are retired from farming. The remnants typically occupy the steep heads of gullies where there is sufficient year-round moisture and shelter to allow the survival and regeneration of the original traces of forest.

In areas that have been retired (and possibly protected) the trend is for colonisation of native and exotic shrub species in various combinations. This process is slower on the more exposed tops and drier north-facing slopes where open areas of grass can persist for many years.

Over time, retired and protected areas generally progress to a taller and different mix of plants, often with the exotic species being overtopped by the taller indigenous forest species. This process is well understood and fairly predictable where the main exotic species is gorse. Where the main exotic species is Darwin's barberry, the long term process is less well understood and is being investigated. Darwin's barberry originates entirely from the adjoining urban environment, being a once popular garden plant.

Because of the many different environmental conditions and ages, the vegetation along the length of the Outer Green Belt is like a mosaic of plant communities at different stages of transition from open grass through to tall forest. The actual

Map Two - Outer Green Belt Ecology



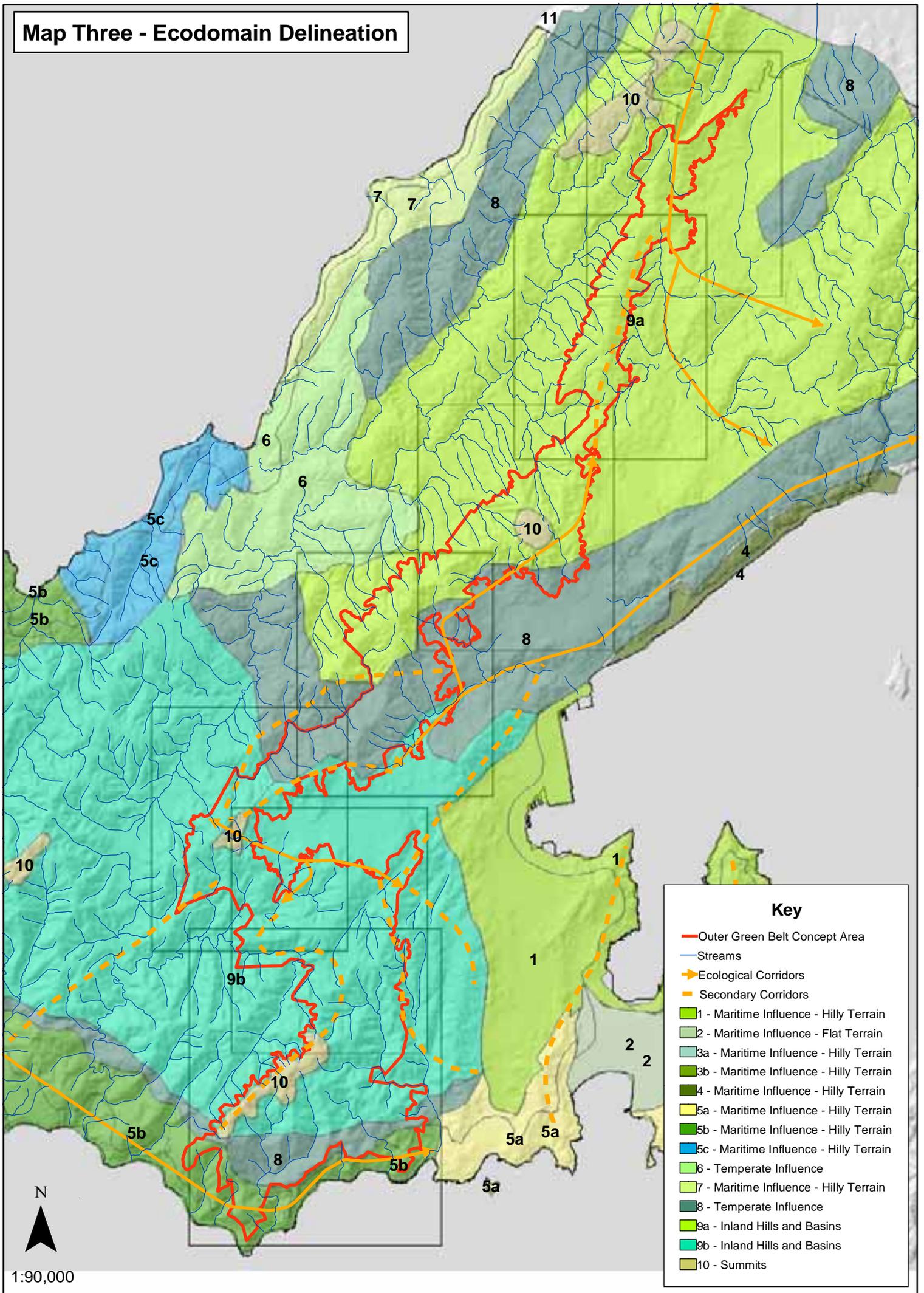
Key

-  Outer Green Belt Concept
-  Secondary Bush Remnants
-  Primary Bush Remnants
-  Ecodomain Boundary
-  Open Space
-  Streams

Landcover

-  Indigenous Forest
-  Planted Forest
-  Horticultural
-  Pastoral
-  Scrub
-  Bare Ground
-  Coastal Sands

Map Three - Ecodomain Delineation



Key

- Outer Green Belt Concept Area
- Streams
- Ecological Corridors
- - - Secondary Corridors
- 1 - Maritime Influence - Hilly Terrain
- 2 - Maritime Influence - Flat Terrain
- 3a - Maritime Influence - Hilly Terrain
- 3b - Maritime Influence - Hilly Terrain
- 4 - Maritime Influence - Hilly Terrain
- 5a - Maritime Influence - Hilly Terrain
- 5b - Maritime Influence - Hilly Terrain
- 5c - Maritime Influence - Hilly Terrain
- 6 - Temperate Influence
- 7 - Maritime Influence - Hilly Terrain
- 8 - Temperate Influence
- 9a - Inland Hills and Basins
- 9b - Inland Hills and Basins
- 10 - Summits

vegetation has been recently mapped¹⁵ and this information is included in Section 5 of this Plan. This pattern is typified by the public lands on and near Kaukau which includes:

- *Grassland* *Alien species dominant*
- *Shrubland* *Shrubs in grassland*
- *Scrub* *Flax dominant*
- *Scrub* *Gorse or Darwin's barberry dominant*
- *Scrub* *Broadleaved (inland) dominant*
- *Scrub* *Mixed narrow leaved indigenous*
- *Forest* *Alien species dominant (pines)*
- *Forest* *Kohekohe dominant*
- *Forest* *Tawa dominant*
- *Forest* *Mixed broadleaved forest*
- *Rock and Scree*

Apart from a significant remnant in Otari-Wilton's Bush there is very little of the Outer Green Belt with forest containing podocarps. Podocarps were a significant component of much of the pre-settlement vegetation. The co-dependence between podocarps and certain indigenous bird species is an important issue in restoring natural biodiversity and some of the original character to the Outer Green Belt. kereru in particular are important in the natural dispersal of podocarp seeds.

While kereru exist in some areas, they are not sufficiently abundant or widely dispersed, nor are there enough existing podocarps for natural dispersal to take place quickly. For this reason, Project Podocarp has been established as a community initiative (with support from New Zealand Royal Forest and Bird Society), to plant podocarps in strategically useful locations to assist native birds in future natural dispersal.

3.2.4 ECOLOGICAL ISSUES AND OPPORTUNITIES

The ecological role of the Outer Green Belt

The concept of a continuous ecological corridor, from end to end, is far from being a reality. While some sections are well vegetated and protected there are extensive gaps, especially where the dominant or only cover is pasture and the land is in private ownership. Achievement of the vision requires at the very least, the protection of all existing vegetation, and the linking of this vegetation into one common band.

This Plan provides an opportunity to define more precisely the footprint of the intended corridor so that:

- It is ecologically meaningful and sustainable
- reflects the other roles and values of the Outer Green Belt (landscape, recreation, historic, cultural, utilities)
- it is achievable, legally and practically
- reflects likely changes and the effects of remaining development opportunities at the edge of the built environment.

The support and involvement of private landowners is crucial for this vision to be achieved and the Council will seek their support and involvement using this Plan as a guide. The maps and text in Section 5 broadly indicate the areas of Wellington City Council land which will, over time, be revegetated.

¹⁵ Pacific Eco-Logic Ltd, 2002 (1)

Measuring the ecological condition of the Outer Green Belt

While the overall ecological value of the Outer Green Belt is a somewhat holistic question that is only dealt with descriptively in this Plan, its ecological condition can and will be assessed according to best practice biodiversity monitoring processes and standards.

City-wide the principal basis for measuring biodiversity outcomes are the specific indicators adopted by the Council in 2002¹⁶:

Indicator 1: The distribution and relative abundance of native forest bird species, especially kereru, bellbird and tui in Wellington City Council reserves.

Indicator 2: The structure and composition of forest and coastal plant communities in Wellington City Council reserves.

Indicator 3: The condition of forest vegetation sensitive to possum browse in Wellington City Council reserves.

Indicator 4: The extent of vegetation cover classes within Wellington City Council reserves.

These indicators need to be monitored and interpreted for each part of the Outer Green Belt and more detail on current information and management options relating to these indicators is provided in Section 5.

Botanically, Otari-Wilton's Bush is the most significant site in the Outer Green Belt and requires continued support to ensure its protection. Implementation of the existing *Otari-Wilton's Bush Management Plan*, supported by the policies in this Plan, will see this area gain in significance and develop further as a popular destination for people wanting to see examples of Wellington's original vegetation.

Along with Otari-Wilton's Bush, Karori Sanctuary provides another key destination in the Outer Green Belt for viewing our natural heritage (although the emphasis is on the experience of indigenous fauna as it will be some time before mature native forests return to this area). Continued support for Karori Sanctuary is necessary to ensure it reaches its potential as a sanctuary for native flora and fauna and a major visitor attraction for Wellington.

Identifying and establishing ecological corridors

Inherent in the Outer Green Belt concept is the principle of creating ecological corridors to aid the movement of indigenous flora and fauna within an integrated, interconnected system of protected areas. Originally, Wellington's forests were part of a continuous broad forest extending beyond the present city boundaries to most parts of the North Island. Now, many reserves are ecologically isolated. Even if the Outer Green Belt is completed it would not connect with other areas beyond the city unless other corridors area created over both public and private land.

The Bush and Streams Restoration Plan emphasises to the need for the creation and protection of ecological corridors linking to a larger regional network through Belmont Regional Park. *The Bush and Streams Restoration Plan* shows the broad

¹⁶ Pacific Eco-Logic Ltd, 2002 (2)

ecological corridors which conceptually link the Outer Green Belt into a broader regional network. Other secondary corridors are also indicated and will be looked at more closely in Section 5.

Plant pest management

Plant pests are probably the biggest threat to the Outer Green Belt environment. They can transform a landscape in a relatively short time to an undesirable condition or hinder a desired natural transitional process on a massive scale. The Council's *Pest Management Plan* is the source of general policy for managing this issue.. The following issues, of particular importance for the Outer Green Belt, will need to be addressed in the review.

While gorse is now seen to have a beneficial role in the regeneration of indigenous forest, Darwin's barberry is seen as a probable hindrance to regeneration, particularly in the more exposed areas such as the top of Wright Hill.

In areas like Wright Hill a clear direction for the management of Darwin's barberry needs to be stated. Significant new infestations need to be prevented or managed to ensure the protection of existing indigenous vegetation - and prevent the loss of landscape values and recreation access. The Council needs to consider management of Darwin's barberry under its own programmes as set out by the *Draft Pest Management Plan*.

One such site is Kaukau and the ridge to the south along the route of the Skyline Track, which contains an interesting and diverse indigenous plant community in the form of wind-shorn scrub. Darwin's barberry is invading this area and has the potential to overtop the existing vegetation if left unchecked. The Council is committed to managing this pest, particularly in key native ecosystems and open areas.

Continuing vigilance against other long established or more recent pest plants is also needed in accordance with the *Regional Pest Management Strategy* and the Council's *Draft Pest Management Plan*.

Animal pest management

The most significant areas of indigenous bush are classified by the Greater Wellington Regional Council as Key Native Ecosystem Management Areas (KNEMA's). As such, they are subject to the Greater Wellington Regional Council's possum management target of five percent residual trap catch rate. More detail on the achievement of possum control targets is included in Section 5 of this report.

The two councils have taken a cooperative approach to possum control in the city's reserves and open spaces. The flow-on effects in terms of the forests' ecological health will be established by monitoring biodiversity indicators. Generally, monitoring shows control work has greatly reduced possum numbers – while at the same time there has been a significant increase in the numbers of tui. Kereru numbers have also increased, but their range is still limited to a few key native ecosystems in the Outer Green Belt.

The control programme has been supported by other ground based control operations. Such work has been running at Otari-Wilton's Bush since 1993 and similar initiatives have started elsewhere, particularly within the Outer Green Belt.

Goats have become a major problem on the south west Wellington Peninsula in recent years. This is partly due to the collapse of the goat farming industry in the 1980s. Goats clearly flourish in the steep and rugged, yet relatively open, country in the south west of the city. Landowners vary in their tolerance of goats, and while this is the case, a voluntary system of control will not work. The parts of the Outer Green Belt most affected by goats in recent years are Makara Peak and lands to the south of the landfill (pigs are also an increasing problem in this area). Goats have also periodically been present in the southern portion of Wright Hill.

Karori Sanctuary is an obvious highlight in terms of pest control, being the only part of the Outer Green Belt where (except for mice), mammalian pest species are absent. This is due to the construction of an 8.6 kilometre pest-proof fence surrounding the former Karori Reservoir. The regeneration of bush in the sanctuary will provide an interesting comparison to other parts of the Outer Green Belt not subject to the same level of pest control.

Priority setting for ecological restoration and management

The Council has an on-going programme of planting around the city. This generally has either a biodiversity or ecology focus, or an amenity and landscape focus. In many cases planting projects are closely associated with the management or removal of plant and animal pests.

Biodiversity planting mainly focuses on the protection and enhancement of Key Native Ecosystem management areas and other indigenous forest remnants (creating buffer zones by replacing weeds with pioneer native species and enhancing diversity by planting successional species), but may include riparian planting, revegetation planting (planting of open areas to create ecological linkages) and other initiatives proposed in the *Bush and Streams Restoration Plan*.

The Council is in the process of defining city-wide priorities for biodiversity planting, supporting the goals of the *Bush and Streams Restoration Plan*. Priorities will be based mainly on an analysis of existing biodiversity resources, plant and animal pest management issues, community wishes, and the location of Wellington City Council lands.

Fire

Although there have been few fires recently, fire has been a significant hindrance to native forest restoration in some parts of the city (a fire destroyed part of a pine plantation near Makara Hill Road several years ago). In contrast, the South Coast and Western Hutt Hills have recently suffered from repeated fires, many on or around 5 November each year. Fire has the potential to severely scar the Outer Green Belt landscape and set back natural restoration processes. Planting priorities will include the planting of fire resistant species along scrub margins, where the likelihood and consequences of fire are most significant.

Maintenance of open areas

This Plan interprets the broad vision to find a harmony and balance between ecological, landscape, recreational and cultural objectives. *Capital Spaces* emphasises the restoration of indigenous vegetation and the ecological benefits this would provide. However the potential exists for ecological outcomes to be achieved alongside landscape and recreational outcomes involving areas of bush and areas of open space.

Some of the existing open ridgetop and hilltop landscapes are highly valued for their existing intrinsic value and as open spaces for recreation. This Plan defines those areas which the Council intends to maintain in their existing open condition. This approach was generally supported in the initial submissions on this Plan. More information on these areas and their values is provided in the following sections.

Effects of urban development

Part of the role of the Outer Green Belt is to define the western limit of the urban development, and provide a green backdrop to the city and a buffer between the urban and rural environments.

This Plan proposes an Outer Green Belt concept area defined by a line that encompasses all areas holding Outer Green Belt values, which warrant close attention and protection. Some of this private land may be subject to future subdivision and some level of development, particularly on the lower eastern slopes adjacent to areas already developed. Bush remnants, and areas of high landscape value should be protected from development, particularly for residential purposes, and this Plan includes policy statements to support this.

In time, and partly through this Plan, it is intended that the edge of the city will become more clearly defined and that land beyond this line within the Outer Green Belt is protected from all activities that would harm natural values. This Plan on its own does not have any legal bearing on private land, but may in time be supported by new rules in the *District Plan* or other tools, particularly to protect bush remnants, water courses, ridgeline landscapes and to prevent large scale landform modifications. Any new rules will of course follow in-depth consultation with landowners.

Community / landowner initiatives and assistance

Many of the current projects to restore the natural environment of the Outer Green Belt are based in and originate from the community. These are becoming increasingly sophisticated and the level of coordination between these groups and the Council is increasing. This Plan will help the Council and the community provide a common reference point and a broad (but detailed) vision to which the individual projects contribute. The Council will work to increase the overall level of community participation in this area.

A list of the organisations with which the Council is currently involved in managing and restoring the Outer Green Belt is provided in Appendix 2.