

# The current and historic state of indigenous biodiversity in Wellington

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Contract Report No. 3942I

Providing outstanding ecological services to sustain and improve our environments



# The current and historic state of indigenous biodiversity in Wellington

**Contract Report No. 3942I**

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## 1.0 Introduction

Wellington City has an Operative District Plan and a Proposed District Plan, both of which contain provisions relating to the protection of ecologically significant indigenous vegetation and habitats of indigenous fauna within defined areas, i.e. Significant Natural Areas (SNAs). The now-operative National Policy Statement for Indigenous Biodiversity (NPS-IB) contains provisions addressing the protection of indigenous biodiversity within SNAs and outside of SNAs, including highly mobile indigenous fauna. As part of the Proposed District Plan process, Wellington City Council require advice on options for managing vegetation clearance to address the protection of indigenous biodiversity. Wildlands has previously provided preliminary advice on this matter but a more comprehensive evaluation is now required.

This report provides the first stage of this advice: a succinct overview of the state of indigenous biodiversity in Wellington City.

## 2.0 Ecological districts

Wellington City is within the Sounds-Wellington Ecological Region and is divided roughly evenly between the Cook Strait and Wellington Ecological Districts. The summary descriptions of Cook Strait and Wellington ecological districts below are sourced from: McEwen (1987), Singers and Rogers (2014), Singers (2014), Greater Wellington Regional Council (GWRC 2002) and Landcare Research (2020).

### 2.1.1 Wellington Ecological District

#### Topography, Geology, and Soils

Wellington Ecological District comprises steep, strongly faulted hills and ranges, two harbours (one with several small islands), the large Pāuatahanui estuary, and the large Hutt River valley.

The geology almost entirely comprises Triassic-Jurassic alternating argillite and greywacke. There are a range of soils from greywacke and Pleistocene drift material and loess, with alluvial, peaty and stony soils in valleys. Soils on steep slopes are moderately leached, stony and shallow steepland soils. They are moderately fertile, with only slight scree erosion, and mainly used for pastoral farming, with some areas reverting to scrub. Soils on hilly, rolling and flattish slopes are generally moderately deep to deep loess or drift material over greywacke. In lower rainfall areas near the coast, subsoils are pale coloured, firm to compact, but in more inland higher rainfall areas the subsoils are browner, more friable, and better structured. Soils in valleys range from sandy and silty well-drained soils on levees, through poorly drained heavier textured soils in back-swamps and fans, to peaty soils in swamps. Shallow, stony soils occur on low terraces. There are minor areas of salty soils in estuarine areas and sandy soils on coastal dunes.

#### Climate

The climate is windy with west to northwest winds prevailing, a high wind-run and frequent gales. Summers are warm and winters mild. Annual rainfall is 900-1,400 mm and evenly distributed throughout the year.

#### Pre-human Vegetation

Indigenous forests were originally widespread, with podocarp forests (*kahikatea/Dacrydium dacrydioides*, *tōtara/Podocarpus totara*, *matai/Prumnopitys taxifolia*) on hills, rimu (*Dacrydium*



*cupressinum*)-northern rātā (*Metrosideros robusta*)/kohekohe (*Dysoxylum spectabile*) forest nearer the coast, and miro (*Prumnopitys ferruginea*)-rimu/tawa (*Beilschmiedia tawa*) forest at higher elevations.

### Current Vegetation

Much of ecological district is now farmed (semi-extensive sheep and cattle), with c.30% of the land covered in exotic grassland and c.8% in exotic forest. Areas of gorse (*Ulex europaeus*) and/or broom (*Cytisus scoparius*) are common, covering c.14.5% of the district, while urban areas (e.g. Wellington City) comprise c.22% of landcover in the ED (Landcare Research 2015).

Remaining indigenous vegetation includes salt marsh communities around Pāuatahanui Inlet, 'Mānuka and/or Kānuka' (c.2% of landcover), 'Broadleaved Indigenous Hardwoods' (c.15% of landcover), and remnants of the original 'Indigenous Forest' (c.2% of landcover) (Landcare Research 2015), although many have been logged for podocarps. Compared to the neighbouring Tararua Ecological District, very little beech is present, although black beech (*Fuscospora solandri*) and hard beech (*F. truncata*) occur in ridge stands between Haywards and Moonshine.

## **2.1.2 Cook Strait Ecological District**

### Topography, Geology, and Soils

Cook Strait Ecological District is defined by its maritime climate, characterised by high wind-run and frequent gales, and the topography. The very exposed, steep coastal escarpments, terraces, headlands and islands on either side of Cook Strait have distinctive vegetation types. Many species occur on both sides of Cook Strait, but the district also represents a major biogeographic barrier to a large number of organisms.

The geology is complex with offshore islands and island groups from different geological epochs. The Wellington coast and Mana Island comprise Triassic and Jurassic alternating greywacke and argillite, and Holocene alluvium. Soils are mainly shallow and stony steepland soils from greywacke, with skeletal soils and areas of bare rock and scree on coastal cliffs. In some places there are small areas of shallow and gravelly soils on old beach ridges.

### Climate

The climate is maritime, with generally mild temperatures and good annual rainfall (approx. 1200 mm). The Cook Strait ED is characterised by high wind-run and frequent gales due to winds being forced through the gap between the North and South Island ranges.

### Pre-human Vegetation

The steepest hill slopes and cliffs were probably originally covered in mixed low forest and scrub dominated by akiraho (*Olearia paniculata*), māhoe (*Melicytus ramiflorus*), kiekie (*Freycinetia banksii*), wharariki (*Phormium cookianum*), and mānuka. Forest species included karaka (*Corynocarpus laevigatus*), kohekohe, and ngaio (*Myoporum laetum*), and also tawa, tītoki (*Alectryon excelsus*), occasional podocarps, and northern rātā.

### Current Vegetation

Forest and scrub have now been largely replaced, as a result of fire and grazing, by shrublands and grasslands in which tauhinu (*Ozothamnus leptophyllus*), akiraho, māhoe, mānuka, *Coprosma propinqua*, *Muehlenbeckia complexa*, wharariki, silver tussock (*Poa cita*), and many introduced plants are key components (McEwen 1987b).



## 3.0 Ecological domains

Ecological Domains (GWRC 2002), also known as eco-domains, combine information on geology, geomorphology, meteorology, biology, and human use of natural resources, to describe ecological characteristics of a region. This method resulted in over 60 areas across the Wellington region being identified as ecologically distinctive.

The following eco-domains occur within Wellington City:

- Eastbourne - Point Howard/Seatoun-Scorching Bay
- Petone - Kaiwharawhara
- Wellington City
- Miramar Flats
- Western Temperate Foothills
- Point Dorset - Makara
- Makara-Pukerua Bay
- Western Hills
- Western Hills Cloud Zone (>400m)
- Pipinui Point
- Wairaka with Green Point
- Porirua

## 4.0 The Wellington Region

The Wellington Region (also known as Greater Wellington) covers an area of 8,049 square kilometres and includes four main areas: the Kāpiti Coast, the Wairarapa, the Hutt Valley, and Wellington City. The entire region has a population of 550,500 (June 2023) of which 215,200 (39.1%) people live in Wellington City (39.1% of the region).

## 5.0 Wellington City

Wellington City (c.29,000 ha, excluding inland waters or oceanic areas) is at the south-western tip of the North Island. The city is situated on a peninsula between Wellington Harbour, the Tasman Sea, and the Pacific Ocean. Wellington lies on an active geological fault, and land to the west of the fault rises abruptly with many suburbs high above the centre of the city. Many of these steep slopes have not been developed and are covered in vegetation. The climate is temperate marine, with moderate temperatures all year round. However, strong winds are common due to the funnelling effect of the Cook Strait. Wellington abuts Porirua City to the north and Hutt City to the northeast.

Wellington City is split into various zones, with a zone spatially identifying an area with common environmental characteristics, so that environmental outcomes across each zone can be effectively managed by local government. Although there are eighteen different zones, these can all be grouped within three main zones. These are (with proportion of total City land area<sup>1</sup>):

- Public (19%)
- Residential (16%)

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<sup>1</sup> Zone data according to the WCC Operative District Plan, 2021. Available at: <https://catalogue.data.govt.nz/dataset/wcc-district-plan-zones2>



- Rural (65%)

Ownership of land is split between local (Wellington City Council and Greater Wellington Regional Council) government, and central government (i.e. managed by DOC), and private ownership, with residential zoned land comprising approximately 75% of all urban zoned land in Wellington City (Macleod and Hope-Pearson, 2014).

## 6.0 Biodiversity in Wellington

### 6.1 Historic land cover changes

Biological diversity – or biodiversity – is the complete variety of life on earth. Biodiversity includes: genetic diversity, which is the variability in the genetic make-up amongst individuals of the same species; species diversity, which is the variety of species within a particular area and; ecosystem diversity, which is the variety of ecosystem types and associated biological communities or habitats (e.g., scrubland, forest, sand dunes, wetlands, streams).

Forest ecosystems across the Wellington Region (total land area 813,500 ha) are thought to have once covered around 782,000 hectares, but now only roughly 214,000 ha (27%) remain, with the greatest losses having occurred in lowland forests (Singers et al 2018).

Before humans arrived in New Zealand, the area that is now Wellington City was covered in indigenous forest. Through their analysis of original ecosystem types, Singers and Rogers estimated that the City originally had 97% indigenous forest cover (i.e. types MF6, MF7, MF8, and WF2, Singers and Rogers 2014). Much of the Wellington City District was cleared by early settlers, thus many areas of extant indigenous vegetation are secondary forest or successional scrub/shrubland, with little primary forest remaining. Wellington City features many areas of indigenous vegetation and habitat, from small remnants in urban settings, to more extensive areas of scrub and forest in Town Belts, rural areas, and coastal margins.

Across Wellington City, a summary of pre-human biodiversity is provided in WCC (2015):

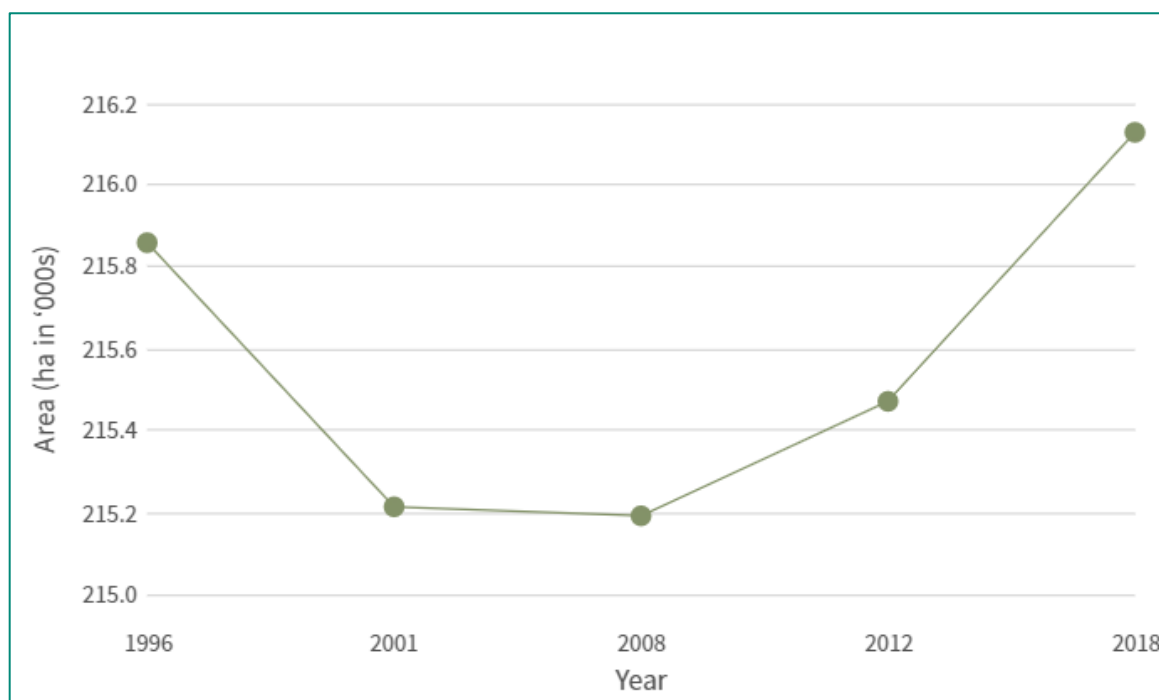
- The city was once covered in lowland broadleaf-podocarp forest. Trees such as northern rata would have been common emergents, along with rimu, matai, kahikatea and totara. In the canopy the dominant species would have been tawa, kohekohe, kamahi, titoki, pukatea and kowhai. The sub-canopy and ground cover would have had high diversity of climbers and ferns.
- The main wetland areas were dominated by flax, rush, raupo and cabbage tree. The major Wellington stream systems would have had abundant eel, koaro, bullies, koura, various galaxiid species and a high diversity of freshwater invertebrates.
- Coastal escarpments facing the Cook Strait (Wellington's south coast), as well as the harbour escarpments, would have been covered with a mix of coastal forest, dense coastal scrub, flax and tussockland, and scree. The coastal forest was dominated by kohekohe, ngaio, northern rata, akiraho and kowhai, while the dense coastal scrub was characterised by tauhinu, mingimingi, matagouri, prostrate kowhai, pohuehue and speargrass.



## 6.2 Land cover changes since 1996

### 6.2.1 Forest and scrub ecosystems

Land Air Water Aotearoa provides data on terrestrial land cover changes across New Zealand<sup>1</sup>. Across the Wellington Region, indigenous forest cover and indigenous scrub and shrubland cover remained overall unchanged across these two decades (Figures 2 and 3).



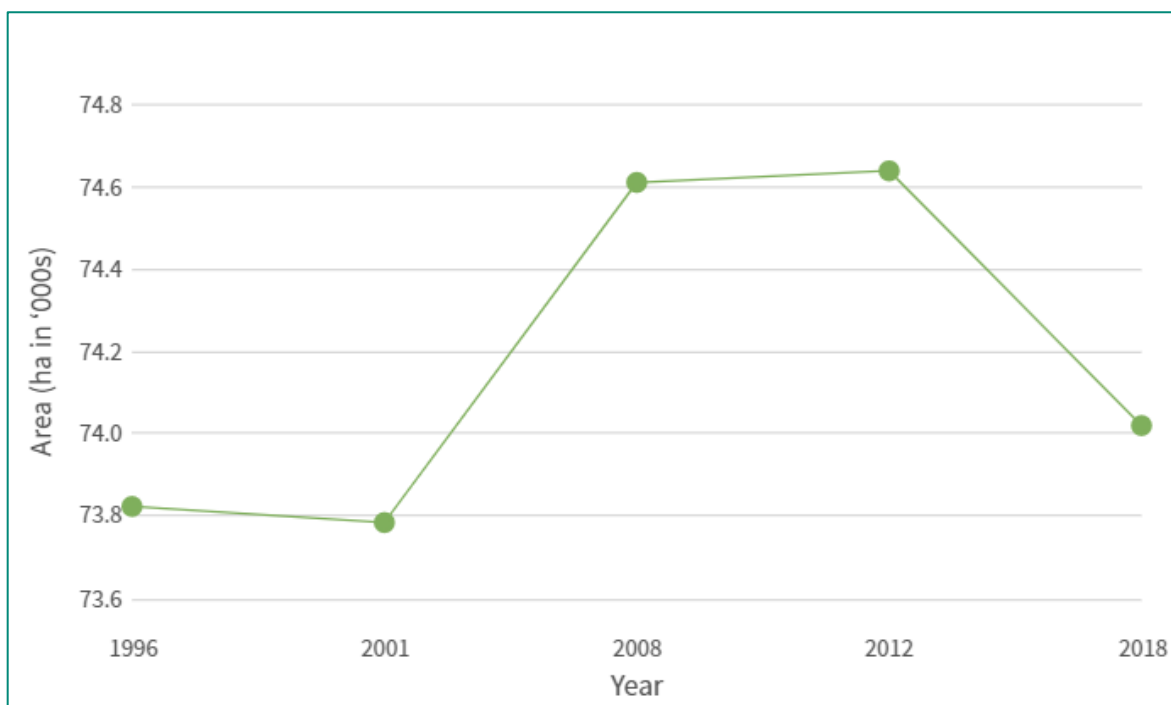
**Figure 2.** Changes in area of indigenous forest cover between 1996 and 2018 across the Wellington Region (graphic from [lawa.org.nz](http://lawa.org.nz)). Forest originally covered 782,000 hectares.

Today much of the indigenous vegetation in the lowland and coastal areas of Wellington Region is fragmented and modified, resulting in loss and modification of ecosystem functions. As Figure 2 shows, extensive clearance of indigenous forest occurred after 1996. Although an increase is shown in the most recent Land Cover surveys (2012 and 2018), the increased area is characterised by secondary forest which lacks much of the biodiversity values found in old growth forest.

Key trends within Wellington City include increased extent of exotic forest and built-up urban areas. For example, in the Karori catchment, exotic forest cover increased by 120% and urban cover increased by 2%, and in the Kaiwharawhara catchment, exotic forest cover and urban cover increased by 6% and 3%, respectively (Table 1).

<sup>1</sup> The Land Air Water Aotearoa land cover analyses ([awa.org.nz](http://awa.org.nz)) are calculated using changes in areas of land use based on data in the Land Cover Database. The earliest version (LCDB 1.0) was released in 1996/97, and the latest version (LCDB 5.0) was released in January 2020 ([Iris.scinfo.org.nz](http://iris.scinfo.org.nz)).





**Figure 3.** Changes in area of indigenous scrub and shrubland cover between 1996 and 2018 across the Wellington Region (graphic from lawa.org.nz).

Overall, indigenous forest cover has remained fairly stable since the 1990s across Wellington City’s main catchments (Makara, Karori, and Kaiwharawhara), with indigenous scrub/shrubland cover generally increasing, and exotic scrub/shrubland decreasing. For example, in the Makara catchment, indigenous scrub/shrubland cover increased by 669% and exotic scrub/shrubland cover decreased by 9%, and in the Karori catchment, indigenous scrub/shrubland cover increased by 31% and exotic scrub/shrubland cover decreased by 1% (Table 2). Conversely, exotic scrub/shrubland cover increased by 33% in the Kaiwharawhara catchment. This increase in exotic scrub/shrubland in this catchment likely represents the retirement of large areas of farmland along the City’s outer limits (i.e. the Town Belt), where large swathes of gorse (*Ulex europaeus*) and Darwin’s barberry (*Berberis darwinii*) have established.

**Table 1** – Changes in land cover classes in major Wellington City catchments, 1996 to 2018. Indigenous vegetation and natural cover are emphasised in **bold**. Data from LAWA.org.nz.

Land Cover Class	% Cover Change, 1996 to 2018		
	Makara	Karori	Kaiwharawhara
<b>Indigenous forest</b>	<b>+5ha (+2%)</b>	<b>-2ha (&lt;1%)</b>	<b>-9ha (-2%)</b>
Exotic forest	+219ha (+58%)	+67ha (+120%)	+4ha (+6%)
<b>Indigenous scrub/shrubland</b>	<b>+174ha (+669%)</b>	<b>+1ha (+31%)</b>	--
Exotic scrub/shrubland	-152ha (-9%)	-11ha (-1%)	+66ha (+33%)
Exotic grassland	-246ha (-5%)	-55ha (-15%)	-76ha (-57%)
Other herbaceous vegetation	<1ha (<1%)	--	<1ha (<1%)
<b>Natural bare/lightly-vegetated surfaces</b>	--	<b>-8ha (-66%)</b>	<b>&lt;-1ha (-3%)</b>
Artificial bare surfaces	--	<1ha (<1%)	-3ha (-50%)
Urban area	<1ha (<1%)	+8ha (+2%)	+19ha (+3%)



### 6.2.2 Wetland ecosystems

Only 2,774 hectares of wetlands remain in the Wellington region, or c.2% of their original extent. Most remaining wetlands are small in area. Although there has been a minor increase in wetland extent in recent times, re-created wetlands do not have the same ecological values as original wetlands and have limited ability to offset lost functionality (Maseyk and Parlato 2023). Furthermore, wetlands on private land continue to be at risk, with a 37% of losses on private land having occurred since 2001<sup>1</sup>.

### 6.2.3 Coastal ecosystems

Very few examples remain of the coastal forest types in the region, with approximately 3% of tītiki and ngaio coastal forest, 2% of tōtara and matai broadleaved dune forest, and 1% of kahikatea and pukatea swamp forest remaining (Singers *et al.* 2018). Within Wellington City, less than 20% of the original dominant coastal forest type (koekohe and tawa forest) remains today, with the majority of this forest type now found along the Kāpiti Coast.

There has also been extensive loss of coastal dunelands across the region, with sea-level rise eroding the active foredunes and encroachment by development occurring on the more stable back dune. Current dunelands are also dominated by exotic species (approx. 69% of duneland vegetation cover) (Maseyk and Parlato 2023).

## 6.3 Current state of biodiversity in the Wellington Region

In a recent review of indigenous biodiversity monitoring and reporting across the Wellington Region, Maseyk and Parlato (2023) explain that the state and trend of indigenous biodiversity in the Wellington Region is a product of the legacy of historic loss and the continued pressures from land use and management practises, including continued urban development and ongoing pressure from invasive species. These authors also state that the Wellington Region has a large proportion of resident species that are Regionally Threatened (100% of bat species, 85% of reptile species, 79% of bird species, 67% of indigenous freshwater fish species, and 22% of indigenous vascular plant species). Many indigenous ecosystems and habitats have been almost entirely depleted: there is 5% left of original lowland broadleaf-podocarp forest, 2% of original wetland area, and just 1% of original coastal forest (WCC 2015). Retention of Threatened and At Risk species is contingent on the recovery of the extent, connectivity, and condition of the ecosystems they rely on (Maseyk and Parlato 2023).

To protect the city's natural capital, Wellington City Council have stated a "biophilic mandate" with the aim of restoring biodiversity across the city. More specifically they seek to:

- Increase the number and population size of indigenous species and their habitats;
- Create resilient ecosystems;
- Improve aquatic ecosystem health;
- Establish restoration programmes for rare, threatened or locally significant species;
- Develop ecological networks across the landscape (WCC 2015).

## 6.4 Threatened Environment Classification

The Threatened Environment Classification (TEC) combines three national databases: Land Environments of New Zealand (LENZ), Land Cover Database (LCDB5.1), and the Protected Areas Network (PAN-NZ), to determine which environments are considered to be the most at risk according

<sup>1</sup> Media release by Forest and Bird, February 2018. Available at: <https://www.forestandbird.org.nz/resources/world-wetlands-day-forest-bird-release-maps-showing-extent-wetlands-crisis>



to the amount of indigenous vegetation remaining and whether they are legally protected or not (Cieraad *et al.* 2015, Walker *et al.* 2007).

Each of the 500 LENZ Level IV environments were assigned one of six threat categories on the basis of past habitat loss (i.e. percentage of pre-human indigenous cover remaining) and current legal protection (Table 2). A land environment was given a high threat status if it supported a small amount of original vegetation, and a low threat status if it continues to support large areas of original vegetation.

Around 75% of Wellington City is within a threatened environment, including 25% acutely threatened land environments. Most acutely threatened areas comprise exotic grassland and urban areas.

**Table 2–** Extant indigenous cover for Wellington City for each of the Level IV Threatened Environment Data<sup>1</sup>. Classification categories as per Cieraad *et al.* (2015) and Walker *et al.* (2007). This table excludes 1.3% (387 ha) of unclassified environments.

Threatened Environment Category	Criterion	Area (ha)	% of district
Acutely Threatened	<10% indigenous cover remaining	7,001	24.1%
Chronically Threatened	10-20% indigenous cover remaining	199	0.7%
Critically Under protected	>30% indigenous cover remaining <10% legally protected	11,685	40.3%
Under protected	>30% indigenous cover remaining 10-20% legally protected	2,899	10.0%
No Threat Category	>30% indigenous cover >20% legally protected	6,829	23.5%

## 6.5 Significant Natural Areas in Wellington City

Wildlands Consultants Ltd has been working with WCC to identify, map and assess SNAs in Wellington since 2013. Each potential SNA was assessed against the ecological significance criteria in Policy 23 of the Regional Policy Statement (RPS23) for the Wellington region (Greater Wellington Regional Council 2022) (Wildland Consultants 2016). ‘Significance’ has a specific statutory meaning derived from S6(c) of the RMA, and relates to the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna. However, the definition of significance has been the subject of much discussion among ecologists and its meaning has been broadly clarified through RMA hearings, including in the Environment Court.

The criteria for identifying indigenous ecosystems and habitats with significant indigenous biodiversity values in Policy 23 are: representativeness of current or historic natural ecosystems; rarity of species and/or communities; diversity of species, communities, or features; ecological context such as connectivity; and tangata whenua values. For example, some areas are ecologically significant because they are connected to large areas of protected habitat; some areas are ecologically significant because they contain representative elements of historic indigenous vegetation; and other areas are considered significant because they provide habitat for Threatened or At Risk species. Areas also needed to be larger than 0.5 hectares to qualify.

<sup>1</sup> Data summary available from <https://ourenvironment.scinfo.org.nz/>.



In total, ecological assessments (Wildland Consultants 2016) identified almost 5,500 hectares of land that initially qualified for SNA protection (i.e. 11.5% total City area). The total area was then reduced to 4,856 hectares following on from site visits to properties that required further assessment of SNA boundaries. Areas of SNAs on public and rural land were then identified by WCC in their proposed District Plan and are currently protected in a manner consistent with the requirements of the Resource Management Act 1991, and directive Policies 23 and 24 in the Regional Policy Statement (2013). In 2022, SNAs on residentially zoned properties were removed from the notified District Plan by WCC.

Table 3 presents the amount of indigenous dominant vegetation in each zone within the city. As significant vegetation on residential land is currently not protected, vegetation clearance of over 637 hectares of indigenous dominant habitat remains currently unregulated (Table 3). Furthermore, not all vegetation meets the level of significance needed to trigger an SNA designation (e.g. areas of indigenous vegetation < 0.5 ha), yet some ecological value is likely to also be present in other areas of vegetation outside of SNAs. For example, in Wellington City, mature exotic trees can provide important nesting habitat for indigenous birds. Therefore, WCC requires policy to manage vegetation clearance in areas outside of rural and public SNAs, so that ecological values in these habitats are protected at some level.

**Table 3** – Total area (hectares) of indigenous dominant land that is currently protected by SNA designation. Indigenous habitat data from LCDB5; zone data<sup>1</sup> and SNA data<sup>2</sup> from Wellington City Council’s online ArcGIS dataset.

	Public (ha)	Residential (ha)	Rural (ha)	Total Area (ha)
Total land area Wellington City (from zone mapping)	5,204	4,232	17,784	27,226 <sup>3</sup>
Total area classified as SNA (Wildland Consultants 2016)	3,009	82	1,765	4,856
Total area of indigenous dominant habitat (LCDB5 - excluding low producing grassland) <sup>4</sup>	3,463	637	7680	11,780
Total area of indigenous habitat outside of SNA	454	555	5915	6924
Percentage of indigenous habitat that is protected by SNA designation	87%	0%	23%	41%

<sup>1</sup> Zone data available from: <https://data-wcc.opendata.arcgis.com/maps/6c3aaccfdbbf470491fb688595cf5b7e>

<sup>2</sup> SNA data available from: [https://data-wcc.opendata.arcgis.com/datasets/420153583b1d4889b4be4dc76b7fe6ac\\_46](https://data-wcc.opendata.arcgis.com/datasets/420153583b1d4889b4be4dc76b7fe6ac_46)

<sup>3</sup> Total area is slightly less than the area of Wellington City (c.28,962 ha) because zone mapping excludes major road corridors.

<sup>4</sup> The LCDB classes that represent indigenous dominant habitat are: Broadleaved Indigenous Hardwoods, Fernland, Indigenous ForestManuka and/or Kanuka, and Matagouri or Grey Scrub. Gorse and/or broom have also been included as indigenous as 40% of the mapped SNAs are categorised as gorse and/or broom in LCDB. Rivers, Lake or Pond, and freshwater vegetation were also included. Although Low Producing Grassland can also feature indigenous species, this class was excluded.



## 7.0 Summary

In summary, indigenous vegetation (and therefore most biodiversity values) are well protected on public land. Much of the rural zone is not protected as SNA – however, these numbers should be approached with some caution due to the potential lack of accuracy in the LCDB database. Inclusion of vegetation classified as gorse and/or broom in the analysis may overstate the amount of indigenous vegetation in rural areas. However, gorse is a good nursery crop and if left without disturbance, indigenous vegetation will generally dominate over time. Any vegetation clearance rules will need to consider how to deal with early successional sequences of vegetation which could become worthy of protection in a matter of decades, and which can provide fauna habitat (and therefore biodiversity values) before indigenous dominance may be reached. None of the indigenous vegetation in the residential zone is currently protected through SNA rules as SNAs identified here are not included in the District Plan. However, even if they were included, they would only protect 13% of the indigenous habitat here.

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