TE AWAROA: RESTORING 1000 RIVERS

RESEARCH REPORT 4: WAIMATĀ RIVER

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Introduction:

The aim of this report is to carry out a high level stocktake of the indigenous biodiversity of the Waimatā catchment, identify the most significant contributors to the continuing loss and degradation of terrestrial and freshwater biodiversity and develop options for intervention, protection and regeneration at a catchment scale.

For this purpose, the report examines the pre-human biodiversity of the catchment, and traces the impact of changing land uses on the ecological health of the Waimatā River, including impacts on people living in the catchment. The report then suggests options for shifts in land use and management that aim at better relations between people, land and the Waimatā River over time.

Section One: Pre-Human Biodiversity of the Waimatā Catchment

1. Topography and Geology

The Waimatā catchment, comprising about 220 square kilometres, is located in the Gisborne region north-east of Gisborne City. The Waimatā river itself flows south, with the upper section confined by finely dissected, moderately steep terrain hills. The lower section flows through a series of low hills to join the Taruheru river in the center of Gisborne city, flowing across the Poverty Bay flats and into Poverty Bay via the Tūranganui river.

The topography of the Waimatā catchment is typically dissected hill country, mostly less than 600m in altitude. There are three broad geological zones in the area, with the major rock types being sandstone and highly erodible mudstone, referred to locally as *papa*. In the Waimatā catchment, the sandstone and mudstone are generally overlain by a thick sequence of more recent (Miocene-Pliocene) mudstone, sandstone, minor limestone and intercalated tephra (Marden et al) or volcanic ash (referred to as Taupo Gravelly Ash) which was deposited in three showers commencing c.1700 years ago. This zone is typified by moderately steep to

gently rolling hills (Leathwick *et al* 1995). These rocks are easily weathered, yielding large amounts of sediment as they are uplifted and then eroded. Also easily weathered are the older mudstones that contain smectic clays, a band of which stretches across the upper catchment and which are also found in mélange rocks in the lower catchment. Smectic clays allow water to be absorbed so that layered rocks shear easily when water is present, facilitating the formation of earthflows (Waimatā Project Report 1: Cullum *et al,* 2015). Most of the Taruheru catchment consists of low hills and alluvial flats, built up through numerous flood events.

The Waimatā catchment lies adjacent to a major tectonic boundary. Off shore, the Pacific Plate is moving under the Indo-Australian plate at the Hikurangi subduction margin at a rate of up to 6cm a year (Wallace *et al*, 2009) so that faults and earthquakes are common and uplift rates are high (Cullum *et al,* 2015). The combination of tectonic activity and soft rock means the East Cape region has some of the highest sediment yields per unit area in the world (Hicks *et al* 1996) The Waiapu and Waipoa rivers generate 35 megatonnes/year (0.2% of the global yield) and 15 megatonnes/year (0.1% of the global yield) respectively. Although sediment yield from the Waimatā is relatively low compared with these rivers, it is still high compared to other catchments in New Zealand. Since the Last Glacial Maximum (LGM) sediment yield of the Waimatā has been estimated at 2.6km3, most of which has been transported by river to the ocean (Cullum *et al,* 2015). These geological processes are fundamental to the sedimentation issues facing the East Coast.

Map 1.1. The extent of the Waimatā Catchment and adjacent catchments within the Gisborne Region. The overlay transparency allows for the identification of the main plantation forestry blocks, pasture, and small pockets of native forest. (Source: Tairāwhiti Planning Maps, GDC 201)

2. Soil, landscape and Geomorphology

In addition to ongoing tectonic subduction, the Waimatā catchment bears the imprint of changes in sea level associated with long term climate changes in the Pleistocene era. The landscape now bears the imprint of the associated multiple cycles of erosion and deposition (Cullum *et al* 2015). As a result, flights of terraces border almost the entire length of the river. These terraces resist erosion, effectively confining the course of the river to a fixed position

in narrow valleys with little space in which sediment is stored (Cullum *et al,* 2015). Sediment that enters the river thus tends to aggrade the river base or flow downstream out to sea.

Landscape types in the Waimatā and Taruheru catchments are defined in terms of valley morphology, hillslope, gradient and geology. Landscape types in the Waimatā catchment begin with steep headwaters, which are characterised by narrow v-shaped valleys with high, steep sides. From the headwaters the river moves through several other landscape types as it flows toward the sea. These are the earth flow regions, followed by finely dissected steep terrain, low relief steep terrain, the lowlands and the low relief terrain of the Taruheru catchment. The final two landscape types that characterise the Taruheru catchment are the Poverty Bay flats and finally the coastal plains. Detail on each of these landscape types can be found in Cullum *et al* (2015).

The soils which have formed on these different types of terrain vary considerably according to the underlying geology and the steepness of the gradient (Gibbs, 1959). Those within the Waimatā catchment are largely defined as steepland yellow-brown earths, while to the east the more gently sloping land has formed yellow-brown earths and to the west in the Waipaoa valley there are series of alluvial soils. Alluvial soils on the flats comprise well-drained recent soils on levees and poorly drained gley soils on the backswamps of the flood plain. A zone of saline gley soils associated with estuaries is present near the coast (Clarkson and Clarkson, 1991).

3. **Flora**

The Waimatā river and its catchment run across two ecological districts, with the headwaters and 80% of the catchment lying in the Waiapu ecological district, and the southern 20%, where the river meets the sea, lying in the Tūranga ecological district. Both of these districts lie within the Gisborne Botanical Province (Wardle, 1991).

Characterisation of an ecological district depends on the topography, geology, climate, soils, vegetation and human-induced modifications of the area (Nicholls, 1979). An ecological district is a localised part of New Zealand where the topographical, geological, climatic, soil

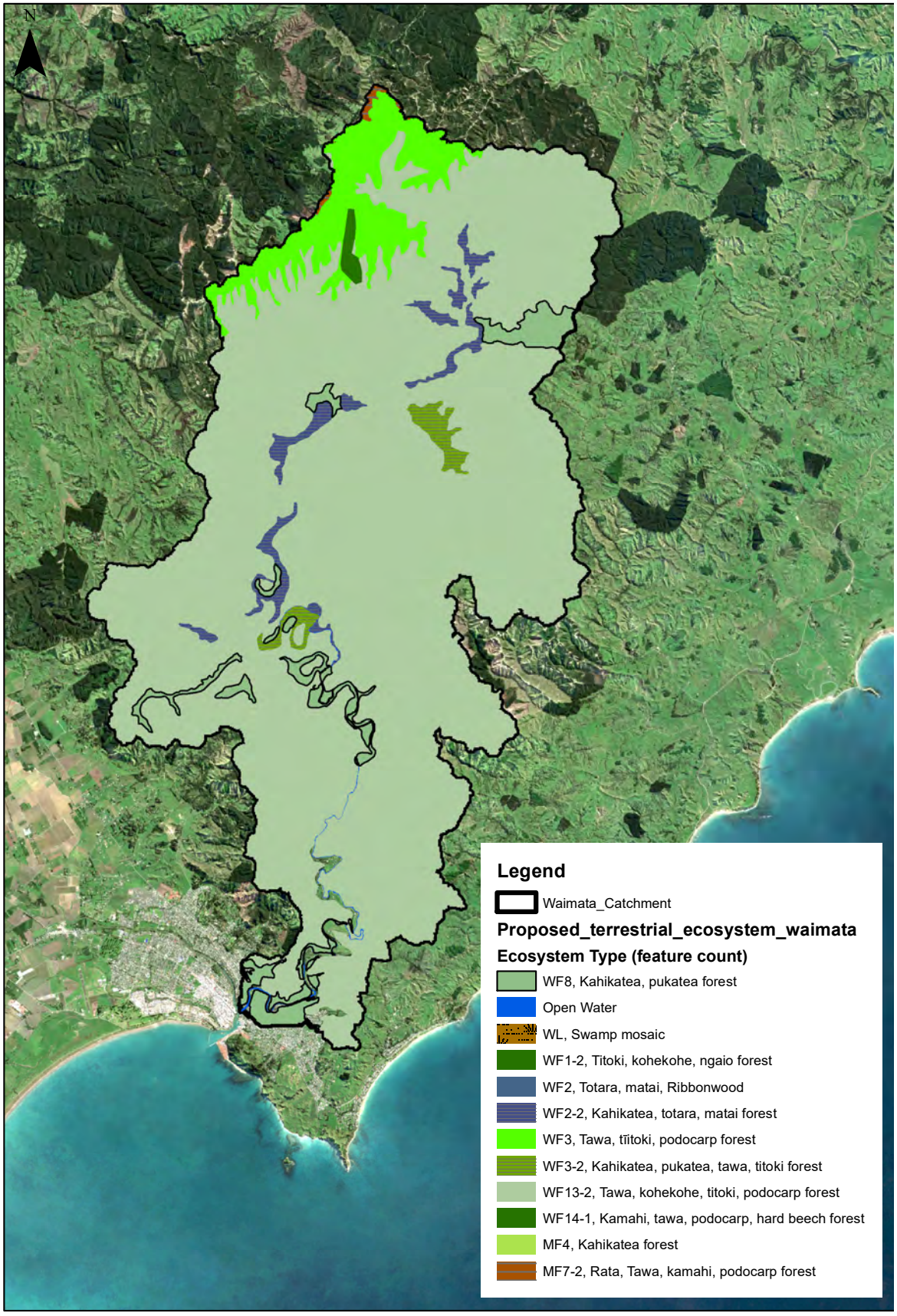
and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities (Park *et al,* 1983).

The two ecological districts spanned by the Waimatā have varying types of geology, soil and vegetation but it is the difference in their topography that is immediately obvious. The finely dissected, moderately steep hills of the Waiapu Ecological District contrast strongly with the low hills and alluvial flats of the Tūranga District.

Singers and Lawrence (2016) used an ecosystem classification tool developed by the Department of Conservation (Singers and Rogers, 2014) to map the predicted pre-human ecosystems of the Gisborne District (**Map 1.2.**). This tool amalgamates previous classifications and ecological studies aligned to an abiotic framework. Although most of the coastal forest in the district had already been cleared by Māori when the first European settlers arrived, and this was followed by an almost complete removal of the original forest cover in the Waimatā catchment, it is possible to reconstruct the general nature of the pre-human forest cover from the remnants that survive, along with historic descriptions (Leathwick *et al* 1995).

Stanley Tait, a bush feller and fencer in the region in the early 1900s, provides one of the most vivid descriptions of the native bush and waterways in that period:

> Steep hills and river flats were bush-covered right down to the beds of the rivers which were hard and full of huge boulders. The water was clear and sweet and it ran fast. Children swam in the clear pools, and there were eels, native trout and fresh water mussels. The native bush was beautiful. It was full of tawa, with plenty of tōtara, white pine and matai. There was beech forest at the higher levels. There were pongas and ferns of all sorts, and the under- growth was thick and green (Coombes, 2000, Pg. 11).



***Map 1.2**. The Proposed (Pre-human) Terrestrial Ecosystems of the Waimatā Catchment indicating that tawa, Kohekohe, titoki, podocarp forest dominated. (Singers and Lawrence, 2016).*

Predicted vegetation for the catchment reflects previous assessments (Leathwick *et al 1995*), with some finer division of several ecosystems. Forest in the Waimatā catchment was largely comprised of tawa (*Beilschmiedia tawa*), kohekohe (*Dysoxylum spectabile*), titoki (*Alectryon excelsus*) and podocarp forest, typical of moderate to steep hill slopes in lowland and climatically warm areas which experience little frost. Kohekohe was less dominant higher in the northern headwaters of the catchment, and the mix of species changed inland, and with the increase in altitude. Some kohekohe remained along with pukatea (*Laurelia novae-zelandiae*) rewarewa (*Knightia excelsa*), scattered northern rāta (*Metrosideros robusta)* and hinau (*Elaeocarpus dentatus*), all overtopped by emergent conifers – kahikatea (*Dacrycarpus dacrydioides*), rimu (*Dacrydium cupressinum*), matai (*Prumnopitys taxifolia*), tōtara (*Podocarpus tōtara*), tānekaha (*Phyllocladus trichomanoides*) and/or miro (*Prumnopitys ferruginea)* (Leathwick, 1995). Patches of kāmahi (*Weinmannia racemosa*) dominated forest with tawa, podocarp and mixed beech (*Nothofagus*), (or rāta in more humid locations) also featured on the moderate to steep hill slopes at the head of the catchment.

On the alluvial river terraces of the upper catchment, tall forest of emergent kahikatea over a canopy of tōtara and matai dominated. This ecosystem also featured black maire (*Nestegis cunninghamii*) white maire (*Nestegis lanceolate*), titoki, tawa, small leaved kōwhai (*Sophora microphylla)*, narrow leaved lacebark (*Hoheria angustifolia)*, houhere (*Hoheria polulnea)* and a range of divaricating shrubs. This ecosystem type primarily occurs on alluvial terrace landforms with recent brown, raw, allophanic and pumice soils, and may have been much more widespread on shallow hillslopes prior to human occupation.

In the top half of the lower catchment on the poorly drained, gley soils of the flat alluvial terraces and forest wetland margins of the valley floors, kahikatea-pukatea forest was dominant. Patches of emergent kahikatea-pukatea forest with abundant tawa and titoki occur exclusively within valley floors with “imperfectly drained” or “mottled” soils such as recent fluvial mottled (RFM). The moderately well drained recent alluvial soils of the remainder of the lower catchment supported forest dominated by pūriri (*Vitex lucens*), (once common on the east coast) and tōtara. The vegetation then changes back to kahikatea-

pukatea forest (with intermittent pūriri) in the final stages of the river's descent to the Poverty Bay flats, where it joins with the Tūranganui river and flows out to Poverty Bay.

The Tūranganui catchment is located entirely on the Poverty Bay flats, with the river itself running east of Gisborne city. Pollen cored in Gisborne city suggests that the vegetation during the last 40,000 years was similar to that found in surviving forest remnants (McGlone et al, 1984). Plant species collected first by Banks and Solander (1769) and then other collectors including Henderson and Ongley (1920) on the Gisborne flats suggest that they were dominated by kahikatea, mainly growing with pukatea on the poorly drained soils (Clarkson and Clarkson, 1991). Other ecosystem types would have existed in various topographical units of the coastal area where the Tūranganui meets the sea. These would have included swamp mosaics on the flats immediately behind the fore dunes of pīngao (*Ficinia spiralis)* and spinifex (*Spinifex sericeus)*, then dune forest of tōtara, kānuka (*Kunzea ericoides*) and broadleaf. Estuarine rushland herbfield is also likely to have been present.

A variety of vegetation would have occurred in disturbed areas throughout the catchment. Erosion-exposed soils would have been colonized by pioneer woody species such as tutu (*Coriaria arborea)* and kōwhai (*Sophora* sp.) and small tree species like kohuhu (*Pittosporum tenuifolium*). After fire, kānuka and/or mānuka (*Leptospermum scoparium*) would have been the initial colonisers often accompanied by tuahinu (*Ozothamnus leptophyllus)* and bracken (*Pteridium esculentum).*

4. **Fauna**

In both the Waimatā catchment and the wider Gisborne District, all indigenous groups of fauna would have been present. Numerous bird species would have colonized the forest (kokako, kākāriki, whitehead, huia, kākā, kereru, kiwi), the coast (dotterel, tern, stilt, oystercatcher, heron) and wetlands (rails, mātuku, crake, fernbird), and included several species of the extinct moa (Leathwick *et al*, 1995; Clarkson & Clarkson, 1991) Seabird colonies would also have been plentiful across the coastal part of the district and many species of bat (including the now extinct greater short tailed bat), lizard, frog (Hochstetter's) and invertebrates would have been present. Māori tradition describes the presence of moa, the

extinct eagle and tārepo (wingless goose) in the district. Tuatara would have been plentiful on the hills, as evidenced by the numerous bones in Māori middens at Wainui (Clarkson & Clarkson).

A quote from Coombes (2000) indicates that while local Māori were predominantly a coastal people, they were also highly dependent on forest resources, collecting different resources during their seasonal migrations. As one kaumātua noted;

> Here [at Mangatu kāinga] there were tuna [eel] in the river, but the people were a long way from the sea. The way I understand it, those people would go down to the sea in summer and. fish and eat hard out for a while. For most of the year, though, they were dependent on finding food from the bush. Pigeons were eaten in great number, but the [Polynesian] rat was a very important food source. If we couldn't have caught rats and pigeons from the bush, it would have been hard for the community like there was here to have survived.

5. **Freshwater**

It is difficult to determine the ecological state of freshwater in the Waimatā catchment prior to human habitation. By examining the state of a reference site in the region with similar geology and a relatively unmodified catchment, we may get some indication of the pre-human freshwater biodiversity of the Waimatā.

According to Gisborne District Council Freshwater ecologist Harriet Roil, one such site is the Waihirere stream in the Waiherere Domain. This site, which is located at the head of the Taruheru River, has been used by Gisborne District Council as a reference point for the biodiversity of the Waimatā river. The stream shows a rich abundance in Ephemeroptera, Plecoptera and Trichoptera (EPT) (commonly known as Mayfly, Stonefly and Caddisfly) populations (Roil pers comm, 2018). EPT taxa are generally intolerant of pollution so the more found in a sample, the better the stream health. It is likely that the Waimatā would have supported a diverse range of EPT taxa prior to human colonisation. EPT taxa feed on periphyton and detritus within the water column, keeping organic matter levels down and water quality high. They would also have provided a plentiful food source for inhabiting fish species.

The Waihirere stream data also indicates that freshwater fish species in the Waimatā would have been highly diverse, and likely to have included now-threatened species such as the giant kokopu, banded kokopu and potentially the lamprey and Short jaw kokopu. Other species present would have included the Longfin eel, Koaro, Torrentfish, Inanga and Bluegill bully. The more common Crans bully, Shortfin eel, Black Flounder, Mullet, Goldfish and Smelt would also have been present.

Kakahi or freshwater mussels are also found in the Waimatā catchment. Kakahi, which are well known for their filter feeding techniques, use native fish to assist in their life cycle and improve their distribution tactics.

Section Two: Human impacts on pre-human biodiversity

1. Māori settlement and the impact on the pre-human environment

Tribal history in the bay in the bay is complex, but well documented. Salmond (1991) and Halbert (1999) discuss three main groups of migrants known to have arrived in Tūranga-nui in about the 1300's. One early migration to the East Coast is associated with Paikea, who came to the East Coast from Hawaiki in the shape of (or riding on) a whale. Another group came on the canoe *Horouta,* which was captained by Paoa. The high priestess of this canoe, Hine Hākirirangi, is said to have introduced kūmara to the region. Around the same time, the sacred canoe *Takitimu* arrived from Hawaiki, bringing tapu axes and stones and a number of gods. According to some accounts, its captain Kiwa planted a mauri in Tūranga as a link between people and the land, while its chief priest Ruawharo established a house of learning called Tokitoki at the bay. The two names alternately given to the district, Tūranga-nui-a-kiwa and Tūranga-nui-a-rua (Kiwa or Rua's great standing place) recall a contest of mana between Kiwa and Ruawharo. The final migration was that of the ancestor Maia, who quarrelled with Uenuku in Hawaiki and escaped by sailing to this country on a raft of gourds.

Voyagers on board these vessels set up camp ashore as the extensive native forest was rich in resources, and the ocean and rivers provided plentiful food and water supplies. Māori kin-

groups who settled in the region included Ngai Tamānuhiri, Ngāti Porou, Ngāti Rākai, Rongowhakaata, Te Aitanga-ā-Māhaki and Te Aitanga-ā-Hauiti. These tribes often used the Taruheru, Tūranganui and Waimatā Rivers as boundaries, and also Te Toka-ā-taiau, a sacred rock which was located in the Tūranganui River (Reeve, 2015). Kin groups often intermarried, however, creating bridges of kinship and alliance. Te Wai-o-Hīharore, a small coastal area between the Waikanae stream (the site of many eel weirs) and Te Oneroa beach (where fishing nets were cast and pipi were collected) on the western mouth of the river, was set aside as a fishing camp where in times of war, inland kin groups could safely go to fish. This was used by all of Te Aitanga-ā-Māhaki. A freshwater spring on the site flowed under the beach into the sea, attracting kahawai (Waimatā Project Report 2: Salmond and Phillips, 2015).

The Waimatā River also served as an inland highway linking Tūranga to the East Coast, especially Whāngārā and Uawa. Those who lived on the North, West and East Waimatā blocks had close relationships with Ngāti Konohi at Whāngārā and Te Aitanga-ā-Hauiti at Uawa. It was also used as an escape route during the inter-iwi wars from 1700-1800, and the upper reaches of the river served as a refuge (Salmond and Phillips, 2015).

The higher slopes of the rugged hills of the Waimatā catchment were not suitable for cultivation and settlement, but provided forest resources of timber, fruits, kiekie (*Freycinetia banksii*) for weaving and birds and invertebrates for food. The introduction of the kuri (Polynesian dog) and kiore (Polynesian rat) had impacts on the indigenous fauna, especially ground-dwelling lizards and birds, while many birds were also hunted for human consumption. Some ridgelines provided pathways to link the coast with inland resources, but the coast would have provided quicker transport from the settlements in the eastern bays around to Poverty Bay. The waterways provided eeling grounds and, where slightly swampier ground existed, sources of flax/harakeke (*Phormium tenax* and *Phormium cookianum*) and raupō (*Typha orientalis*) used for making fishing nets, baskets and many other necessary items (Reeve, 2015).

From maps developed for the Māori Land Court in the 1870s and 1880s, the middle and upper reaches of the Waimatā catchment appeared to be largely in bush, with some minor

clearances along the ridges (to provide tracks and unimpeded views) and the lower reaches of the river. This bush was probably cleared for construction materials or to clear land for kūmara fields or fern-root diggings, as suggested by the archaeological evidence. Archaeological sites have been recorded only in some parts of the lower catchment. These appear to be grouped either close to the river itself in the middle and lower reaches, or along the higher ridgelines overlooking the Waimatā River. Most of the sites appear to be pit and terrace sites, suggesting that there was some cultivation of kūmara where there were small river flats with suitable soils.

Permanent occupation was concentrated near the mouth of the river, in the lower reaches, where the hills were less steep and the river flats were made of rich alluvial soils (Salmond and Phillips, 2015). Here, the bush was largely cleared and a full range of settlement types (pa, kāinga, garden and camp sites etc) was found. The damage to rivers was minimal as they were taonga to Māori (Reeve, 2015) The area around Awapuni lagoon, Waikanae river mouth and Tūranganui was used for catching eels, freshwater mussels, crayfish and whitebait and flounder. Māori recall rivers at the time being particularly abundant with eels, but swamps also provided other food sources such as moa, weka, pūkeko, kiore and fern root. Maps prepared for Waitangi Treaty claims by Aitanga-ā-Hauiti and Aitanga-ā-Māhaki show a division of the rohe centred on Tūranganui and the lower reaches of the Waimatā. Much of the middle reach and all of the upper reach of the Waimatā, as well as other hill country to the north-west, were claimed by both iwi (Salmond and Phillips, 2015).

2. European settlement and the impact on the natural environment.

The arrival of Captain Cook and his crew on the Endeavour in Tūranganui in October 1769 was a precursor to the European settlement and colonisation of the region. The visit itself was short-lived, with the Endeavour and its crew leaving just two days after their arrival. Misunderstandings between Māori and Captain Cook led to violence and the death of a number of Māori. Cook renamed the area Poverty Bay as it afforded him and his crew “no one thing we wanted” (Reeve, 2015), most likely because they were unable to access fresh water and food due to clashes with the local inhabitants (Salmond, 1991). During this short visit however, Royal Society scientists travelling on the Endeavour, Joseph Banks and Dr

Solander, made extensive plant collections (Salmond, 1991). Although the specimens were from coastal areas and Poverty Bay itself rather than inland, their collections demonstrate the diversity of plants present in the district, many of which are now highly threatened. Because the scientists' explorations were limited to the coastal zone, these threatened species tend to be wetland and sand dune plants and small herbs which favor highly disturbed sites where exotic weeds now dominate. Other notable botanists who later visited the area included William Colenso and Thomas Kirk, who wrote that "The extensive forest districts exhibit great variety and luxuriance" (Kirk, 1897).

In the wake of the *Endeavour*, traders, whalers and missionaries arrived in Poverty Bay, trading resources such as blankets, flax, firearms and tobacco with local Māori. Following the East Coast War and Te Kooti raids in 1865-66, a town was planned and built. The name of the town was changed from Tūranganui to Gisborne after the Honourable William Gisborne, the Colonial Secretary in Britain at the time (Reeve, 2015). Forest close to town was felled for firewood or burned. An account by E.F. Harris in the 1870's remarks that any remaining bush on the flats was soon gone, "especially Tawa" was "felled for firewood and burned mostly by residents of Gisborne". He recalls Whakawā, "another fine white pine bush" which adjoined other large forest areas such as Opua station where "numerous clumps of Kōwhai some 30 inches in diameter" could be found, and on his own land "white pine [kahikatea] trees close on five feet through. (Times Jubilee Handbook, 1927), all of which was soon burned by the settlers.

As land went through the Native Land Court from the 1880s, there was increased European settlement in Poverty Bay, and with this came the large-scale clearance of native forest to make way for pastoral agriculture. Gundry (Waimatā Project Report 3: 2015) gives a detailed account of these changes in land use and their impact on the Waimatā, based on extensive research into contemporary photographs, newspaper reports and other sources:

"The meat and wool boom began in 1890 and high external stock prices and the fertile alluvial soils in the Waimatā catchment made agriculture an easy choice for income. Swim dips and killing houses were built on stringers over the waterways so that waste and sheep dip could be quickly disposed of . This had a major impact on freshwater life in the river."

"Land blocks in the Waimatā catchment were purchased and new owners set about clearing the heavy bush to clear pasture for sheep. Many hundreds of acres were cleared, providing a wealth of work for bush fellers over the next two decades with at least 3000acres felled in the catchment in 1901 alone. On 18th December 1895 The Poverty Bay Herald reported:

> The Burning of bush, fern and grass is now being carried out in various parts of the district and the consequence is that the air around the town is charged with smoke….Some fours thousand acres of bush country were cleared by fire in the Waimatā district yesterday, a good burn being obtained."

By the end of the nineteenth century, almost all of the kahikatea swamp forest and wetlands of the Poverty Bay flats had been drained and little forest remained on the surrounding hills. Large scale removal of forest had a drastic effect on the region's wildlife. E.F. Harris (Times Jubilee Handbook, 1927) recalled that in 1873, Poverty Bay had been an ideal spot for sportsmen. Pigeons [kereru] and Kaka were numerous and were able to be shot "off his horse "with "20-30 pigeons easily attainable". Ducks (probably a mix of endemic and introduced species) were to be found in large numbers in all the rivers, and from Harris Bend on the Waimatā river right up to its source they were also plentiful. "Parakeets (Kākāriki) used to come to the flats in their thousands; their last visit was in 1875", presumably when the last of their habitat was destroyed. These recollections provide an indication of the sheer volume of bird life that existed and how quickly and dramatically their numbers declined with the large scale and comprehensive removal of habitat.

Deforestation of the region continued, and headed inland. From 1880 to 1920 the hill country was extensively cleared through logging and burning for conversion of land to pasture for sheep and beef. During this period, native beech and podocarp broadleaf forest cover on the East Cape was reduced from an estimated 68% to 23% of land area (Ewers *et al*, 2006) Further clearance was encouraged by government-led initiatives in the 1960s and 1970s that provided subsidies for land development fertilizer grants, reduced loans, and guaranteed minimum livestock prices. (Rhodes, 2001). Native podocarp forest now accounts for only 2.5% cover of land in the region (Cullum *et al* 2015). Much of the region is now in pasture [40%], exotic plantation forest [19.3%] or regenerating mānuka / kānuka scrub [9.1%] (Fig.2.1).

Section 3: Current State of Indigenous Biodiversity in the Waimatā Catchment

1. Effects of changing land uses on Geomorphology of the river

After a flood on March 11 1880, Henry Dods of Linburn station in the Waimatā catchment (1892) remarked that "no one with his eyes open can fail to see that denudation of the hills is enormous, they are scarred with thousands of slips and although most of these do not descend directly in to the river they are left as masses of loose soil on the hillsides and every flood carries a portion of them down to the stream. I have seen slips of 6000 and 9000 cubic feet slide from ground level into the river …" (Gundry, 2015).

It didn't take long after the bush began to be cleared in the Waimatā Valley until the effects were felt downstream, with flooded land and homes, slumped riverbanks, damaged or destroyed bridges, harbor siltation and driftwood clogging the river, bridges and beaches. In her report, Gundry (2015) quotes many observations made by farming families in the valley. According to Howard Kenway, for instance:

> Slips of considerable extent bear witness to the enormous quantity of water which poured down the hill sides. Messrs Richardson Bros' swing bridge, which was several feet above the last big flood, was swept away… Taking bush off the catchment made floods higher with the same rainfall. …Two bridges and a wool shed were carried away in July 1927 after a cloudburst in the valley that saw the river rise 35 feet at Savage's, 20 miles from Gisborne. Drover Jack Robb's house was washed from its foundations and wrecked; stock were lost. The bridge below the store was washed away and rebuilt as a suspension bridge. A composite girder bridge was built in its place in 1959. In the 1927 flood, the steel superstructure of Kenway's Bridge – the largest bridge on the Gisborne-Waimatā Road – was swept off its piles. Water lapped the bridge deck in the September 1930 flood and the bridge was raised five and a half feet.

The extensive and rapid deforestation of the region had devastating effects on both indigenous species, with the removal and modification of their habitat, and the wider environment in the Waimatā valley. The combination of weak lithology, steep slopes resulting from tectonic uplift and incision, high rainfall, frequent storms, and recent forest removal makes this landscape exceptionally prone to erosion, generating and delivering huge quantities of sediment to river systems (Cullum *et al,* 2015). Even before the arrival of

humans, the landscape bore the imprint of multiple cycles of erosion and deposition associated with climate changes over millennia.

As Cullum *et al* have noted, flights of terraces border the banks along almost the entire course of the Waimatā river (Cullum *et al* 2015) These terraces resist erosion, effectively pinning the course of the river to a fixed position (Fryirs *et al* 2016). The Waimatā river thus acts like a chute, with much of the sediment and woody debris that enters the river being swept downstream and out to sea (Cullum et al, 2015). Deforestation has exacerbated the rate of erosion and local geologist Mike Marden notes while there is conclusive evidence to show that forests slow down the rate of earth flow displacement, when there has been rainfall over a long period the soils become very wet, and forest cover is not always able to prevent slopes from failing. A mature forest can at best slow the rate and amount of downslope displacement, particularly of earthflows, and thus reduce the amount of sediment delivered to river channels. (from Gundry, 2015).

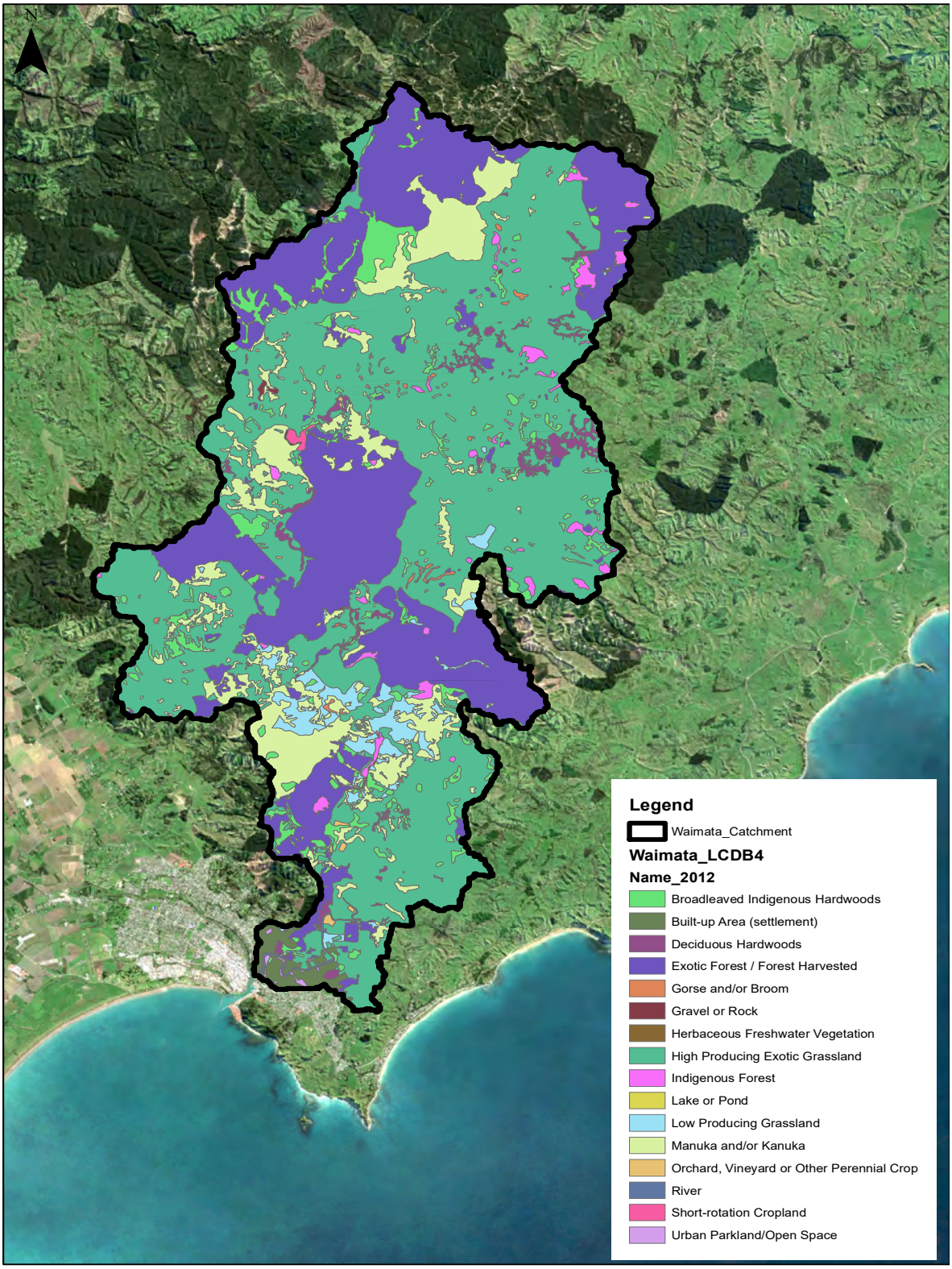
Each period of deforestation, from first Māori settlement to early European settlement and the more recent clearing of plantation forests has been followed by extensive hillslope erosion as soils are no longer stabilized by tree roots, and run-off increases as less water is intercepted and transpired by trees (Marden *et al* 2012). Across the region, responses to deforestation have been widespread, including floodplain sedimentation, widening of downstream channels due to sediment scouring and aggradation of channel beds.

2. Deforestation and conversion of land for agriculture

By 1920 much of the region's native forest had been removed, largely by logging and burning for conversion to pastoral farming, with remaining vegetation strongly biased towards higher altitudes. Of the 23% of the region that remains in native forest (LCBD, 2014), these areas tend to be isolated, restricted to steep hillsides and largely consisting of secondary regrowth forest dominated by kānuka (Clarkson and Clarkson, 1991). Early successional scrub of young mānuka and kānuka makes up another 9% of the region. (Fig.2.1.). Podocarp and tawa/broadleaf forests of the lowlands and foothills fared the worst, with more than 85% of the original landcover cleared. The regenerating scrub and shrublands that remain do not

represent the ecosystems that once dominated the foothills and lowlands. The remaining intact forest on the plains totals only around 25ha. The most threatened ecosystem in the region is wetlands with only 1.75% (1,487.23ha) of their original extent (84,765.16ha) remaining (LCBD, 2014)

The Waimatā catchment did not escape the destruction of the forest, as first the low hills and then the steeper, more finely dissected areas were cleared for conversion. While the catchment was once predominantly clothed in primary forests of tawa, titoki, kohekohe and podocarp (Singers & Lawrence, 2017) these now cover just 6% of the catchment (Map 2.1.) with alluvial terraces of kahikatea-pukatea forest now almost all but absent. The current catchment is dominated by pasture and exotic pine plantations. High-producing exotic grassland makes up around 50% of the catchment area (Fig.2.2.), higher that the regional cover of 40%. The second highest land cover unit, exotic pine (*Pinus radiata*) plantation forest, sits at around 28% cover, nearly 10% higher than the exotic forest cover across the Gisborne region as a whole (19.3%). Indigenous scrubland/secondary forest of mānuka and/or kānuka covers 11% of the catchment, similar to the estimated regional cover of 9.1%. Pockets of indigenous forest are scattered throughout the catchment, with larger areas towards to the west and north. Together these cover 6% of the catchment, compared with an 23% of indigenous forest cover for the region. The remaining 5% landcover in the Waimatā catchment is a mix of exotic vegetation, open water/river, horticulture and built-up areas.



***Map 2.1**. Different landcover types for the Waimatā Catchment. **Source:** New Zealand Landcover Database V.4:*

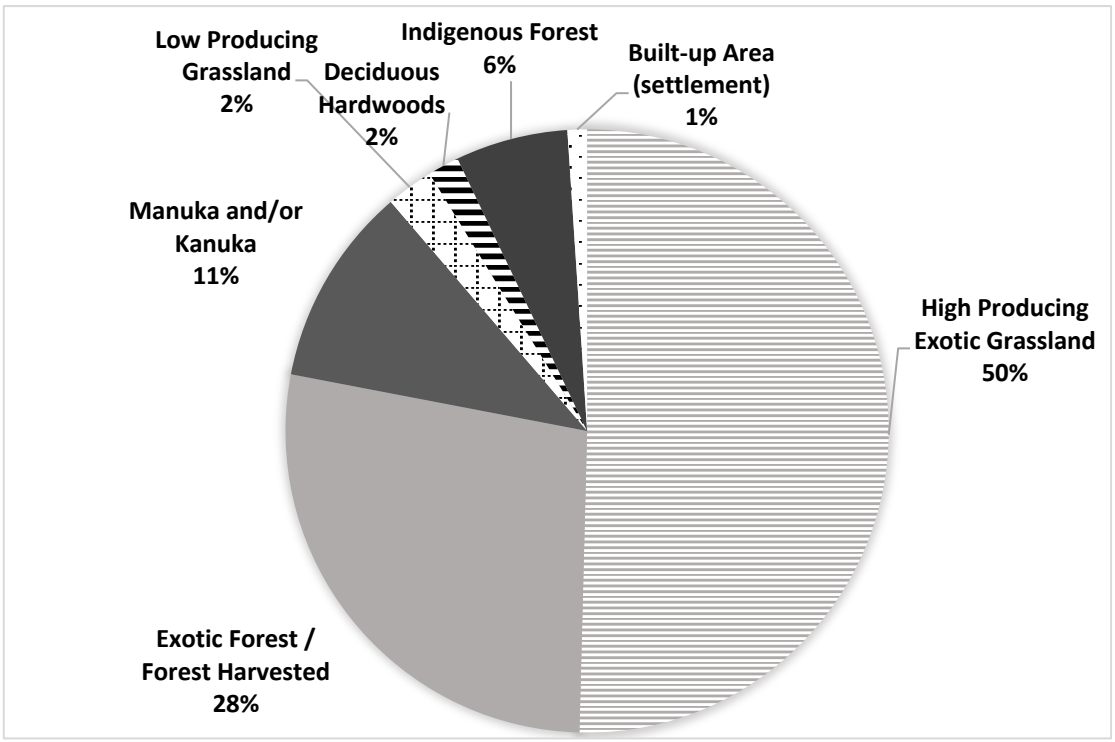


Figure 2.2. *% cover of the different landcover classes in the Waimatā Catchment (LCBD, 2014). Several other land classes have been excluded as their sum total was <1%.*

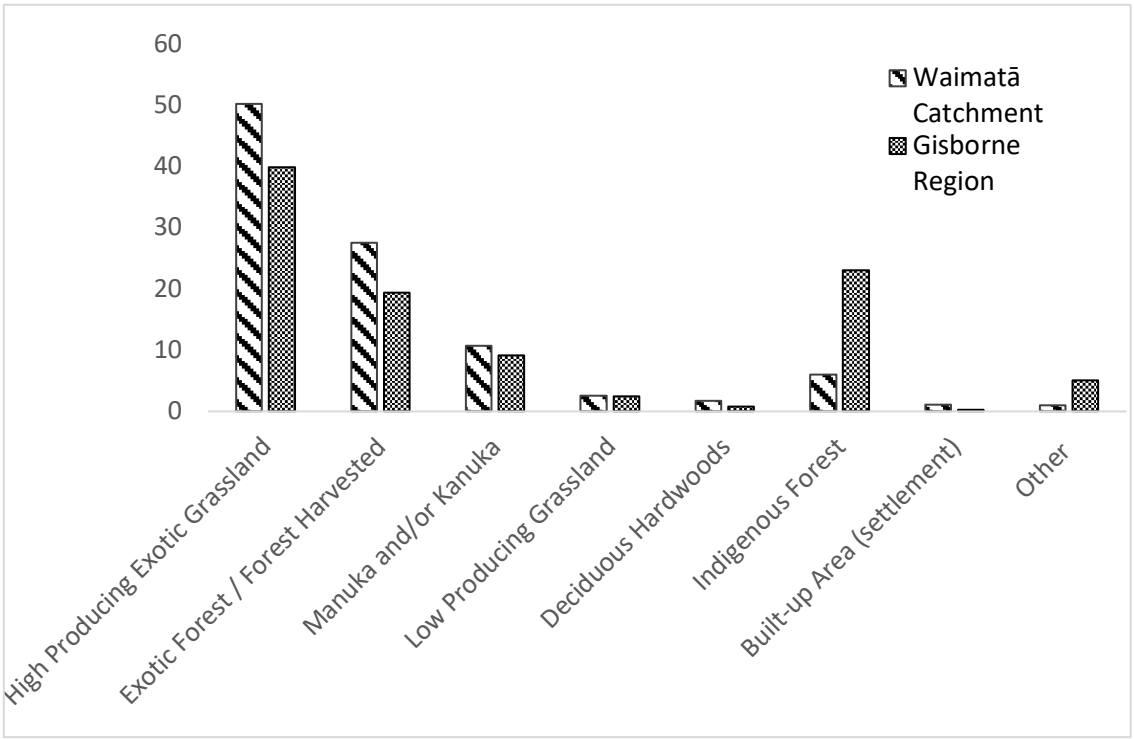


Figure 2.1. *Percent (%) cover of different landcover classes in the Waimatā catchment compared to the average percent cover of each of these landcover classes regionwide (LCBD 2014). Several other land classes have been excluded as their sum total was <1%.*

Landcover types reflect the current land uses in the Waimatā catchment, with most of the land in high production grassland for sheep and beef farming. Planting of the Waimatā in exotic forestry did not occur until 1960, when the first exotic plantation forest was established in the Mangatū block (Mike Marden *pers comm*, 2018). Further planting occurred later in the headwaters of the catchment, mostly during the 1990's after Cyclone Bola, where planting focussed on erosion control. The Gisborne District Council identified the worst areas of eroding land as Land Overlay 3a that should be planted with effective tree cover by 2021, with most of this being exotic pine planting. Funding was (and still is) available through the Ministry for Primary Industries' Erosion Control Funding Programme. Most of the native vegetation that remains is on very steep land unsuitable for farming, where the forest was left intact, while some mānuka/kānuka scrub is a result of reversion from farmland to prevent erosion, or areas that have been protected for their biodiversity value.

In total, the remaining indigenous land cover in the catchment is approximately 17% (including mānuka/kānuka). The largest of these areas is at the head of the catchment and is made up of public land (Whakaroa Reserve) and private land. Here, remnant forest of tawa and black beech are mixed with regenerating mānuka-kahikatea forest with emergent rewarewa and an understorey of five-finger, kāmahi and tree ferns. Tawa forest is the most common type of indigenous forest remaining (with the exception of mānuka/kānuka), often growing with kohekohe, kānuka, titoki, and/or kahikatea on the flats. Black beech occurs occasionally (GDC, 2006).

Nearer to the ocean, land in the catchment has been converted to lifestyle and horticultural blocks mixed with farmland, and then suburban dwellings and parkland, and where the river flows into the Tūranganui river and out to sea, urban shops and dwellings, and Gisborne port. Most of the older trees planted along suburban roads, in gardens and in parkland are exotic, although in more recent times there has been an increase in planting native species. As it approaches the sea, the river has been extensively modified, with artificial banks constraining its channel, large scale bridges and major engineering works (including diversion of the river at 'the Cut', reclamation and regular dredging). Further reclamation is currently being discussed.

With less than 50% of the Waimatā catchment now in exotic or native forest cover, the overland flow to the streams and rivers has increased in historic times, with larger volumes of water travelling across exposed land to the river, carrying with it sediment, nutrients and woody waste from the land. For each 1000mm of rain that falls, 300m is intercepted by the forestry canopy and 300m is transpired through the root system, reducing the rainwater to the river by 60%. (Marden *et al,* 2012). Without forest cover, close to the full 1000mm end up in the river. As exotic forests are harvested, the volumes of water flowing into the Waimatā River increase proportionately, carrying sediment and forest debris into the river. This can have significant impacts downstream on farmland, urban areas, the city and port.

3. The condition of Protected Management Areas (PMA's) and other forest remnants.

Much of the additional remaining indigenous forest in the Waimatā catchment (2.7% of the total catchment area) has been identified as Protected Management Areas (PMA) under the Gisborne District Council's District Planning process. Protected Natural Areas are the outcome of surveys by DOC in the 1980's under the Protected Natural Area Programme (PNAP). A subset of the most ecologically significant sites was then included in the Gisborne District Council's District Plan accompanied by a set of objectives, policies and rules to ensure a greater level of protection of these sites from modification and removal. For example, the removal of vegetation from PMAs requires a consent if clearance exceeds 500m2 in any contiguous area and/or exceeds 500m2 over any 12 month period (removal of up to 500m2/year is permitted). Removal by grazing is not controlled, however; and there is limited support for pest and weed control in these areas.

The largest of the PMA's is Hiriwoa Kānuka bush (WR79,) a combination of Whakaroa Reserve, a Department of Conservation Scenic Reserve, and private land. This is followed in size by PMA WR62 off Cave Road, a 197ha kānuka-dominated bush with tawa and kohekohe in the gullies. Other larger PMAs in the catchment include Waikomo Stream bush 62ha (WR52) and Riverside Road 29ha (WR63), both of which are dominated by tawa and kohekohe with titoki and kahikatea. In addition, Waikomo has some pūriri which is relatively uncommon in the catchment as distance from the coast increases, and pukatea. The remaining PMA's are dominated by Tawa, kohekohe, titoki, kahikatea forest, however a couple of sites are

dominated by regenerating podocarp forest of rimu, miro, tōtara and kahikata (GDC, 2006, McClean, 2018).

A recent survey of PMAs by Gisborne District Council (McClean, 2018) in the catchment area found that those in the lower part of the catchment tend to be smaller and contain more weeds. There were however some exceptions including Riverside road (WR63 - Longbush) which is relatively weed free, and Cave Road (WR62) which is relatively large (>100 hectares).

The survey found that in the upper part of the catchment, PMAs tend to contain a lower diversity of weeds. A number of PMAs in and around the Utting road area of the Waimatā catchment have been fenced by landowners to exclude stock. Where fenced, understorey regeneration tends to be rapid due to favourable natural factors including mild temperatures (few frosts), reasonable rainfall (over 1500mm) and good natural soil fertility. In addition to fencing, some landowners have been pro-active in managing plant and animal pests. One landowner who owns a large PMA dominated by secondary forest has been controlling wilding pines by ground and aerial means for several years. In the lower part of the catchment several PMA's have been managed intensively for a wide range of animal and plant pests over the past decade (e.g. Gaddums Hill and Longbush).

Gundry (2015) describes some remnant bush areas within the catchment;

> On Waikereru Station stands one of the biggest Kahikatea in the country, at one time described as 49m high and over 1000 years old, with its base covering nearly half a tennis court. According to Bruce Holden, his grandfather Thomas Holden left a lot of patches of bush on Rimuroa during its clearance. Today, Ngahiwi has about 80 acres of original bush, predominantly kohekohe, rimu, rewarewa and pūriri. None of these areas is protected by a QE2II covenant.

In a recent survey of lower Waimatā riparian vegetation (Forbes *et al*, 2018) a total of 457 ha of the Waimatā River riparian zone approximately 14km upriver was surveyed. 67% (308 ha) of this section of the riparian zone was forested, with exotic forest making up 78% (239.3ha) of the total forested area, the remaining 22% (68.9 ha) of forests being predominantly native (Table 3). More than half (63%) of the forested area was grazed. Treelands (canopy cover of 20-50%) covered 62.5 ha and shrublands, with rushlands and grasslands each forming

relatively minor components of the riparian zone vegetation structure. Riparian vegetation varied spatially along the river, although this was generally scarce below Goodwins bridge.

Fresh goat sign was detected at 42% of native sites and the abundance of goat sign was positively associated with understorey browse severity. The co-occurrence of these variables indicated that goats are retarding the regeneration of some native forest areas. A quarter of all sites had common fresh sign of stock with occasional stock being seen or heard at those sites. In most sites (61%) stock sign was uncommon and often old or only occurred near forest edges. Forty percent of old growth sites showed no sign of stock presence.

Photo 3.1. *Longbush Reserve (left) bordering the Waimatā River with a QEII covenant on the Hoogerbrug property (right) opposite. (Photo: Adam Forbes).*

Other forms of legal protection

Areas protected by Ngā Whenua Rāhui kawenata (NWR) or Queen Elizabeth the Second covenants (QEII) include 13 Covenants in the Waimatā catchment, covering 313 ha and ranging from 0.36ha to 105.1 ha. Covenanting under the QEII trust means that the land and its biodiversity values (e.g. wetland, indigenous bush etc) are legally protected from

modification (other than what is agreed between the landowner and the Trust) in perpetuity. In these covenants, bird species include whitehead, and new Zealand falcon. Plant species present include *jovellana sinclairii,* many of the now (officially) threated *Myrtaceae* including the following; *Lophomyrtus obcordatum Metrosideros colensoi, Metrosideros perforate, Metrosideros diffusa*, kānuka and mānuka. Orchids including Drymoanthus adversus, Earina mucronata, Earina aestivalis, Earina autumnalis, Gastrodia sp., Microtis unifolia, and various Nematocerus and Pterostylus Thelymitra species are also present.

One of these QEll covenants,"Rimunui" on the property of the Hoogerbrugs, which is fenced, covers 30ha across the river from Longbush. Ecologist Steve Sawyer describes this as one of the best examples of coastal hardwood trees he has seen in the region – tawa, kohekohe, pūriri, titoki, cabbage trees and kahikatea (Gundry, 2015). The Hoogerbrugs have fenced off a similar-sized block near the boundary with Bruce Holden's Ngahiwi station.

4. Biodiversity in production forest

Areas of indigenous forest within exotic forest plantations are reasonably common in the catchment, and much of this forest is in relatively good condition. Malcolm Rutherford, botanist and QEII representative for the Gisborne Region, has spent time in many of these areas. He says these forest types are often modified primary forest with a canopy dominated by either tawa, or kohekohe-titoki with occasional pūriri and pukatea present and pockets of emergent podocarps. Steeper areas, often near stream sides, usually contain a broad range of mixed broadleaf species, most likely as a result of being inaccessible to browsing mammals such as goats and deer. One area in the upper headwaters of the catchment contains a ridge of tānekaha (*Phyllocladus trichomanoides*), the only location for this species known in the catchment. He says a relatively large area (65ha) of mature kānuka forest exists within exotic forest in the centre of the catchment, with areas of cliff face vegetation, and other smaller remnants of regenerating forest adjacent.

***Photo 4.1**. A PMA site within a plantation forestry block. Photo: D. McClean.*

Mr Rutherford says it is not uncommon to find a higher diversity of species in these areas due to the absence of stock and the past control undertaken by forestry companies. Plant species he has observed include the epiphytic Bulb Leaf Orchid (*Bulbophyllum tuberculatum*), the first record in the catchment of this species. Other species of interest observed include the orchids *Earina autumnalis* (Easter Orchid), *Earina mucronata* and the nationally threatened species *Jovellana sinclairii* (NZ Calceolaria).

Mr Rutherford notes that some stream habitats are of reasonable quality within these areas. He has observed high numbers of longfin eels of varying sizes and other species such as Cran's and Common bullies. Other fauna observed within these forest areas include whiteheads and the NZ falcon.

As in much of the catchment, Kohekohe in the forest canopy is often heavily browsed by possums, and the understory seems to be favoured by deer and goats, areas which are more easily accessible are often quite bare. Where possum control is being undertaken understorey vegetation is more common.

The recent survey of PMAs in the catchment found that remnant indigenous bush patches within pine plantations are often in better condition than those in farmland, probably because

of a combination of the lack of stock; goat and possum control being undertaken by the forestry company; and the shelter provided by the pine trees. However this condition is often dramatically reduced when and after the surrounding plantation forest is harvested.

5. The impact of pest plants and animals

The primary threat to Gisborne Region's remaining biodiversity is from introduced pest plants and animals. The effects of mammals introduced during both Māori colonisation (dogs – kuri, and the Polynesian rat or kiore) and Europeans (possums, mustelids, rats, mice, cats, goats, deer, cattle, sheep and pigs) have surpassed habitat loss by direct human removal, as the greatest threat to biodiversity nationwide. Introduced species are having catastrophic, and in many cases irreversible, effects on native fauna and flora. Their Impact has been two-fold. Forests have been stripped of native vegetation, fruit and seed; and native fauna have been predated, often to isolated populations or extinction. Exotic plants too have thrived in New Zealand's climate. Fast growing palms and shrubs often out-compete native species in regenerating forest, vines proliferate, in some areas smothering whole kilometers of bush and wetland, and aquatic species invade wetlands, rivers and lakes.

It can be assumed that in the absence of a strategic and sustained programme to control introduced pest species at a regional or catchment scale, the majority of more common pest animals are currently present throughout the Waimatā catchment. The most common pest animals, and those most readily detectable in the catchment, are the browsing herbivores, goats and deer (along with wandering stock); and the omnivorous possum. These animals do the most damage to native forest vegetation and ecosystems. Ship rats (*Rattus rattus*), stoats (*Mustela erminea*) and possums (*Trichosurus vulpecula*) are the most significant predators of native species in the mainland forests of New Zealand (Brown *et al,* 2015). They prey on birds, eggs, bats and invertebrates directly, while rats also eat seed. Presence of these pest animals can lead to almost complete removal of the forest understorey, including the future seed source, and drastically reduce birds, bat and invertebrate numbers.

In the Waimatā catchment, there are limited areas where pest plant and animal control is being carried out. This includes several areas in the lower Waimatā where landowners, the

Department of Conservation, Eastern Institute of Technology (EIT) and Gisborne District Council are working collaboratively to restore areas of native bush on private (including Waikereru Ecosanctuary) and public land (Donners Bush Reserve). This will be discussed further in Section three. There is also some goat and possum control carried out in forestry blocks in the catchment, and additional sites of possum control on a smaller scale throughout the catchment.

6. The impact of indigenous vegetation removal

Current district plan rules allow for removal of early successional indigenous vegetation (e.g. kānuka and mānuka forest) as a permitted activity as well as the clearance of up to 500msq in each PMA annually. Since 2008 consent applications to the Gisborne District Council have been granted to remove 2650.3ha of native forest. Of this, 1050.9ha was classified as regenerating kānuka/mānuka; with the remaining 1599.4ha was classified as more diverse regenerating or mature indigenous forest.

Of this 1599.4ha, 165.8ha was vegetation within Protection Management Areas. A selective tree felling volume of 376m3 was also granted in the more diverse regenerating or mature indigenous forest, 126m3of which was within a Protection Management Area. (GDC, 2016). With only 17% of the catchment in indigenous cover, and just 15% of that (635ha, 2.75% of the total catchment cover) in PMA's, continued vegetation removal on this scale is having a significant effect on the proportion of indigenous vegetation cover in the catchment.

7. Freshwater Biodiversity

Many steep headwater reaches of the Waimatā are currently in poor condition, being prone to overloading by fine-grained sediments resulting from forest harvesting and land erosion. Enhanced sediment loads also reduce local biodiversity and create a burden for downstream reaches. The debilitating effect in ecosystems of large loads of fine grained sediment in rivers is well documented. Water quality decreases and both fish and invertebrates tend to be less abundant and less diverse in turbid river carrying heavy sediment loads (Cullum *et al* 2015). Turbidity and bed sediment cover decrease food resources for aquatic creatures and the

diversity of available habitat also decreases. Forest management practices and in headwater reaches and earthflow activities in numerous tributaries have resulted in pulsed inputs of fine grained material in to the Waimatā river.

Current data for the freshwater biodiversity of the Waimatā

Monitoring of the stream ecology has occurred since 2015-2016 summer period and knowledge previous to this is sparse. There are four sites measured in the Waimatā catchment and all four sites are in the River Environment Classification (REC), a database of catchment spatial attributes summarised for every segment in New Zealand's network of rivers. For the purposes of comparison, results are compared to those for the Waihirere stream which is fed by a fully forested (native) catchment.

Information provided by Gisborne District Council shows that all four sites in the Waimatā catchment have a lower %EPT and MCI score than the reference site at Waihirere stream in the Waihirere Domain, (EPT stands for Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly), all species sensitive to water quality change. A high EPT is an indicator of good stream health. MCI stands for Macroinvertebrate Community Index, an index which measures the presence of macroinvertebrates for monitoring and reporting on stream health in New Zealand). This indicates that the change in land use from indigenous forest and development within the catchment has had a negative effect on water quality and a decrease in species richness and abundance from the pre-human state. Makahakaha Stream is an exception, with results being in the "Good" category (prior to forestry harvest in 2016). It is known that stable, mature exotic forest can provide similar freshwater habitat to that of an indigenous catchment (while trees are in situ) Pawson *et al,* 2010)

At the four monitored sites in the Waimatā catchment, the MCI index is in the "Fair" – "Poor" range which indicates a degrading freshwater system that supports a less diverse composition of EPT species (Figure 1). The decrease in MCI and EPT taxa also has an impact on fish populations. Since New Zealand fish species feed on macroinvertebrates in the water, as the species richness and abundance decreases, so do the fish populations. There are currently 12 known freshwater fish species in the Waimatā river and these include the At Risk Longfin eel (*Anguilla dieffenbachia*) Koaro (*Galaxias brevipinnis*) Torrentfish (*Cheimarrichthys fosteri)*,

Inanga (*Galaxias maculatus)* and Bluegill bully (*Gobiomorphus hubbsi).* Other fish species include Common bully (*Gobiomorphus cotidianus)*, Crans bully (*Gobiomorphus basalis)*, Shortfin eel (*Anguilla australis*) Black Flounder (*Rhombosolea retiarii*), Mullet (*Mugil cephalus*), Goldfish (*Carassius auratus*) and Smelt (*Retropinna retropinna*).

Alterations in land use result in changes in fish habitat. This is reflected in the current fish populations and the decrease in abundance and richness in the species found in the Waimatā river (GDC, 2018). While eels are tolerant of silty substrates, sedimentation may reduce their availability of food by clogging up instream substrates where organisms such as invertebrates and koura live.

Kakahi *(Hyridella menziesi*) or freshwater mussels are also found in the Waimatā catchment. Kakahi are well known for their filter feeding techniques and use native fish to assist in their life cycle and improve their distribution tactics. Mussels release their larvae which attach to native fish gills, especially koaro and grow before detaching and finding a place to grow into maturity. Mussels can live for many years and the decline in habitat and their freshwater fish life history stage may be having an impact on their populations (GDC, 2018). In 2014, scientist Dr Chris Ward said that while it was good to see freshwater mussels inhabiting sections of the Waimatā River, their occurrence was unlikely to be a reliable indicator of ecosystem health or water quality. The kakahi are pipi-like in that they live unattached at shallow depths within the bottom sediment, and are similar in size and shape. He expected them to live mainly in scattered patches where irregular bedrock shelters pockets of stable sediment (Gundry, 2015).

In contrast to the main Waimatā river itself, some of its tributaries are in comparatively good condition, particularly those that are in indigenous forest catchments. Freshwater surveys of two tributary streams at Longbush Eco-sanctuary (Palmer and Hardy, 2015) exhibit high levels of biological values determined by macroinvertebrate, periphyton and physical habitat evaluations. After a week of heavy rain, while the Waimatā river reached very high levels of turbidity, whereas the contribution of sediment from the Longbush catchments was hardly any greater than the small amount transported by the streams during stable low flows

(Palmer and Hardy, 2015). The bush around these streams has been allowed to regenerate over the past 20 years.

8. Oral history and local perspectives on Biodiversity

Residents in the catchment have differing perspectives on the life in the river over the years, with Gundry (Waimatā Project Report 3, 2015) providing a detailed record of their observations. Species they note as being present in the river range from eels, kahawai, galaxiids (whitebait), mullet, trout and kākahi (freshwater mussels) to larger specimens like shark, seal and even a notorious dolphin near the ocean. In 2014, kahawai, mullet and eels were the main species described in the lower reaches of the river with mullet, eels and whitebait seen upstream as far as Waikereru. In the 2000s, eels were seen in the Makahakaha Stream that feeds into the Waimatā north of Waikereru. Eel numbers have dwindled over the years, a decline blamed by some on commercial eel fishers. Freshwater mussels were observed in the vicinity of the orchard near Gowerville in the 1960s; and in 2014, children living near Waikereru found freshwater pipi. Whitebaiters have found the Waimatā River near Goodwins Road bridge to be a successful haunt. Whitebait are the juveniles of five species of Galaxiidae – notably inanga, koaro, banded, giant and shortjaw kokopu.

While eels can successfully live in silty water, trout require pristine waters. This didn't stop various acclimatisation societies from attempting to stock district rivers with the introduced species. Thousands of ova were imported but were never successful.

In 2016 Richard Utting at Kōwhai Station reported that good stocks of long-finned eels, and a few whitebait and wild crayfish – koura – were found further up the river a few years earlier. As a child, in the 1960s and 70s, he used to spear flounder on the flat rocks near Thomas Corsons' place, where the river bends sharply away from Riverside Road .

Lee Creswell always remembers the stream up at the Uttings being very clean, never silty. Mike Marden has also observed good water quality up above the confluence of three streams at the edge of the Utting's property.

Catchment residents have also witnessed changes in the visibility of other fauna over time. According to John and Maggie Hegarty, weka by the hundred were a feature of life at Waikereru station. There were hundreds of Hegarty's Hens, as they called them. Maggie had to learn to keep the kitchen door closed to keep them out. Kayaker Alan Thompson recalled weka up around the island until 1988, and shags. Both seemed to vanish after Bola. He recalls flocks of ten to thirty shags – white breasted and black which have only just started coming back in the past few years.

In the Marian Drive area, Grant Bramwell thought the bird life had increased, with significantly more kereru in 2016 than in 2000. He has also noted that tui, fantails, kingfishers, bellbird and moreporks are plentiful but waxeyes are not as common. He considers that more pest control – especially for rats – would help. Other residents agree that tui, pigeons, bellbirds, falcon, harrier hawks, fantails, grey warblers, waxeye, black and white tomtit, shining cuckoo, black and pied shags were noted in bush areas throughout the Waimatā.

As Richard Utting recalled:

> The bird life in our bush is fantastic with tui, pigeons, bellbirds. We don't have as many pigeons as we used to. Mat Bailie reckons the sparrow hawks are getting them. One year, I counted 27 pigeons sitting around eating leaves in nearby trees. They eat the catkins of silver poplars. There's lots of kingfishers.

Phil Creswell, who lived at Motukeo for a few years in the early 1950's remembers abundant birdlife at Longbush with tui, kingfisher, bellbird and pigeons. Now living beside the lower reaches of the Waimatā River, he says the bird life has tripled over the past 25 years with abundant tui, kingfisher and pigeon – presumably because people have planted more trees and flaxes that have food for them, and not spraying.

Dave Hughes recalled accompanying Kaharoa's Stan Jones (and others) in about 1973 to help excavate moa skeletons from a Hiwiroa stream. From these a half skeleton was constructed and is now in the Tairāwhiti Museum.

9. The impacts of plantation forestry

After increased hillslope erosion and gullying presented a major challenge in the region, reforestation methods using exotic species (mostly *Pinus radiata*) occurred from 1960, but planting of the Waimatā didn't occur until the 1990's. Although many pine plantations were established as government-subsidized soil conservation initiatives, most plantations are now commercial forestry businesses, and many have been sold to overseas owners (including most of the forests in the headwaters of the Waimatā catchment (Waimatā Project Report 1, Cullum *et al* 2015)). The current harvesting of these forests is causing new concerns about erosion and increased water flows and sediment loads in the river, and the effects this is having on the river's biodiversity, and on riparian margins and wetlands adjacent to the river, the aggradation of the river floor and downstream flooding.

Plantation forests are known to reduce erosion and sedimentation of waterways for a period between planting and harvesting. Pinus radiata forests are typically harvested after about 25-30 years, and the land remains vulnerable to erosion for 5-6 years after harvest (Marden *et al*, 2012) and replanting. They also provide habitat for a number of native species, particularly insectivorous or seed eating birds such as tomtit, silvereye and fantail. High diversities of invertebrates, comparable to that in indigenous forest, have also been recorded in pine plantations (Norton, 1998). The colonisation of both standing and newly harvested areas of pine plantation by the NZ falcon is well documented (Seaton *et al,* 2009). Long-tailed bats have been seen in many pine forestry blocks throughout New Zealand (Borkin and Parsons, 2010) with the heaviest populations in and around the central North Island. They choose home ranges in forests with older trees that provide roosting sites and find insect-rich hunting grounds along the edges of forest stands, roads and streams (Borkin and Parsons, 2010), functioning as safe and green corridors connecting the remnants of indigenous ecosystems. Even being near to an unconnected fragment can encourage movement of indigenous species through the landscape. Planted forests also reduce 'edge' effects and maintain inner forest conditions in neighbouring patches of native forest by maintaining low light conditions, temperatures and microclimates similar to those found in deep within a forest.

Pest control in plantation forestry is also likely to benefit indigenous biodiversity both within the pine areas themselves and indigenous bush patches adjacent and within the exotic forest.

In most plantation pine forests, possums, goats and often deer are controlled to prevent damage to pine trees, particularly when they are young. This reduces browsing mammal densities in indigenous forest blocks both within and adjacent to the pine forest, although these may increase when the pine trees are harvested. Recent surveys of indigenous forest blocks within pine plantation blocks in the Waimatā (McLean, 2018) found that forest condition was influenced by introduced mammalian browsers more than other factors. It also found that pest plants were low across most of the forests (although weeds including blackberry, Japanese honeysuckle and pampas are common around some forest margins).

New Zealand's plantation forests provide multiple values including protection of water and soil resources, carbon sequestration, amenity, as well as wood production (Dyck, 1997). However, when forests are planted, thinned or harvested most, if not all of these benefits are swiftly reversed/lost. The effects downstream on both the waterways and the communities that use them can be dramatic.

During planting, reverting native vegetation is often sprayed with defoliants. During thinning, logs may be dropped into adjacent native bush gullies, crushing the forest and habitat, where logs are then left to lie, sometimes making their way in to the river system during heavy rain. It is during harvest, however that most of the damage is done. Slash and unwanted logs are often pushed into gullies where they crush existing native vegetation and destroy habitat, then eventually make their way directly in to the river system. This, combined with the newly created edge, where exposure begins to cause dieback and wind throw, shrinks the native bush area. Pines are then planted close to the “new” edge of the bush for the process to be repeated over the next 30 years, and eventually the native bush fragments disappear.

In clear-fell harvesting, the removal of large areas of forest that both intercept and transpire rain and hold steep, erosion prone soil, results in a significant increase in sediment mobilization during heavy rain events that may occur within the next 5-6 year “window of vulnerability” (Marden *et al*, 2012) while new pine trees establish. Significant erosion of hillsides and forestry slash mobilization may also occur, resulting in flooding downstream, sedimentation of low lying alluvial areas, river bank scouring and slumping from slash, and

destruction of riparian vegetation and infrastructure including bridges, roads, fences and death and/or injury to stock.

Many of those who live in the Waimatā catchment see the negative effects of forestry harvest on their livelihood and their families as significant. Citing social, environmental and economic effects, they are concerned about slash coming down the river in times of heavy rain to batter banks, fences, flood gates, trees and wildlife. Michael Savage's family at Monowai Station, for instance, have been farming in the Waimatā catchment for more than 100 years, and he observes that the changes in the river have been enormous since the forest upstream began harvesting. A tributary usually half a meter deep and able to be stepped over can rise to 10m during heavy rain (Photo 7.1. & 7.2). This plus the increased velocity and forestry waste can devastate streams, farmland, fences and roads. He says although the river has always had high sediment loadings after rain, it's never been anything like what it is with forestry, and then there's the addition of logs. While it has been close to a decade since a forestry block was harvested at the top of the catchment, farmers downstream say there are still log jams and pine logs coming down the river, and a significant build up of sediment (Gundry, 2015).

7.1. Tributary to the Waimatā river during a heavy rain event (Photo: Laura Savage).

7.2. The same tributary as above one week after the storm event. Note the residual sediment shelf and size of the river (Photo by the author).

Landowners believe that forestry has increased sediment in the Waimatā to the point that the river "turns to soup" whenever there is rain. Eels are crushed and "beaten to death by logs, and the number of pest animal species deer, pig, possum, goat and stoats increase as the understorey growth in forests attracts them there (Gundry, 2015). Wilding pines and other weeds are often left uncontrolled, and spread to adjacent properties.

Mike Marden witnessed the 2005 and 2015 floods from his Haronga Road property adjacent to Waimatā River:

> In 2005, I was appalled at the amount of forestry slash. It was like a solid carpet, probably not long after Hikurangi started harvesting at the top of Bailies. It went on and on for days. It stuck in my mind. I thought they were getting away with murder. It's very steep topography there. Whether they didn't clean the creeks of slash sufficiently, I don't know, but it was astounding to see that amount of slash in the river (Gundry 2015).

Marden argues that forestry companies should evaluate which areas to replant and allow for planting exclusion zones such as in and around stream channels or swampy areas that could be developed as sediment traps. If this does not occur voluntarily, regulatory measures to exclude some highly erosion-prone areas from replanting may be required.

Some forestry companies acknowledge that historical harvesting practises have caused serious damage, and are already addressing issues. Some managers and owners who have experienced severe on-site storm-related damage have voluntarily retired areas recognised as having a high risk of further damage during future storm events. Such areas will instead be allowed to revert to native cover.

Dan Fraser of Forest Enterprises, who has been in the industry for over 17 years, believes that there is a general movement by forest managers towards improving harvesting practices to make the industry more sustainable, particularly in forests which have smaller, local investors who don't want to be associated with bad practice. In the forest areas he is now managing, several measures are taken to manage slash and sediment and to protect biodiversity. These include ensuring that any remaining native bush patches are retained and that during thinning and in harvest, trees are felled away from the bush and care is taken to ensure that any forestry slash or remaining logs are stored clear from gullies, streams and bush areas. No vehicles are allowed to drive across tributaries, instead bridges are installed, and regular possum and goat control is carried out. Fraser also ensures that a pre and post- harvest fish and invertebrate surveys are carried out.

In the forests that he is managing, setbacks of 10m from waterways will be implemented to prevent earthworks and replanting of pines within the riparian margin. Sometimes, however, even riparian setbacks might not prevent wood entering the stream when a hillside suddenly slips away. This is particularly a risk in areas where previous years of farming on deforested land has meant that the land has eroded right back to papa rock, with only a thin layer of soil left to cover it. If there is a high rainfall event, this area and all the slash and forestry waste on it can come loose from the rock and fall in to the river. Slash catchers have been used in the past to prevent this, but these have not been shown to be particularly satisfactory. Other methods such as planting and retaining a wide riparian margin of fast growing exotic trees

such as poplars whose trunks act as a “living slash catchers” are possibilities. The aim of such margins is to prevent slash from entering a waterway, with native vegetation establishing underneath with the potential to replace the poplars once the trunks are large and sturdy enough. However even with methods such as this in place, Fraser acknowledges that in reality, many areas need to be retired from harvest, and he is committed to doing this where the risks of collapse and downstream effects are high. This is difficult, however: “How do you tell a group of mum and dad investors that have put their retirement money in to your company that they won’t be getting the money you told them they would from that block?”

According to Fraser, it is easy to blame the forestry industry as a whole for flooding and sediment issues:

> When there is a heavy rain event the rivers flood and are chock full of sediment, and then they recede and there’s sediment everywhere and somehow people accept that, when really they should be asking questions about why it’s happening. When the same thing happens but there are logs visible, suddenly it’s the fault of forestry and the pressure comes on the forestry industry alone.

He acknowledges that there is definitely room for improvement within the industry, but other land uses including farming also contribute to water problems and everyone needs to do their bit.

Several farmers are already fencing and planting waterways on their land in the catchment, however fencing is expensive due to the terrain, and there is a reluctance by many landowners to spend money on a fence and trees that will get ripped out by logs the next time there is a significant rain event. Michael Savage reports that he has planted up almost all of his tributaries with poplars and willows to stabilise the land, but agrees that many farmers, including himself, don’t want to invest in fencing until they see the forestry companies doing their bit first. He says it’s too disheartening for people to keep fencing and planting and then see everything disappear the next flood event. The community want to see more than just more slash catchers, as he has seen rivers and logs just overtop these or scour out around the sides.

Dan Fraser acknowledges that slash and waste logs can cause significant damage during a storm event, more than sediment alone, but suggests it is not helpful to make assumptions

about who is responsible and why. He says he and his company would welcome any investigation into the cause of excess slash becoming mobilised in rivers during flood events, so that the correct source of the problem can be identified and addressed [ref].

One often suggested method to mitigate the effects of forest harvest is selective harvesting or the "coup" method used overseas, where smaller amounts areas of forest are harvested and replanted at a time. This is with the aim of exposing smaller areas of bare soil at a time to reduce erosion and run off during rain events. However, the form and root strength of Pinus Radiata leaves it extremely vulnerable to wind once the forest is opened up, even for a small area of harvest. This results in a high risk of losing much of the remaining forest areas to windthrow. Pinus Radiata also grows best in open, exposed areas with high light levels and won't regenerate well in small areas surrounded by existing mature trees.

Although other species such as redwood or the native tōtara would allow for this type of harvesting method, the rate of economic return does not compare to that of pine with the redwood harvest age being around 45-47 years, and tōtara closer to 75 (although this may differ depending on climate)

10. Forestry Stewardship Council (FSC) Certification

The FSC is a global not-for-profit organization that sets the standards for what is a responsibly managed forest, both environmentally and socially. FSC forest management certification is awarded for responsible management of a forest or plantation area. Being FSC certified means that your forest, or supply chain, is managed sustainably; that you comply with their environmental, social, and economic standards.

Several of the forestry blocks within the Waimatā catchment are FSC Certified and are required to comply with the FSC standards and principles. Although this is generally beneficial, compliance monitoring can be patchy and some companies fail to recognize their social and community responsibilities under the certification. From the forestry company's perspective, the FSC Certification introduces another layer of compliance and cost, and often the economic benefits from being certified are minor.

11. Summary of main issues affecting the natural environment of the Waimatā catchment

The Waimatā catchment, like much of the Gisborne region, has been subject to intense land use changes over a relatively short period of time. This began with the removal of most of the indigenous vegetation cover near the coast by Māori settlers for gardening and fern-root digging, and after European settlement by the draining of wetlands, the clearance of coastal bush remnants and removal of native forest further inland for conversion to pastoral farming.

Over time, the increased intensification of farming with the change to smaller lifestyle blocks and urbanization downstream in the lower catchment, and the introduction of production forestry upriver in more recent times has resulted in the loss of most indigenous biodiversity from the catchment, with only small and often isolated areas of vegetation remaining where indigenous diversity is low due to degradation from introduced mammals and pest plants. Additionally, the increased erosion and sediment run off as a result of historic and continued deforestation of the catchment has increased flooding severity and sediment loads in the river.

The harvesting of production forestry in the catchment has further increased sediment loads, and significant volumes of forestry waste are washed down the catchment, particularly during very heavy rain events. Both sediment and significant volumes of slash are fatal to instream fauna and cause devastating effects on landowners downstream by flooding land, washing away fences, riparian vegetation, crops and livestock and scouring river banks to cause slumping. Further downstream towards to the river mouth, sediment and debris flood private properties and reserves, block roads and create dams below bridges, pile up on swimming beaches and prevent or limit recreational activities on the river.

The relationship between land, river and people is complex. Any attempt to develop a catchment wide plan with the aim of remediating environmental effects on the catchment, must also provide for the cultural, economic and recreational needs of stakeholders. Although recommendations to this level of detail are beyond the scope of this paper, the following

section suggests some options for land-use management for better ecological outcomes over time.

Section 4. Restoration Opportunities for the Waimatā Catchment

1. Introduction

The previous section identifies the main causes of continued biodiversity loss and environmental degradation in the Waimatā catchment as:

- The presence of pest plants and animals
- Historic and continued indigenous vegetation removal and habitat destruction
- Sedimentation of waterways
- Forestry slash in waterways

This section will look at a range of different tools to address and mitigate these issues, based on current best practice, existing scientific knowledge and discussions with local and national experts on the environmental characteristics of the catchment. The aim is to protect and restore the ecological health of the Waimatā river. To reiterate, this is a preliminary, high level assessment of the catchment, with preliminary, broad recommendations. It is assumed that more detailed assessments of land use at a landowner level will be part of future restoration planning for the catchment.

<u>Stakeholder engagement.</u>

Without doubt, people are an intrinsic part of the Waimatā landscape, and it is an understanding of these peoples' (both past and present) values and their engagement in restoration planning that will drive its success. While this report has a focus on indigenous biodiversity, the social and economic needs of stakeholders in the catchment are discussed and contribute to the choice of recommended tools.

Effective engagement with stakeholders in this particular catchment is vital, because the Waimatā River is intensively used in a variety of ways, and is highly valued by local people. While land use in the upper catchment is dominated by pasture and exotic plantations, such upstream activities have significant impacts on landowners and river users downstream. In 2015, for instance, flooding blocked bridges in both upper Riverside Road and Gisborne city with woody debris, threatening these structures; bank drop-outs and slumping occurred along Waimatā Valley and Riverside Roads, and on suburban and inner city sections bordering the river; and large amounts of debris had to be removed from Poverty Bay beaches. Even minor rain events deposit significant amounts of sediment on the river bed, aggrading the lower reaches of the river. As a result, swimming has been impacted and the river is now too shallow at low tide for some water sport activities. There is also an increased need to dredge the port.

With 12,000 hectares of pasture and around 4000 hectares of pinus radiata plantation in the catchment, much of it still in the window of vulnerability (4-7 years post harvest) or still to be harvested, further downstream damage of this kind is likely and consequential. In a high rainfall event such as that experienced in Tolaga Bay in June 2018, where large quantities of slash and sediment were mobilised, effects on port infrastructure, the city and its people could be devastating. Gisborne city bridges, for instance, carry vital infrastructure such as power and water supplies, as well as providing key transport links. If flooding of this kind occurred, impacts on the local community and economy could be severe.

For these reasons, it is particularly important to ensure effective management of land use in the Waimatā catchment. A risk analysis by the relevant authorities to assess the potential likelihood, scale, severity and impacts of such events on the Waimatā would be timely. Stakeholder engagement is further discussed later in this section.

Current restoration projects

Several projects are already underway in the catchment that focus on increasing biodiversity and decreasing sedimentary loads in the river. In the lower Waimatā, these include Waikereru Ecosanctuary which incorporates Longbush Reserve, where extensive fencing, planting, pest

control, riparian planting and translocation of threatened species has been carried out since 2000 in an effort to stabilise stream and river banks, provide habitat for native flora and fauna and bring rare and threatened species back to the lower Waimatā catchment.

Waikereru is also part of a wider collaborative effort with other landowners and organisations as part of the Lower Waimatā Restoration project led by DOC, which covers a total of ~ 6000 ha. In this project, the Department of Conservation (DoC), Gisborne District Council (GDC), Queen Elizabeth II (QEII) Trust and local environmental leaders (The Longbush Trust) aim to work together to engage landowners in collaborative pest/predator control, land protection and revegetation within the Lower Waimatā Catchment. The next key step is the clarification of iwi aspirations and the co-development of a viable restoration plan.

The protection and restoration of remnant areas within this part of the catchment, and significant pest and predator control across the remaining agricultural land will increase ecological connectivity in the central Gisborne area, forming an ecological corridor between two of the city's most important restoration sites – Waikereru eco-sanctuary and Tītīrangi (Kaiti Hill), contributing to enhanced habitat and biodiversity, reducing erosion and improving the water quality of one of the city's most significant rivers. Tītīrangi is currently undergoing major restoration work through collaboration between GDC and Ngāti Oneone.

The lower Waimatā project also includes Donner's Bush Scenic Reserve owned by the Department of Conservation, which is already the site of a collaborative restoration and pest control effort by DoC, The Longbush Trust, the Eastland Institute of Technology (EIT) and the Gisborne YMCA. There are also a number of QEII covenants in place in this part of the catchment. As the Waimatā is important to iwi, industry and history, there is an opportunity to connect with other partners (such as the Eastland Group) in telling a larger Gisborne Story. The project could also encompass a significant conservation capability training partnership between DOC, Iwi, EIT, Waikereru Ecosanctuary and the YMCA.

In the upper Waimatā catchment, too, Steve Sawyer and Robyn Wilkie are trialling under planting of poplar trees on their riparian margins with native species, and the use of harakeke to stabilise sedimentary river edges. In 2010, the grazed and degraded riverbank along the

base of their property was slipping into the Waimatā River, threatening to take the fence and pastural land with it. After a particularly bad slip, the affected area was planted in poplar willow and mānuka. The mānuka did not flourish but the poplars and willow started to grow, stabilising the bank. When a large flax bush planted high on the banks slipped and was deposited lower on the slope, it started to regrow. Since regular flooding did not appear to affect the health or position of the flax, Robyn Wilkie began to plant flax and other natives amongst the poplar trees. As these native species became established the poplar willows and other species were ringbarked or cut and pasted with Vigilant. After eight years the flax are becoming established, providing nectar for tui and bellbirds; and although recent floods covered the flax with silt and wood material, the leaves lay flat but recovered within three months. This experimental trial suggests that flax might be effective in stabilising a deep sedimentary river bank, an approach that is now being trialled further downriver at Waikereru Ecosanctuary.

In total, there are 13 fenced QEII Covenants in the Waimatā catchment, ranging from 0.36ha to 105.1 ha (313ha in total). Many of these sites are also subject to pest animal and weed control, making them valuable biodiversity sources for the rest of the catchment. Gisborne QEII representative Malcolm Rutherford often sees the occasional block which is fenced off, is never (or very rarely) grazed, and is *not* formally protected. Implying that some landowners want to keep the option of grazing in the future (QEII covenanting usually requires the removal of stock from bush areas to be fenced). In a few cases, biodiversity protection on farms is unintentional, for example a gully, wetland, or steep bank may be fenced off for the purposes of more efficient farming or soil conservation and the lack of grazing sees some species regenerate. Often this is mānuka and kānuka which act as nursery species for more permanent forest species.

Rutherford suspects that predator control outside of covenants is often limited to a cage cat trap, or a few rat traps or poison around farm sheds. Possum control is often carried out by young friends or relatives of the land owners, or occasionally fur trappers, and tends to be varied in timing and quality of control. Goat control is similarly varied, with some owners being completely intolerant of goats, and others mustering them once a year. Most land owners enjoy low populations of deer, for hunting in particular. Pigs are becoming an issue

on farms that adjoin forestry at the top of the Waimatā and do a lot of damage. These are generally not tolerated on farms, but can be difficult to control, when they shelter in adjacent forests (Rutherford, *Pers. Comm,* 2018).

Existing work underway in the Waimatā catchment provides valuable opportunities to connect and construct a network of environmental restoration sites across the wider catchment with collaboration and exchanges of experience and knowledge across a range of stakeholders. The role of this report and its recommendations is to build on the work already underway, with the aim of generating a landscape scale approach to the restoration of the Waimatā River catchment from the headwaters to the ocean.

2. Pest plants and animals

Pest mammals are by far the major contributor to the continuing decline in biodiversity in the Waimatā catchment, and across the region (Brown *et al,* 2015). There are varying options for controlling pest animals, depending on the species, habitat characteristics, the landscape and desired outcomes from the control (e.g whether the aim is the recovery of a particular indigenous species, an ecosystem, or a river catchment).

In the past, pest control operations have focussed on the knock down or removal of a particular pest animal, often to assist in the recovery of a particular species, and/or using a particular method. The current focus of pest management for biodiversity protection is now shifting from mainly single- species control to the control of key pest threats and a focus on landscape scale (e.g. catchment scale), multi-species control for multiple ecological outcomes (Brown *et al,* 2015). This technique results in pest control programmes where multiple pest species are reduced at the same time. If one assumes that focus on a particular site with high conservation values may produce good biodiversity outcomes at that site and across adjacent areas, the maintenance of those outcomes will require sustained control over the long term. If the focus can be expanded to a catchment-based programme, linking up existing high value conservation sites, and those where pest control is undertaken, then the area of the catchment benefitting from best control expands, as does its halo of affected adjacent sites. This reduces reinvasion rates as the pest free boundary is expanded.

For the Waimatā catchment, the initial focus for pest control should be on goats, deer and possums to reduce the significant effects that these species have on indigenous vegetation through browsing. In high conservation value sites, ship rats and stoats should also be controlled. The negative impacts of all the above species have been well documented in New Zealand and elsewhere (Innes et al. 2010; Latham et al. 2017b; Parkes et al. 2017). Possums, stoats and ship rats currently pose the greatest threat to our native wildlife in mainland forests (Innes *et al* 2010). They are known to have caused the extinction of native animal species, currently suppress native animal populations, and will cause further extinctions if not controlled. Depending on the method of control used, all three species may be targeted concurrently (e.g. by toxin application either aerially or ground based in bait stations) or with a combination of trapping and baiting.

Multi-species control can also address the issue of predator-prey interactions. Often the successful control of one particular predator species may increase the presence of other pests (Latham *et al,* 2017). Without an understanding of how other predator species respond to a particular control, operations may not protect wider conservation values.

Significant pest plants of the Waimatā catchment include pampas (*Cortaderia selloana*), blackberry (*Rubus fruticosus* agg), Japanese honeysuckle (*Lonicera japonica*), Mexican daisy (*Erigeron karvinskianus*), barberry (*Berberis glaucocarpa*), wilding pine, and box alder (*Acer negundo var. negundo*). Old man's beard (*Clematis vitalba*), tradescantia (*Tradescantia fluminensis*), woolly nightshade (*Solanum mauritianum*), and climbing spindleberry (*Celastrus orbiculatus)* are also locally common. Species which are either individual trees that are easily identifiable (wilding pine) or are only located at isolated sites (old man's beard) may be managed at a catchment scale, for example an aerial spray operation targeting wilding pine. Other species which occur at higher densities and are not easily differentiated from other vegetation (e.g. Japanese honeysuckle, Mexican daisy) may be more successfully addressed on a site by site scale. The Regional Pest Management Plan and Operational Regional Pest Management Plan both provide detail on the invasive nature of each of these species and methods of control.

It would be strategic for any effort to be co-ordinated as far as is possible. Agencies such as Gisborne District and Regional Council, DoC and QEII are all involved in pest and weed control, and ideally these agencies would plan their efforts for an optimal combined impact, and in active collaboration with land owners. This is already occurring to some degree with the lower Waimatā catchment project, but could be increased.

It would also make sense to focus on those parts of the catchment with a concentration of areas that already have a measure of protection (eg. PMAs, DoC reserves and QEII covenants) and where pest and weed control are already under way, optimising the 'halo' effect and minimising reinvasion by expanding the boundaries of the pest-controlled zone.

To ensure that any pest and weed control programme for the Waimatā catchment is sufficient to achieve the desired outcomes, an *adaptive management* approach to monitoring and control should be adopted. Collecting data about the pest population being controlled and the response of the ecosystem to that control, allows the control method/intensity to be modified to ensure that an optimal response to control is being achieved.

3. Historic and continued indigenous vegetation removal and habitat d destruction

The removal of indigenous colonizer species such as kānuka and mānuka for forestry and farm maintenance and to release pasture has long been standard practice in the Waimatā catchment. However, when carried out on a large scale, this loss of vegetation inevitably leads to increased soil erosion, sedimentation (particular along riparian margins) as well as biodiversity loss. Consented removal of mature indigenous forest also continues within the region (and most likely within the catchment), resulting in even greater biodiversity losses.

To change this requires both a shift in values as well as a change in regulations. As projects in other regions have demonstrated, ongoing engagement with landowners to moderate ingrained practices that are ecologically damaging is as important as local regulatory bodies in ensuring better outcomes. The Whaingaroa Harbor Care project, for instance, was set up in 1995 by the community in response to the degradation of the harbor and local fisheries.

After 18 years of riparian management, water quality in the harbour has improved dramatically. Whitebait catches have increased from 1/2 cup per day to 1/2 bucket per day, and recreational fishing catches have also improved. Mudflats previously barren of life are now teeming with crabs, shellfish & wading birds (Waikato Regional Council Website).

A focus on farm and forest management practices is discussed further below. In the consenting of vegetation removal by regulatory bodies, this area is in urgent need of increased monitoring and compliance as well as a re-evaluation of the relevant rules, particularly in relation to vegetation removal within PMA's.

4. Sedimentation of waterways

When vegetation removal occurs at the scale and spread of that in the Waimatā catchment, where only 6% of land cover remains in indigenous vegetation and 28% is exotic forest intended for clear-fell harvest, the effects of increased run off, erosion and sediment are felt along the length of the river. Although any effort to reduce these effects will be helpful, a focus on improving water quality downstream is often thwarted by continued deforestation coupled with flood events further up the catchment. There is no effective treatment for sediment once it enters the river. Efforts to improve the condition of the river should thus focus on reducing the sediment load at source, increasing the capacity to trap sediments at source, in the headwater regions and in the sluggish tributaries of the earth flow zones. (Cullum *et al* 2015).

Landscapes, topography, geology and river geomorphology change constantly throughout the catchment, both within and between land uses and landowners. As Cullum et al have demonstrated (Cullum *et al,* 2015) different sections of the Waimatā are very different in their steepness, soil cover and substrate, and different management strategies are needed for different reaches. No one rule fits every stream, and it is likely that a range of tools will need to be applied for different areas.

<u>Fencing</u>

A recent survey of PMAs (Mclean, 2018) within farmland in the catchment found that one of the biggest contributors to the degradation of remaining indigenous forest was from the presence of browsing animals (including stock, feral deer and goats). Fencing off these areas from stock will assist the recovery of the forest understorey, increasing erosion and sediment control and providing habitat to native species. Weeds may establish initially, but once a native understorey established, these will largely be shaded out.

One key step in restoring the ecological health of the Waimatā River catchment will be to fence and connect remaining bush patches across the landscape, providing stepping stones and corridors for wildlife. Fencing and planting of indigenous species or planting of exotic species such as poplar (where fencing is not achievable due to very steep topography, land movement and slips, or risk of losing the fence during a flood and slash mobilisation event), can help connect up indigenous bush patches or provide shelter to reduce edge effects. This may require financial support for land owners, especially for riparian restoration where the benefits of reduced erosion and increased biodiversity are shared down river and in adjacent areas. Relevant agencies (eg. GDC, DoC and QEII) could potentially provide support as part of the 'Billion Trees' project or other national initiatives.

5. Farm Management in the Waimatā catchment

Most of the Waimatā catchment [50% of land cover] is in productive grassland for sheep and beef farming. As Gundry's report demonstrates, many in the farming community acknowledge that historical deforestation of the catchment has led to severe erosion of the land and increased sedimentation of waterways, particularly after extreme rainfall events. The most memorable of these events was Cyclone Bola in 1988 which dumped 400mm of rain over 24 hours on the Gisborne District, causing widespread damage when rain destroyed or damaged several roads and bridges and three days of continuous rainfall led to mudslides, flooding, and erosion (Gundry, 2015).

Some members of the farming community also accept that to continue farming successfully, there is a need to apply erosion control measures, on particularly vulnerable sites within the

catchment. In the upper Waimatā catchment, for instance, Michael Savage of Monowai Station has planted almost all of the tributaries on his land with poplar and willows to stabilise steep hills and prevent slips and erosion, adding to these plantings each year. He observes that while it would be nice to fence off the tributaries from stock and plant natives, the steep nature of the hill country within the catchment, the risk of erosion and the high cost of fencing (approximately $20,000/km in hill country) mean that common remediation techniques such as fencing off areas from stock and planting natives is not feasible (Savage interview, 2018). Mat Bailie of Hiwiroa station echoes these concerns. With 12 miles of river on his property, he states that he would have to walk away from the farm if he had to fence off the tributaries. Even if the cost of fencing was not an issue, the land is so unstable, especially around the river that fences won't last (Gundry, 2015). Both Michael Savage and his daughter Laura say that while they would prefer to fence off their tributaries and gullies and plant natives, the steepness of the site means fences are unlikely to last long. Moving the fence to a ridgeline or flatter ground could work, but the amount of grazing land that would be excluded would be significant, and not sustainable long term. There is also the issue of forestry slash and floods associated with harvesting ripping out riparian fencing and planting during high rainfall events. According to several landowners, this is another reason that prevents them from carrying out riparian remediation. There is a consensus that the forestry companies need to do their bit too.

The multiple environmental issues now faced by the farming community highlight the complexity of applying standard best practice ecological restoration treatments as a one size fits all approach in the Waimatā catchment. It is likely that a mixed land use, site appropriate farm management plan approach is a more feasible option. This entails the development of a site specific farm plan, developed for each farm and driven by the landowner/community with the support of technical experts. If environmental restoration is to be successful and sustainable it must be driven by those who know, are connected to, and whose livelihoods depend on the land. The engagement of experts (including farming consultants with ecological training and environmental economists) as well as government organisations helps to support landowners' transition to more sustainable land practices.

Within this targeted, site specific approach, there are a number of strategies that could be applied across areas of farmland to address erosion, sediment and water quality issues as well as providing biodiversity outcomes. These include the following:

- Allow regeneration of native species, or planting fast growing exotics such as poplar or matsudana willow on very steep slopes and gullies where fencing is too costly, and on slow moving earth flows. Native regeneration of very steep slopes and gullies can be assisted by planting seed- and fruit-bearing native trees on the foothills, supplying seed source for birds to disseminate.

- Where the terrain allows on lower slopes and flats, streams, gullies and riparian margins, non-productive pasture and remnant bush may be fenced and allowed to regenerate or planted in native plants. It is important to ensure that plants are the optimal species for erosion control and trapping sediment e.g. wetland plants like sedges, grasses and rushes are more effective at trapping sediment.

- On flats and in damp gullies where grazing is suboptimal and topography allows for fencing, re-establish wetlands and fence from stock. This could include planting of sluggish tributaries of the earth flow zones. Again, it is important to ensure that plants are the correct species for erosion control and trapping sediment e.g. wetland plants like sedges, grasses, rushes and flaxes are more effective at trapping sediment.

- Consider retiring very erosion prone areas which are unproductive and allow to revert to natives or other (refer to alternative landuse options below). Fence these where possible.

- Carry out trials in the catchment to identify optimal mixes of species for particular kinds of site, and provide evidence-based advice to landowners

- Fence stock from access to waterways and provide stock drinking water offline.

- The relevant authorities may consider sources of funding to assist land owners in making these transitions.

6. Additional sediment control options (other than farm plans)

For other land use types within the catchment which may not require individual farm plans due to their size, location and topography e.g. lifestyle blocks, small individual owned forestry blocks and urban areas, there are more general environmental restoration options which could be applied to reduce erosion and sedimentation.

Fencing and planting gullies, tributaries and wetlands

Away from the main trunk of the river, where the topography allows, permanent stock proof fencing and planting of appropriate native species is recommended. Where possible, the whole of a gully should be included in the fence area, or the width of the fenced and planted area should be at least 10m wide on each side, more where possible. This will reduce edge effects, promote better plant growth and provide a core bush area large enough to provide shading, sediment and nutrient retention.

Vegetated wetlands are ideal for trapping sediment and nutrients, and flood control (acting as sponges). These are hotspots for native biodiversity and are often not suitable for grazing due to the high water table, resulting in boggy, wet soil. Wetlands often occur naturally at the base of a gully adjacent to existing streams and rivers. Once these areas are identified, they can be fenced from stock. Wetland plant species often return or their own accord once browsing pressure is removed, so there may be no need to plant. Some weed control may be required.

Planting the Waimatā.

Planting on the banks of the Waimatā river itself may be feasible, especially in the headwaters of the catchment where lower volumes of water are the norm. Planting becomes more problematic further down the catchment, however, where flows volumes, velocity and depth of sediment on river banks become greater and risks of bank slumping increase. There are

many areas where continuous slumping means riparian planting and fencing is difficult or unsustainable.

In the past, willows and poplars have been planted to stabilise banks. Local Geologist Mike Marden notes that this can be successful if the trees are managed through pruning to retain a small size and reduce the risk of toppling. However, often planted poplars and willows are left unmanaged, particularly when planted on public marginal strips. They become large and unwieldly – toppling during flood events and taking the river bank with them, contributing further to the slash and sediment already in the stream. Marden suggests that an alternative solution is to plant indigenous species such as mānuka to provide bank stabilisation. It is a species that grows in that environment naturally, it doesn't grow big so it doesn't matter as much if it falls over. It might regenerate, act as a nurse crop for other species or could be planted under existing poplars ready to become the next canopy. There is also an opportunity to extend Robyn Wilkie's flax planting methods over greater areas of the riverbank to more formally assess their erosion control potential.

Planting Sediment traps in alluvial terraces

Alluvial terraces form an interface between hillslopes and the river channel, presenting an opportunity to reduce land use impacts and water quality by targeting mitigation efforts on terrace surfaces. These and other strategies have the potential to enhance the trapping efficiency of nutrients, sediment and forestry slash. Local geologist Mike Marden has begun to reconstruct longitudinal profiles of the Waimatā river based on the elevation of remnants of alluvial terrace that represent levels the river used to be back in time, a study that will contribute to understanding the location and frequency of flooding and siltation in the catchment. It is recommended that this work is funded for completion. Drainage characteristics also help to determine where riparian planting and wetland restoration is likely to be most effective, and data on riverbank height will help assess the stability of river banks. Terraces in pasture with poor drainage may be identified for future wetland restoration. It is important to ensure that plants are the correct species for erosion control and trapping sediment e.g. wetland plants like sedges, grasses and rushes are more effective at trapping sediment.

Alluvial terraces are often the most productive areas of pasture on a lifestyle block or farm, however, so retiring this land is often not an attractive proposition for landowners. Options include retaining a proportion of the land in pasture and applying varying methods of planting e.g. a strip of poplar planting to control erosion or slumping, with a fenced and planted area of sediment trapping native plants beyond. Again, this can be part of a whole farm management approach to achieve a range of environmental outcomes including erosion control and biodiversity.

7. Production forestry

Production forestry is relatively new to the Waimatā catchment, with most forests less than 30 years old and the first rotation planting (largely as a result of Bola) coming to an end. The effects of harvesting on the Waimatā catchment are in the early stages but have already been dramatic, with significant increases in sediment and woody debris being transported down the river in recent flood events. Given that this catchment has a relatively high concentration of land cover in exotic plantation forests (28% compared with 19% across the region), and that the impacts of harvesting affect many other land owners, river users and public amenities including bridges, parks and the port downstream, careful management and control of forest planting and harvesting in this catchment is imperative.

However, as is the case with pastoral farming, the logistics of plantation forestry harvest are many and varied, and the environmental challenges complex. As highlighted in the previous chapter, it is crucial that the correct cause (i.e. lack of a riparian buffer or slash catcher, or a slip event) of the sediment and woody debris be identified so that appropriate remediation and prevention can be applied and if necessary, statutory guidelines amended.

Many of the forests in the Waimatā catchment are also registered with the Forestry Stewardship Council in Bonn, which sets national and international standards for sustainable forest management. The NZ FSC standards include:

- Criterion 3.3: Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.
- Criterion 4.4: Management planning and operations shall incorporate the results of evaluations of social impact.
- Criterion 5.3: Forest management should minimize waste associated with harvesting and on on-site processing operations and avoid damage to other forest resources.
- Criterion 5.4: Forest management should strive to strengthen and diversify the local economy, avoiding dependence on a single forest product.
- Principle 6: Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.
- Criterion 10.2: The design and layout of plantations should promote the protection, restoration and conservation of natural forests, and not increase pressures on natural forests. Wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods shall be used in the layout of the plantation, consistent with the scale of the operation. The scale and layout of plantation blocks shall be consistent with the patterns of forest stands found within the natural landscape.
- Criterion 10.4: The selection of species for planting shall be based on their overall suitability for the site and their appropriateness to the management objectives. In order to enhance the conservation of biological diversity, native species are preferred over exotic species in the establishment of plantations and the restoration of degraded ecosystems. Exotic species, which shall be used only when their performance is greater than that of native species, shall be carefully monitored to detect unusual mortality, disease, or insect outbreaks and adverse ecological impacts.

It is the role of the Forestry Stewardship Council and its auditors to ensure that registered forestry companies comply with these standards; and of the local statutory authority to ensure that these companies comply with the relevant local and regional plan rules. In some cases lack of compliance with these rules may be the cause of significant forestry slash mobilisation events. Calls by the Gisborne community for more compliance monitoring or

forestry harvest in the region are increasing. If lack of compliance is the major cause of forestry slash mobilisation events, then an increase in compliance monitoring with assist with identifying addressing these issues. Again, it is important to ensure that the correct causes are identified so that appropriate measures can be taken.

Regardless of the statutory requirements, there are many possible causes of sediment and forestry slash mobilisation in flood events. There are several best practice methods that are applied by forestry operators to address this issue;

- Retain areas of indigenous habitat to assist with soil erosion control, slash retention and biodiversity outcomes.
- Fell trees away from streams, gullies and indigenous habitat to maintain water quality and habitat structure
- Avoid vehicles in waterways
- Carry out systematic pest control
- Retain a 10m riparian buffer around waterways when replanting to avoid disturbance the waterway and reduce sediment
- Install slash catchers and sediment traps
- Avoid pulling logs across waterways.

However, Dan Fraser of Forest Logistics notes that that a riparian buffer is unlikely to prevent large volumes of slash from entering waterways during a heavy rain event, particularly on areas of steeper terrain where landslips are a high risk, and man-made slash catchers are failing to provide a sufficient barrier between forestry slash and the downstream community.

It is becoming apparent that more stringent measures need to be taken to address the forestry slash/sediment issue. Forest management plans for individual forests, monitored by the local authority, may be the best way of minimising such impacts.

<u>Land retirement</u>

Land that is not suitable for harvesting due to risks on site and the potential downstream effects will need to be identified. This is not necessarily just 3A land but all those areas which may be prone to serious erosion and landslips. These should be retired from production pine forestry and alternative land use sought. A focus on smaller scale planting on less erosion prone land is also desirable. It is recommended that the local authority should examine the scale of exotic forests in the catchment, and seek to control the location and scale of future forestry operations in order to restore and protect the ecological health of the Waimatā river.

Post harvesting site clearance

This involves the removal of all logs over a certain size from the harvest site by the company responsible for the forestry harvest. Rather than taking a scorched earth approach, this means that larger logs are removed from the site, preventing them from ending up in the river system.

Slash catching techniques

The development of techniques for catching forestry slash and woody debris is crucial. Dan Fraser suggested trialling a living slash catcher where fast growing exotic species such as poplar are planted close together in riparian buffer zones. Once large enough, they would be strong enough to withhold slash and debris from entering the stream. Native planting or reversion would take place under poplars and replace them eventually.

Sustainable forest plans

In parallel with whole farm plans, it would be desirable for forestry companies to develop forest plans in consultation with environmental experts and other stakeholders that make recommendations on harvesting, planting and other land uses tailored to specific sites within the forest. Forestry companies and harvesters would be obliged to adhere to the recommendations. These might include a detailed 30 year replant and protection plan for ecological values related to the next harvest. There would be a requirement for compliance monitoring by the local territorial authority.

Focus on multiple land use within a catchment

Another strategy is to ensure that plantation forestry is not more than a certain % of a catchment. This effectively dilutes the effects that forestry can have on a catchment even during harvesting. See catchment approach below.

8. Alternative land use options and the mixed landscape approach.

There is growing evidence to support a move away from a "siloed" approach to rural land use (in which production forestry is separate from farming which is separate from conservation and so on) to an integrated or "interwoven" land use approach. (Hall, 2017). The idea of an integrated land use approach is the development of a framework that supports the ability of local and regional communities to maximise land use in a flexible, environmentally sustainable manner over time. Here different land uses are "entwined" in ways that complement the land and its inhabitants (Hall, 2017).

Applying a mixed land use approach in the Waimatā catchment would provide an opportunity to balance environmental and economic outcomes. The general principle is that instead of conservation, farming and production forestry being spatially separate, they are integrated with each other and potentially with other land uses (eg mānuka honey production, bioactives from native plants, horticulture, viticulture, sustainable harvesting of native forests etc). Applying this at a catchment scale is a major undertaking, which is likely to require significant resourcing and commitment and engagement of a range of stakeholders. However, the long-term outcome of a sustainable future that benefits the community, the environment and the local economy is a strong motivator for success. Possible outcomes might include a mix of exotic plantation forestry and native reversion for conservation, or a pastoral farm block that incorporates an indigenous forestry block or mānuka plantation for honey production and long-term sustainable harvesting. Peter Handford, director of Groundtruth (a company undertaking integrated sustainable land management) and Project Advisor for the Uawanui Project, believes there is a place for sustainable production forestry of longer-lived exotic species such as redwood, or native species like tōtara (*Podocarpus tōtara*). The challenge is that often, economists apply the same formula used for pinus radiata for rates of return to alternative species, including natives, giving adverse outcomes. Handford considers that part of the problem is that NZ forestry has become defined by Pinus radiata, although production

forestry in New Zealand used to be focussed on planting varying types of forests for different reasons, so there was a mix of forest types and harvesting periods and methods. The agencies that managed forestry were formerly locally based and part of the community, which was also advantageous in understanding the challenges of local landscapes.

The development of individual farm and forest plans will be crucial to applying the integrated land use approach as this is an opportunity for landowners to identify areas where the current land use may be unsuitable, and look for more sustainable and economically viable alternatives.

There are a number of alternative land use options that could be applied within the Waimatā catchment (listed below). Among these are cutting edge research-based ideas from within the Tairāwhiti Region. Hikurangi BIoactives Managing Director Manu Caddie, for instance, argues that there is huge potential in deriving health products from native plants. Hikurangi Bioactives is partnering with pharmaceutical companies, researchers and investors to develop new medical and health products based on bioactive extracts from plants, shellfish and fungi. The company currently produces kānuka oil but is also conducting research on the bioactives in kānuka, kina and harakeke. Earlier in the year, the company advertised an opportunity for the local community to invest in Hikurangi Cannabis Company, their medical cannabis research and development enterprise. This was so popular the website could not handle the number of interested investors, and crashed twice. Caddie reports that there is still much research and development to come, but with an established honey industry, oil extraction is taking off, with a range of other native extracts to follow. Planting mānuka is gaining increasing favour because of its potential for top-shelf honey production, the ECFP having already received applications for planting the crop (Gundry, 2015) and Hikurangi has a two year ECFP funded project to optimise oil production from East Coast kanuka strains.

<u>Alternative land-use options to apply to an integrated land use model for the Waimatā catchment;</u>

- Native reversion for conservation and carbon credits

- Alternative sustainable production forestry using longer lived exotics such as redwood or natives such as tōtara. These species would allow different harvesting methods to be applied such as the patchwork or "coup" approach or retention harvesting. Continuous planting over time will produce different aged stands for continuous cover and income.
- Mānuka plantation for honey production – this could be applied under native production forest such as tōtara to provide income until harvesting of woodlot.
- Planting of flax crops for flaxseed oil.
- Hemp crops or medicinal Marijuana
- Carbon farming
- Ecotourism

9. Community-led catchment/landscape scale approach

Ecological restoration is an expanding area of science and practice for environmental management; however its success in challenging traditional or ingrained approaches on the ground is often limited because it is seen primarily as a scientific or practical endeavour rather than a *social* one. In general, the restoration literature suffers from a 'deficit model' of public understanding and from a lack of fit between the expectations of restoration and policy workers and those of the public and landowners (Eden and Tunstall, 2006). As a result of this, scientists and policy makers often fail to successfully implement large-scale land use ecological restoration. The move towards community-led, multi-stakeholder, landscape-scale approaches are becoming more common, with projects driven by stakeholders who are intrinsically connected to and derive a livelihood from the land, and have a vested interest in the success of the project.

According to Peter Handford, this community-driven approach has been the key to the success of the Uawanui project. The Uawanui project has been driven by the iwi of Uawa, Te Aitanga a Hauiti, in partnership with the rest of the Uawa/Tolaga Bay community. Handford argues that this community-led approach will be fundamental in achieving sustainable land management in any catchment, by finding the balance between sustainable land use and

economic gains. Businesses, landowners and the community must still be able to derive an income from the land.

One of the main challenges so far in the Uawanui project has been the harvesting of production pine forestry, which has caused major devastation in the catchment on several occasions, most recently in June 2018. Peter Handford reports that one of the major challenges to improving forestry practice is the lack of a sense of obligation to the community from forest companies. He says if forest owners were based locally and had to drink in the same pub as their neighbours who are farming downstream, they would have a vested interest in making sure they are doing right by their community. It is fundamental that all stakeholders in a catchment are part of a catchment restoration group or governance board, and this must include the forestry companies. He says until they see themselves as *part* of the community, nothing will change. Handford notes that this is something they are trying to achieve with the Uawanui project. Michael Savage of Waimatā agrees, saying that part of the problem is that many plantation forests are owned by overseas companies who don't have a vested interest in sustainable management or feel any obligation to the local environment or community.

Dan Fraser from also considers that a local stakeholder (including scientists and environmental groups), community-led, catchment-based approach to land management is more likely to have a successful outcome. He alludes to the lack of effectiveness of the FSC as an international standard, because this is too far removed from the local community.

Other benefits of a Community/stakeholder-led approach for the management of the Waimatā catchment would include;

- Empowerment of community members involved leading to an increased sense of responsibility, to both the land and to their neighbours.
- Stakeholders carrying out their own compliance and monitoring, providing opportunities for cause and effect-based actions.
- Better biodiversity outcomes over a larger, landscape scale e.g. large scale economically viable planting options, and animal pest control at landscape scale are more likely to be sustainable.

- Access to larger pools of funding due to increased community support

10. Next Steps

The development of a community-driven, catchment-based ecological restoration and sustainable land management plan for the Waimatā River should focus on the engagement of a wide range of stakeholders. It is crucial to have commitment at the project's inception from those that know, are intrinsically connected to, and/or rely on the land for their livelihood. This includes landowners, iwi, technical experts (including economists and ecologists), businesses (e.g. forestry) and local leaders as well as government organisations, backed by the regional council. There is already collaborative work under way in the catchment, particularly that led by DoC on the Lower Waimatā Project. It is hoped that in combination with this existing work, other reports, workshop recommendations and general commentaries, this report will facilitate a collaborative approach to catchment restoration planning for the Waimatā.

In regards to tāngata whenua engagement, the Waimatā occupies a unique position. In the lower catchment it forms the boundary between the Areas Of Interest of Ngāti Porou (including Ngāti Oneone's rohe in the Kaiti area) and Rongowhakaata – both of whom have statutory acknowledgement clauses in their Treaty Settlement. The headwaters of the river sit within the Ngāti Porou Area Of Interest. Furthermore, there is a significant portion of the catchment which is still under negotiation within the claims process of the hapū and whānau of Te Aitanga-ā-Māhaki (including Te Whānau-a-Iwi) and affiliates. As a first step all hapū and iwi who identify/affiliate with the river are engaged with and included in the development of a collaborative vision and approach to the restoration of the river.

Developing a plan for the restoration of the Waimatā River will require clear leadership with strong community support, engagement with diverse stakeholders, close collaboration with the relevant agencies, and the delivery of evidence-based approaches that are tested for practicality with those with the relevant expertise and experience in the catchment. In the case of the Uawanui project, for instance, the community enjoys access to expert advice (through Peter Handford and others) along with close engagement in the planning and

delivery of initiatives, including the selection of the project manager. The Whaingaroa and Uawa projects may be useful case studies for guidance on how the relevant statutory agencies (GDC, DoC and QEII, for instance) best advance the community-led restoration of the Waimatā River.

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