

Forest ecosystem restoration opportunities in the Wellington region



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1. Introduction

This report is intended to be one of a series that will inform a Greater Wellington Regional Council (GWRC) science-based approach to biodiversity restoration of the Wellington region. Restoration in the sense described here is about how to prioritise restoration actions, such as revegetation across the landscape in a way that provides benefits for biodiversity and ecosystem processes, as well as considering the impacts of climate change and nature-based solutions like carbon sequestration. Opportunities to capture representative areas of the region's remaining terrestrial ecosystems have been identified and options for their protection and management prioritised (Crisp et al 2016). The GWRC Key Native Ecosystem programme is helping to realise these management goals, focussing pest control and other conservation activities at significant sites. The reality though is that many ecosystems have lost so much of their natural extent that they are now considered formally Threatened or At Risk of extinction (Keith et al 2013). Without intervention to restore their extent and improve the connectivity between remnant areas, habitat loss and fragmentation will continue to erode the ecosystem processes that created and maintain their biodiversity. Therefore, in addition to protecting the best examples of these ecosystems that remain, we also need to recover their extent if they are to persist. This requires prioritised restoration plans to achieve the best outcome with the opportunities and resources available.

This report focusses on indigenous forest ecosystems, the dominant natural landcover of the Wellington region. Forests are estimated to have represented over 98 percent of the landcover in the Wellington region, but now only around 27% of the region's indigenous forests remain. This loss however has not been equitable, with some indigenous forest types experiencing greater loss than others (Singers et al 2018). Indigenous forests in the lowlands, where people have settled, have experienced the greatest loss. These forests once provided rich habitat for indigenous species, including birds, lizards, invertebrates and bats, but are now fragmented and small in size, which makes these systems vulnerable to further degradation. Enhancing the resilience of these forest remnants will improve indigenous species habitat, as well as reducing sedimentation of streams through reducing erosion-prone land and enhancing ecological corridors.

An ideal approach to conservation planning is to set targets for achieving biodiversity goals. Many of the conservation challenges we face have developed over long periods of time and cannot be solved quickly or easily. It is important therefore to start by identifying environmental bottom lines that identify the most important things we need to do first to secure the biodiversity that remains. Ecosystems that have less than 10 percent of their historical extent remaining are considered to be Critically Endangered (the highest level of threat) according to the IUCN's Red List Criteria for Threatened ecosystems (Rodriguez et al 2015). Aiming to increase the extent of the region's Critically Endangered forest types to more than 10 percent of their original extent in each

whaitua would be a challenging, but achievable bottom line to aim for. Recovering these forests would not only promote biodiversity conservation, but also deliver benefits for freshwater quality, erosion control, carbon sequestration and storage to combat climate change and promote human well-being. This report reviews the region's seven Critically Endangered forest ecosystem types and identifies opportunities for restoration plantings along the region's rivers and streams, on erosion-prone land and in GWRC's parks to restore them to at least 10 percent of their natural extent.

2. Background – Opportunities for implementation

While it is important to be guided by realistic targets, the power of systematic conservation planning lies in identifying ways in which to achieve these targets. This is a two-step process, requiring the opportunities to be identified and the mechanisms to realise these opportunities to be sought out. This report outlines the opportunities where these targets may be achieved. The next step will be to consider the mechanisms that might be used to realise these opportunities.

Allowing rivers to move in a more natural way is a goal for the Flood Protection department. It is acknowledged that exotic species are considered to be the most effective in providing protection against floods in most circumstances, but indigenous species have a role to play in the wider river corridors. Two of the threatened forest ecosystem types; Tōtara-mātai-ribbonwood and Kahikatea-pukatea were once a major part of those systems and should play a role in the revegetation of the river corridors, as well as in riparian plantings where appropriate.

Three Critically Endangered forest types are present on erosion-prone land in the pNRP priority catchments for sediment control in the Ruamahanga whaitua; Tawa-tītoki-podocarp, Totara-titoki and Kahikatea-tōtara-mātai. In the Eastern Wairarapa, a fourth forest type; Tawa-kamahi-podocarp is also on erosion-prone soil. Steep slopes on Land Use Capability classes 7e and 8 are not ideal for farming and are located in the headwaters of streams. Restoring these Critically Endangered forest types in these steep, non-productive lands would enhance biodiversity, as well as reduce sedimentation in streams and provide shading of waterways to improve their biodiversity.

In terms of the Threatened forest types described in this report, Queen Elizabeth Park stands out as providing an opportunity to restore two forest types in the Kapiti whaitua; Totara-matai-broadleaf and Kahikatea-pukatea. Other revegetation opportunities in other areas of the parks are also important, but the vision of a park such as Queen Elizabeth Park could be to restore and provide biodiversity benefits for a range of ecosystem types, including: dunelands; ephemeral, swamp, fen and peat wetlands; and dune and swamp forest.

3. Methodology

Greater Wellington Regional Council (GWRC) has predicted the historic extent of the different forest ecosystems of the region and has identified which types are now under the greatest threat (Singers et al 2018). Of the 21 forest ecosystems identified, half (11 forest types) are now classified as Threatened with extinction (Table 3.1). Seven forest types (i.e. one third) were assessed to be Critically Endangered, the most threatened category, three were Endangered and one was Vulnerable.

For the purposes of restoration planning, an analysis of the remaining forest ecosystem extent was completed for each whitua (Figure 3.1). In this case, “Mānuka and/or Kānuka scrubland” was included (as well as “Indigenous forest” and “Broadleaf indigenous hardwoods”) in the assessment as these scrublands are seen as seral stages in the recovery of mature forest. It should be noted that the assessment of remaining extent was based on the national Landcover Database (LCDB) version four that recorded landcover change up to 2012. It is likely that there have been additions and losses of areas of indigenous regeneration that have developed since that time.

The following sections of this report are separated into the five whitua, where the extent of the threatened forest types and the restoration opportunities are detailed. Six of the seven forest types are regionally Critically Endangered, while one type is classified as regionally Endangered, but is below 10% of the original extent in one whitua (Eastern Wairarapa). Titoki-ngaio forest has 10% remaining if shrubland is also taken into account. The restoration opportunities described are examples of what is possible and are not necessarily intended to direct action. Where restoration is on private land, there are limitations as the landowner may not be willing to participate.

Table 3.1: Forest types being considered for restoration based on Singers et al 2018

Forest type	Forest name	Regional threat status
CLF4	Kahikatea-tōtara-mātai	Critically Endangered
MF1	Tōtara-titoki	Critically Endangered
MF7	Tawa-kamahi-podocarp	Endangered
WF1	Titoki-ngaio	Critically Endangered
WF2	Tōtara-mātai-ribbonwood	Critically Endangered
WF3	Tawa-titoki-podocarp	Critically Endangered
WF6	Tōtara-mātai-broadleaf	Critically Endangered
WF8	Kahikatea-pukatea	Critically Endangered

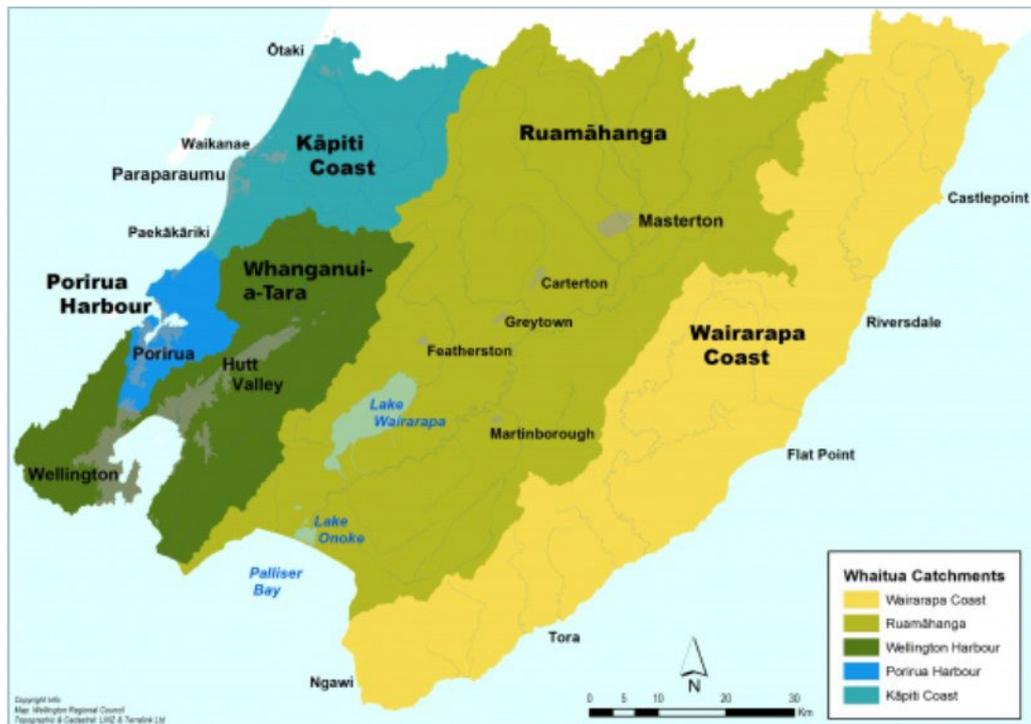


Figure 3.1: Whaitua of the Wellington region

4. Kapiti Coast Whaitua

4.1 Critically endangered forest types in the Kapiti Coast Whaitua

Three forest ecosystem types have less than 10 percent of their original extent remaining in the whaitua. The forest types and the area required for restoration efforts to reach a 10 percent minimum target are shown in Table 3.1 below.

Table 4.1: Number of ha required to reach the 10 percent minimum target for Threatened forest ecosystem types in the Kapiti Coast Whaitua

Forest type	Forest name	Original area (ha)	Remaining area (ha)	Current %	Ha to reach 10%
WF2	Tōtara-mātai-ribbonwood	2,808	112	4	169
WF6	Tōtara-mātai-broadleaf	3,115	131	4	181
WF8	Kahikatea-pukatea	3,863	180	5	206

4.2 Restoration opportunities in the Kapiti Coast Whaitua

4.2.1 WF2: Tōtara-mātai-ribbonwood forest

The original extent of Tōtara-mātai-ribbonwood forest is shown in Figure 4.1. Restoration opportunities exist alongside the Otaki River, and in stream corridors, such as the Waitohu and Mangone Streams.

4.2.2 WF6: Tōtara-mātai-broadleaved forest

The original extent of Totara-matai-broadleaf forest is shown in Figure 4.2. An important restoration opportunity exists in Queen Elizabeth Park (Figure 4.3), but other prospective areas will arise over time when newly mapped wetlands are identified as areas that would be appropriate to plant in dune forest.

4.2.3 WF8: Kahikatea-pukatea forest

The original Kahikatea-pukatea forest extent is shown in Figure 4.4. Opportunities for restoration of this forest type exist alongside Waikanae River (Figure 4.5) and in Queen Elizabeth Park (Figure 4.6).

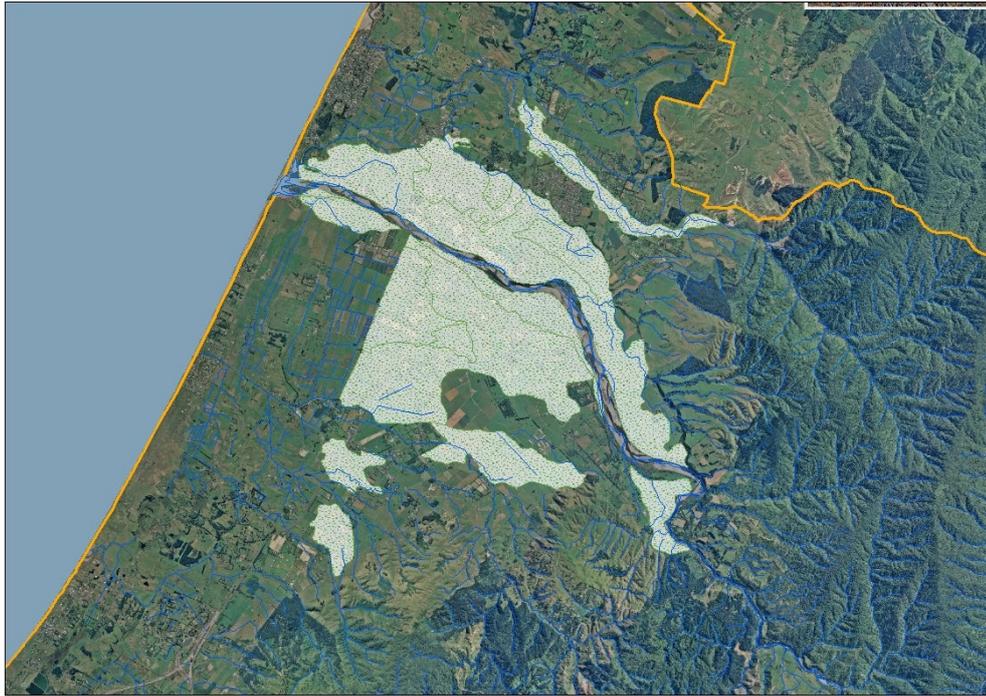


Figure 4.1: Original extent of Tōtara-mātai-ribbonwood forest in the Kapiti Coast Whaitua (2,808 ha)

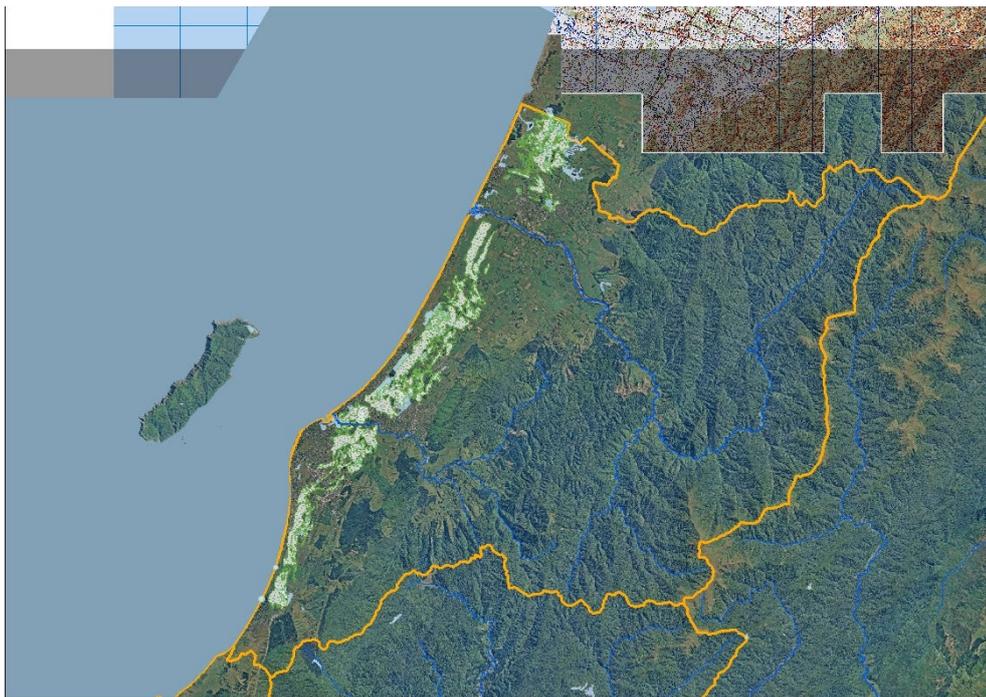
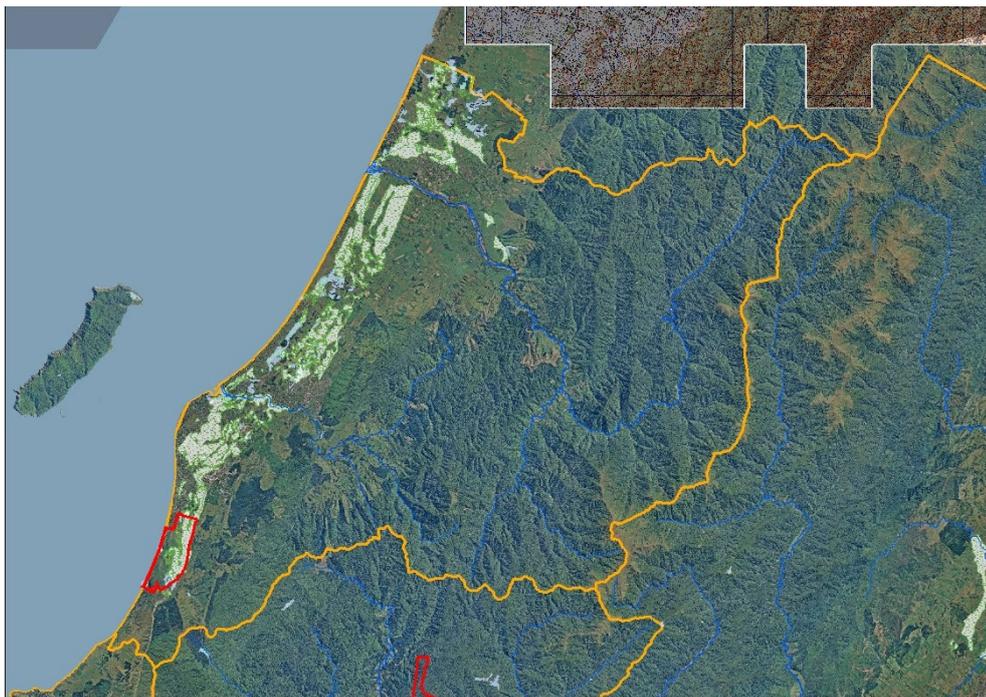


Figure 4.2: Original extent of Tōtara-mātai-broadleaf forest in the Kapiti Coast Whaitua (3,115 ha)



Figure 4.3: Restoration opportunity for Tōtara-mātai-broadleaf forest in Queen Elizabeth Park



**Figure 4.4: Original extent of Kahikatea-pukatea forest in the Kapiti Coast
Whaitua (3,863 ha)**



Figure 4.5: Restoration opportunities for Kahikatea-pukatea forest – Waikanae River



Figure 4.6: Restoration opportunities for Kahikatea-pukatea forest in Queen Elizabeth Park (green hatched area)

5. Te Awarua-o-Porirua Whaitua

5.1 Critically endangered forest types in the Porirua whaitua

Two forest ecosystem types have less than 10 percent of the original extent remaining in the whaitua. These forest types and the area required for restoration efforts to reach a 10 percent minimum target are shown in Table 5.1 below.

Table 5.1: Number of ha required to reach the 10 percent minimum target for Threatened forest ecosystem types in the Te Awarua-o-Porirua Whaitua

Forest type	Forest name	Original area (ha)	Remaining area (ha)	Current %	Ha to reach 10%
WF2	Tōtara-mātai-ribbonwood	370	35	9	2
WF8	Kahikatea-pukatea	238	17	7	7

5.2 Restoration opportunities in the Te Awarua-o-Porirua whaitua

5.2.1 WF2: Tōtara-mātai-ribbonwood forest

The original extent of Tōtara-mātai-ribbonwood forest in the Te Awarua-o-Porirua whaitua is shown in Figure 5.1. An opportunity for restoration of this forest type exists on public land in Porirua City (Figures 5.2).

5.2.2 WF8: Kahikatea-pukatea forest

The original extent of Kahikatea-pukatea forest in the Te Awarua-o-Porirua whaitua is shown in Figure 5.3. Restoration opportunities for Kahikatea-pukatea forest exist along Horokiri Stream (Figure 5.4).



Figure 5.1: Original extent of Tōtara-mātai-ribbonwood forest in the Te Awarua-o-Porirua whaitua (370 ha)



Figure 5.2: Restoration opportunity for Tōtara-mātai-ribbonwood forest in Porirua City



Figure 5.3: Original extent of Kahikatea-pukatea forest in the Te Awarua-o-Porirua whaitua (238 ha)



Figure 5.4: Restoration opportunities for Kahikatea-pukatea forest along the Horokiri Valley in the Te Awarua-o-Porirua whaitua

6. Te Whanganui-a-Tara Whaitua

6.1 Critically endangered forest types in the Te Whanganui-a-Tara Whaitua

One forest ecosystem type has less than 10 percent of the original extent remaining in the Te Whanganui-a-Tara Whaitua. This forest type and the area required for restoration efforts to reach a 10 percent minimum target is shown in Table 6.1 below.

Table 6.1: Number of ha required to reach the 10 percent minimum target for Threatened forest ecosystem types in the Te Whanganui-a-Tara Whaitua

Forest type	Forest name	Original area (ha)	Remaining area (ha)	Current %	Ha to reach 10%
WF8	Kahikatea-pukatea	2,142	69	3	145

6.2 Restoration opportunities in the Te Whanganui-a-Tara Whaitua

6.2.1 WF8: Kahikatea-pukatea forest

The original extent of Kahikatea-pukatea forest in this whaitua is shown in Figure 6.1. There may be some restoration opportunities for this forest type on the side of the Hutt River, but that land has been largely impacted by urban development. There may be another opportunity in the headwaters of the Parangarahu Lakes. The waterways present on the farmland are under erosion pressure and buffering of the streams would aid both the waterways and Lake Kohangatera (an Outstanding Waterbody), (Figure 6.2).



Figure 6.1: Original extent of Kahikatea-pukatea forest in the Te Whanganui-a-Tara Whaitua (2,142 ha)

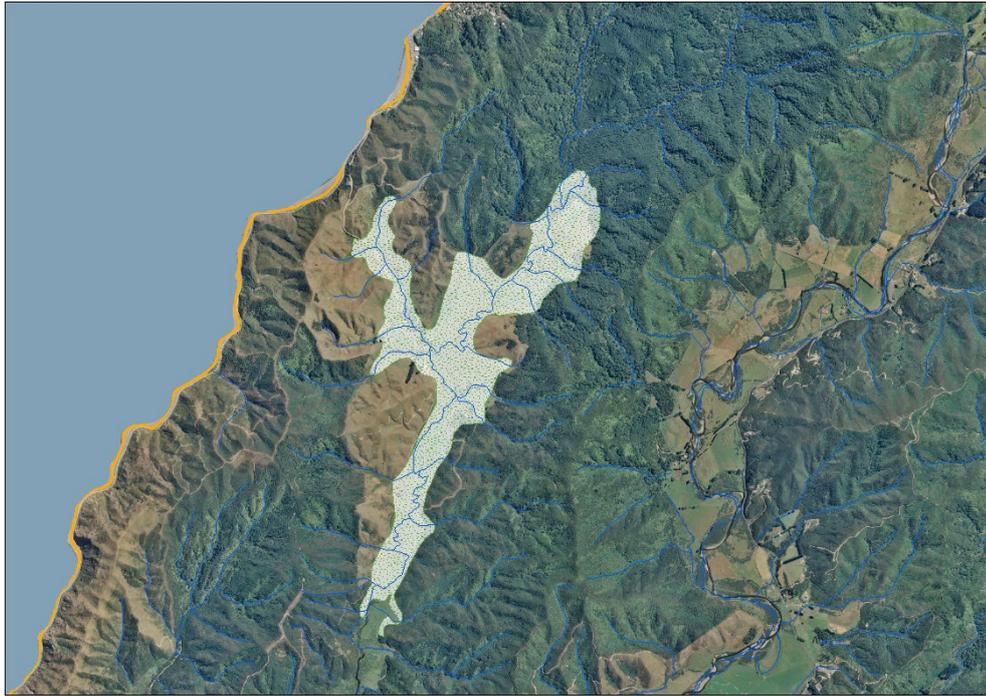


Figure 6.2: Restoration opportunity for Kahikatea-pukatea forest in the headwaters of the Parangarahu Lakes in the Te Whanganui-a-Tara Whaitua

7. Ruamahanga Whaitua

7.1 Critically endangered forest types in the Ruamahanga Whaitua

Six forest ecosystem types have less than 10 percent of the original extent remaining in the whaitua. These forest types and the area required for restoration efforts to reach a 10 percent minimum target are shown in Table 7.1 below.

Table 7.1: Number of ha required to reach the 10 percent minimum target for Threatened forest ecosystem types in the Ruamahanga Whaitua

Forest type	Forest name	Original area (ha)	Remaining area (ha)	Current %	Ha to reach 10%
CLF4	Kahikatea-tōtara-mātai	2,488	26	1	218
MF1	Tōtara-titoki	90,156	3,790	4	5,225
WF2	Tōtara-mātai-ribbonwood	17,886	1,000	6	788
WF3	Tawa-titoki-podocarp	44,153	2,036	5	2,379
WF6	Tōtara-mātai-broadleaf	497	2	0	48
WF8	Kahikatea-pukatea	36,369	1,504	4	2,133

7.2 Restoration opportunities

7.2.1 CLF4: Kahikatea-tōtara-mātai forest

The original extent of Kahikatea-tōtara-mātai forest is shown in Figure 7.1. There are restoration opportunities on farmland that has high erosion potential (Figures 7.2 and 7.3). This forest type is the most threatened in the region.

7.2.2 M1: Tōtara-titoki forest

The original extent of Tōtara-titoki forest is shown in Figures 7.4 and 7.5. There are restoration opportunities on farmland that has high erosion susceptibility (Figures 7.6 and 7.7). While this forest type has by far the largest area that would need to be restored, there are abundant opportunities on erosion-prone land in the whaitua.

7.2.3 WF2: Tōtara-mātai-ribbonwood forest

The original extent of Tōtara-mātai-ribbonwood forest is shown in Figure 7.8 and 7.9. Restoration opportunities for this forest type exist alongside rivers and streams in the whaitua.

7.2.4 WF3: Tawa-titoki-podocarp forest

The original extent of Tawa-titoki-podocarp forest is shown in Figure 7.10 and 7.11. Numerous opportunities for restoration of this forest type exist in highly-erodible land areas (Figures 7.12., 7.13 and 7.14).

7.2.5 WF6: Tōtara-mātai-broadleaf forest

The original extent of Tōtara-mātai-broadleaf forest is shown in Figure 7.15. Restoration opportunities can be found on farms in the lower Ruamahanga valley (Figure 7.16).

7.2.6 WF8: Kahikatea-pukatea forest

The Kahikatea,-pukatea forest original extent is shown in Figure 7.17 and 7.18. Opportunities for restoration of this forest type exist alongside Lake Wairarapa, e.g. in the JK Donald block.



Figure 7.1: Original extent of Kahikatea-tōtara-mātai forest extent in the Ruamahanga Whaitua – limestone soils east of Gladstone (2,488 ha)

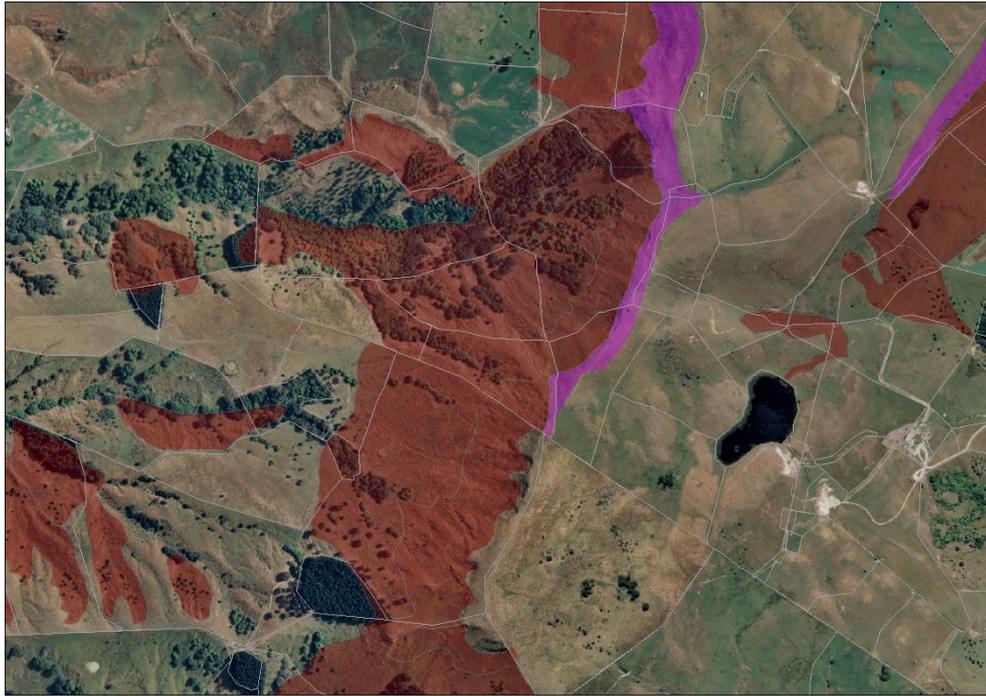


Figure 7.2: Restoration opportunities for Kahikatea-tōtara-mātai forest (red = LUC 7e, purple = LUC 8)

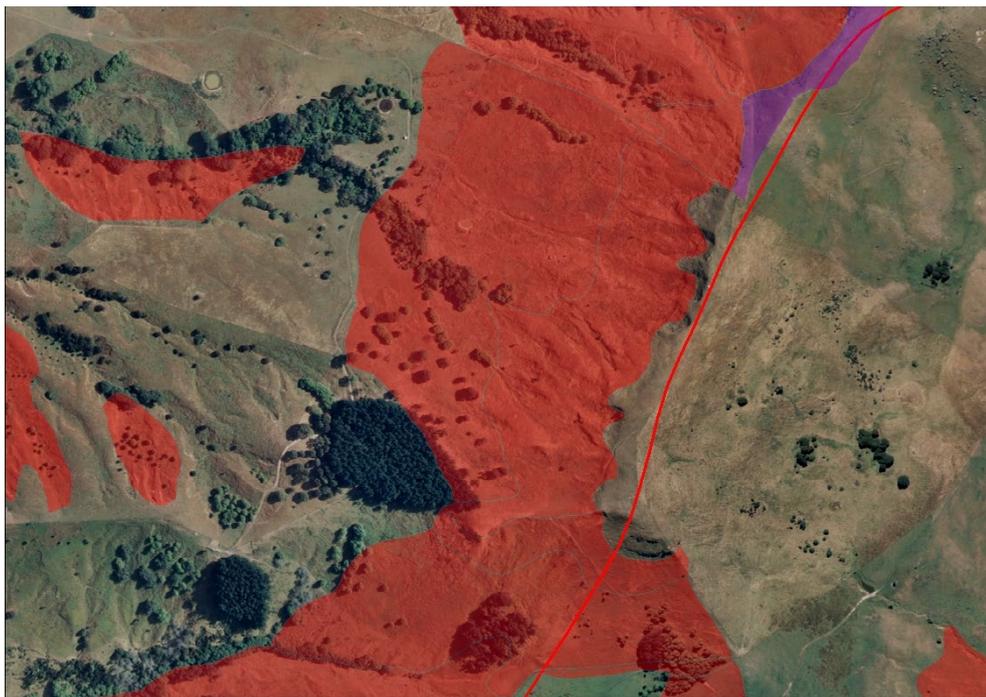


Figure 7.3: Restoration opportunities for Kahikatea-tōtara-mātai forest (red = LUC 7e, purple = LUC 8)

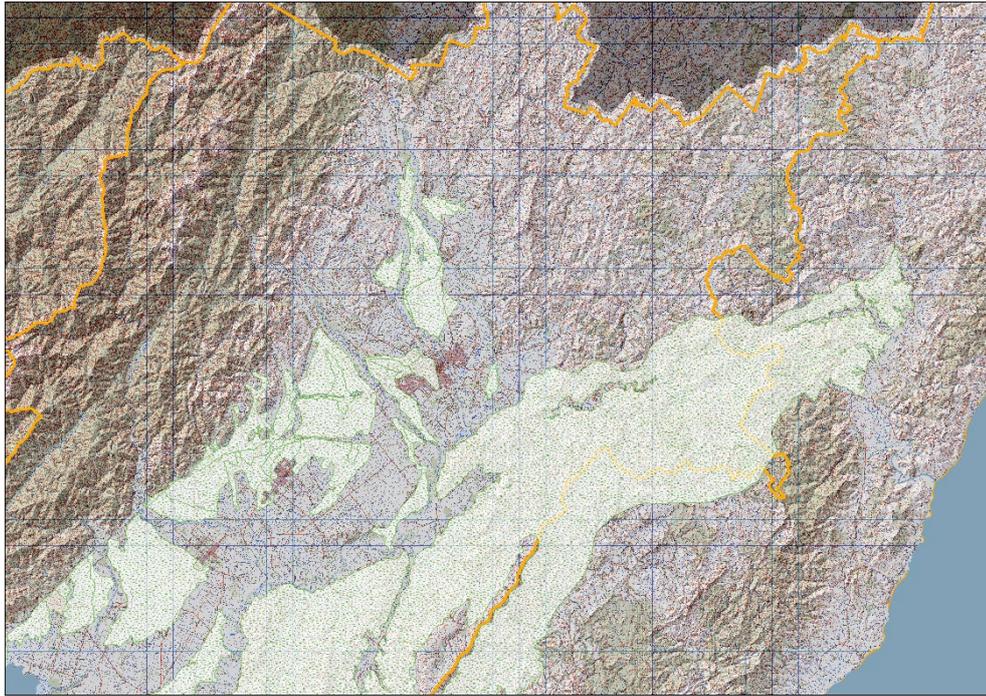


Figure 7.4: Original extent of Tōtara-titoki forest in Ruamahanga whitua (North) (90,156 ha)

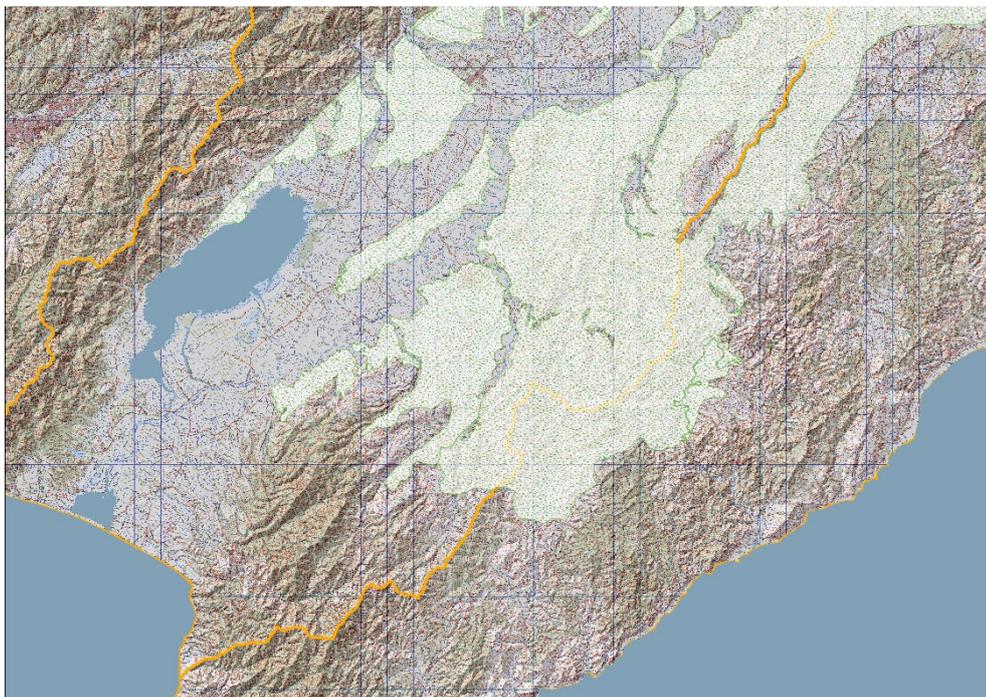


Figure 7.5: Original extent of Tōtara-titoki forest in Ruamahanga whitua (South) (90,156 ha)



Figure 7.6: Restoration opportunities for Tōtara-titoki forest (red = LUC 7e, dark red = LUC 8)

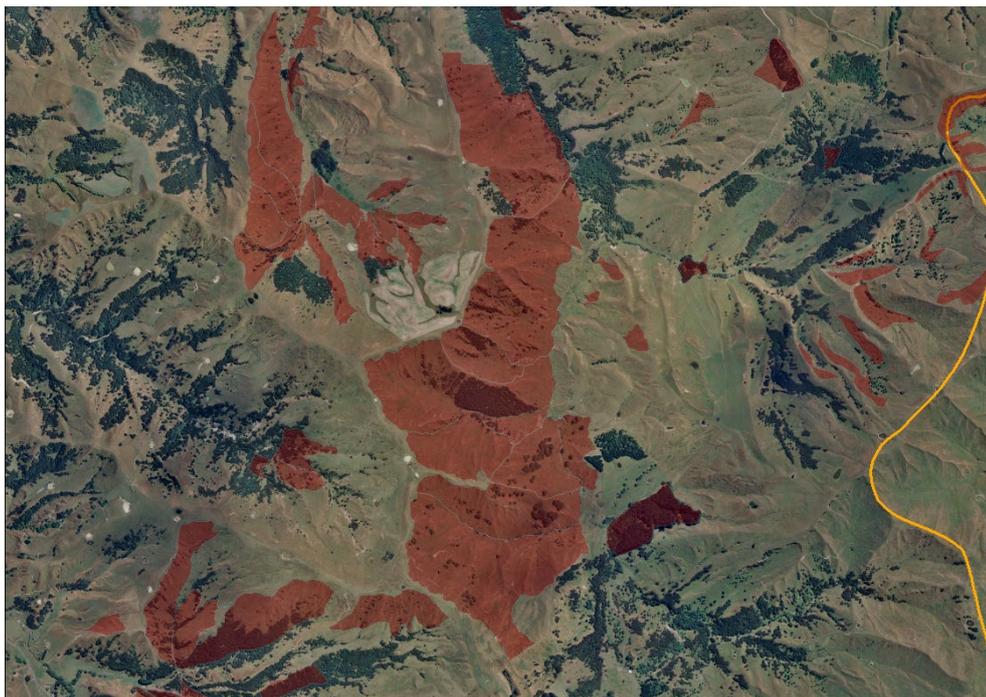


Figure 7.7: Restoration opportunities for Tōtara-titoki forest (red = LUC 7e, dark red = LUC 8)



Figure 7.8: Original extent of Tōtara-matai-ribbonwood in Ruamahanga Whaitua (North) (17,886 ha)



Figure 7.9: Original extent of Tōtara-mātai-ribbonwood in Ruamahanga Whaitua (South) (17,886 ha)

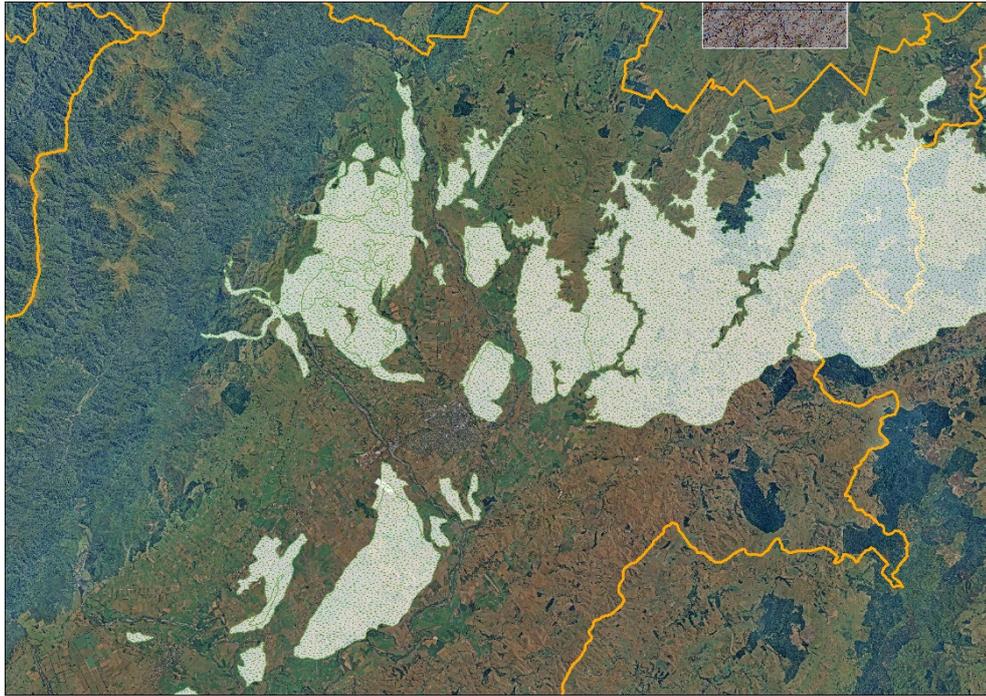


Figure 7.10: Original extent of Tawa-titoki-podocarp forest in Ruamahanga Whaitua (North) (44,153 ha)



Figure 7.11: Original extent of Tawa-titoki-podocarp forest in Ruamahanga Whaitua (South) (44,153 ha)



Figure 7.12: Restoration opportunities for Tawa-titoki-podocarp forest (red = LUC 7e)

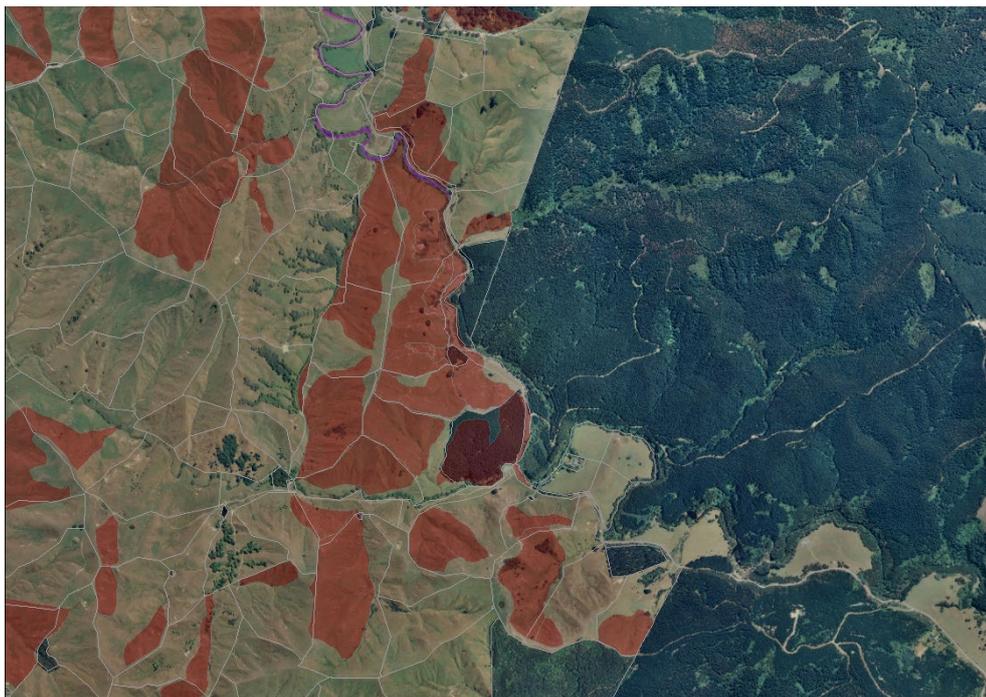


Figure 7.13: Restoration opportunities for Tawa-titoki-podocarp forest (red = LUC 7e, dark red = LUC 8)



Figure 7.14: Restoration opportunities for Tawa-titoki-podocarp forest (red = LUC 7e, dark red = LUC 8)



Figure 7.15: Original extent of Tōtara-mātai-broadleaf forest in Ruamahanga Whaitua (497 ha)



Figure 7.16: Restoration opportunity for Tōtara-mātai-broadleaf forest on Landcorp farm

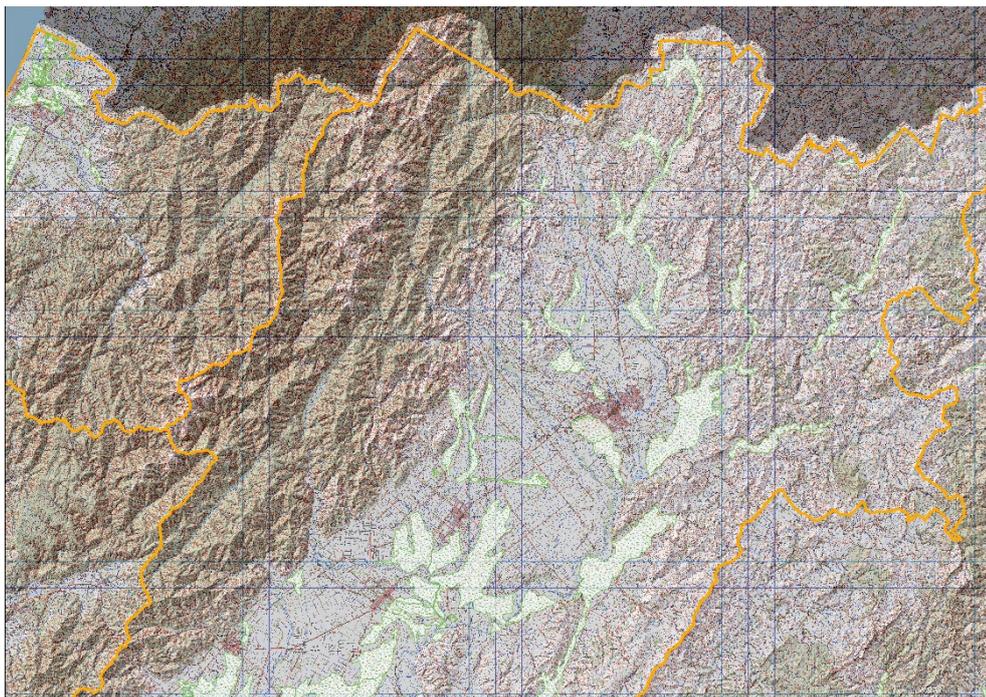


Figure 7.17: Original extent of Kahikatea-pukatea forest in Ruamahanga Whaitua (North) (36,369 ha)

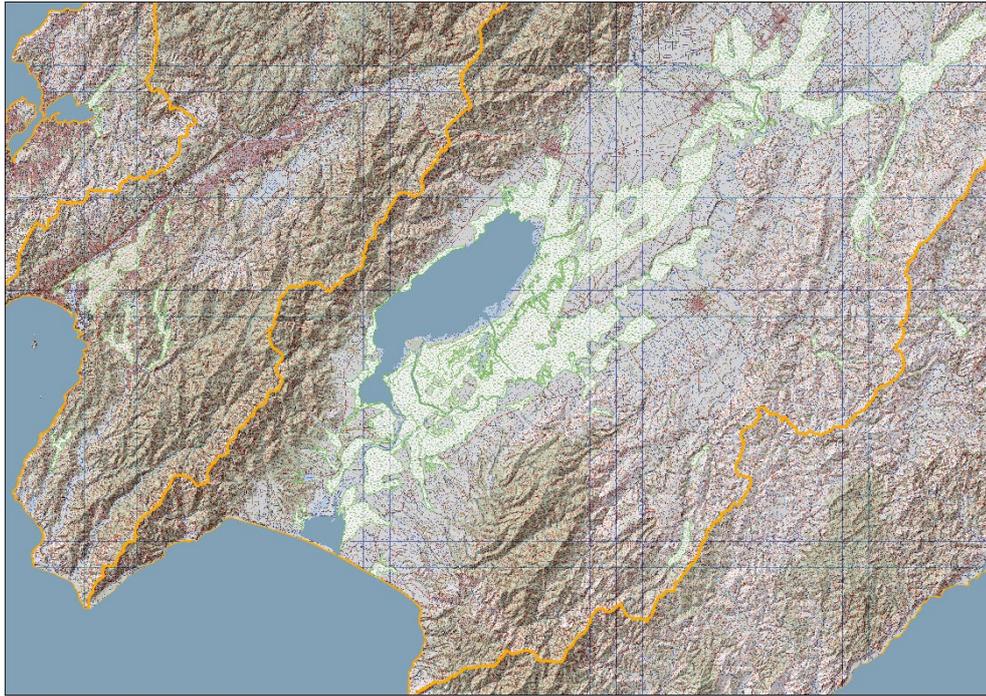


Figure 7.18: Original extent of Kahikatea-pukatea forest in Ruamahanga Whaitua (South) (36,369 ha)

8. Eastern Wairarapa Whaitua

8.1 Critically endangered forest types in the Eastern Wairarapa Whaitua

Four forest ecosystem types have less than 10 percent of the original extent remaining in the whaitua. The four forest types and the area required for restoration efforts to reach a 10 percent minimum target are shown in Table 8.1 below.

Table 8.1: Number of ha required to reach the 10 percent minimum target for Threatened forest ecosystem types in the Eastern Wairarapa Whaitua

Forest type	Forest name	Original area (ha)	Remaining area (ha)	Current %	Ha to reach 10%
CLF4	Kahikatea-tōtara-mātai	534	3	1	51
MF1	Totara-titoki	32,158	2,611	8	605
MF7	Tawa-kamahi-podocarp	3,686	274	7	94
WF8	Kahikatea-pukatea	8,110	359	4	452

8.2 Restoration opportunities in the Eastern Wairarapa Whaitua

8.2.1 CLF4: Kahikatea-tōtara-mātai forest

The original extent of Kahikatea-tōtara-mātai forest is shown in Figure 8.1. There are restoration opportunities on farmland that has high erosion potential (Figures 8.2 and 8.3).

8.2.2 MF1: Totara-titoki forest

The original extent of Totara-titoki forest is shown in Figure 8.4. There are restoration opportunities on farmland that has high erosion susceptibility (Figures 8.5, 8.6 and 8.7).

8.2.3 MF7: Tawa-kamahi, podocarp forest

The original extent of Tawa-kamahi-podocarp forest is shown in Figure 8.8. There are restoration opportunities on farmland that has high erosion susceptibility (Figures 8.9 and 8.10).

8.2.4 WF8: Kahikatea-pukatea forest

The original extent of Kahikatea-pukatea forest is shown in Figure 8.11. There are restoration opportunities for this forest type alongside the Whareama River (Figure 8.12).



Figure 8.1: Original extent of Kahikatea-tōtara-mātai forest in the Eastern Wairarapa Whaitua (right of the red line) (534 ha)

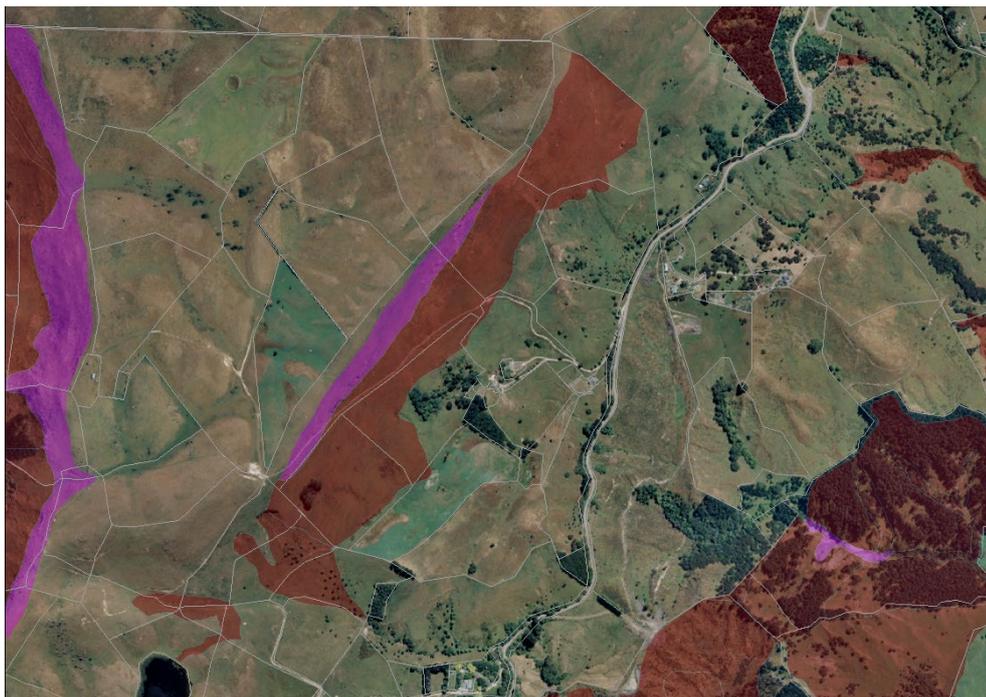


Figure 8.2: Restoration opportunity for Kahikatea-tōtara-mātai forest (red = LUC 7e, purple = LUC 8)

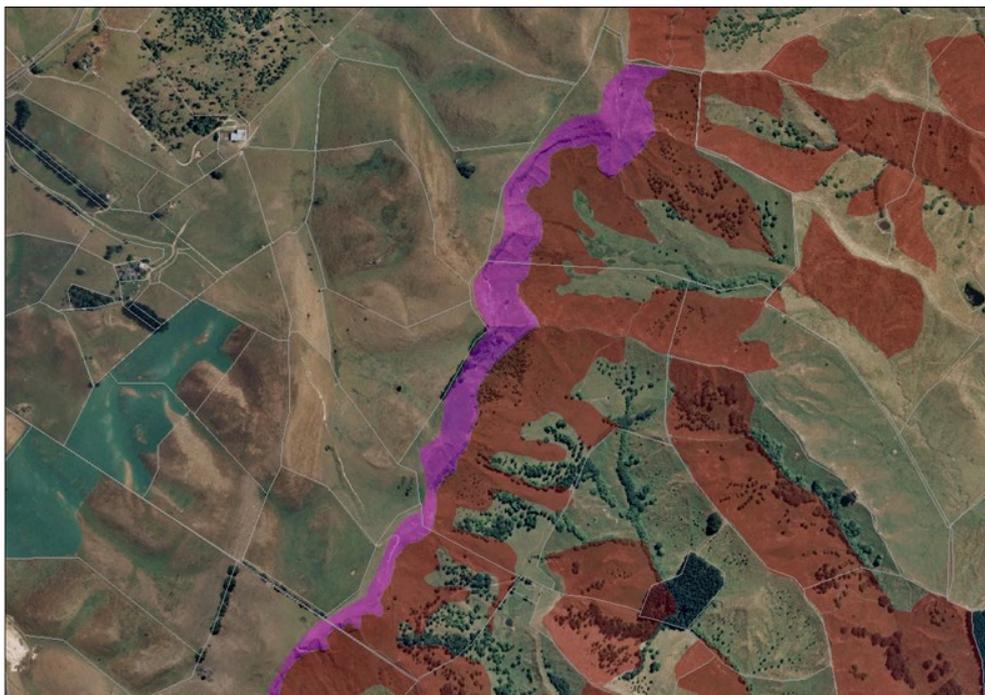


Figure 8.3: Restoration opportunity for Kahikatea-tōtara-mātai forest (red = LUC 7e, purple = LUC 8)

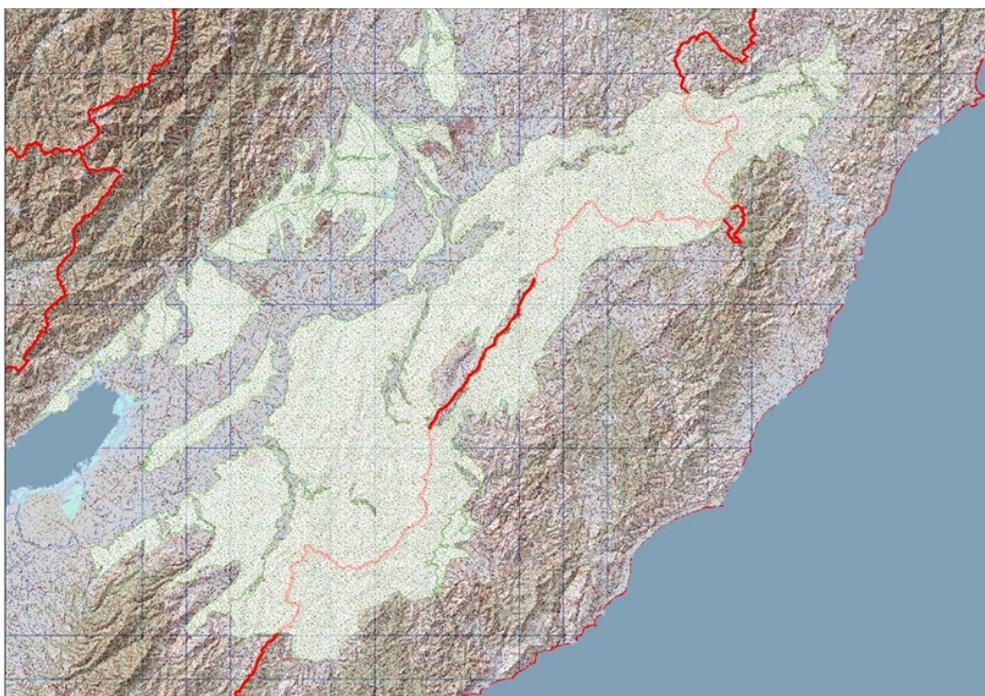


Figure 8.4: Original extent of Tōtara-titoki forest in the Eastern Wairarapa Whatiua (32,158 ha)

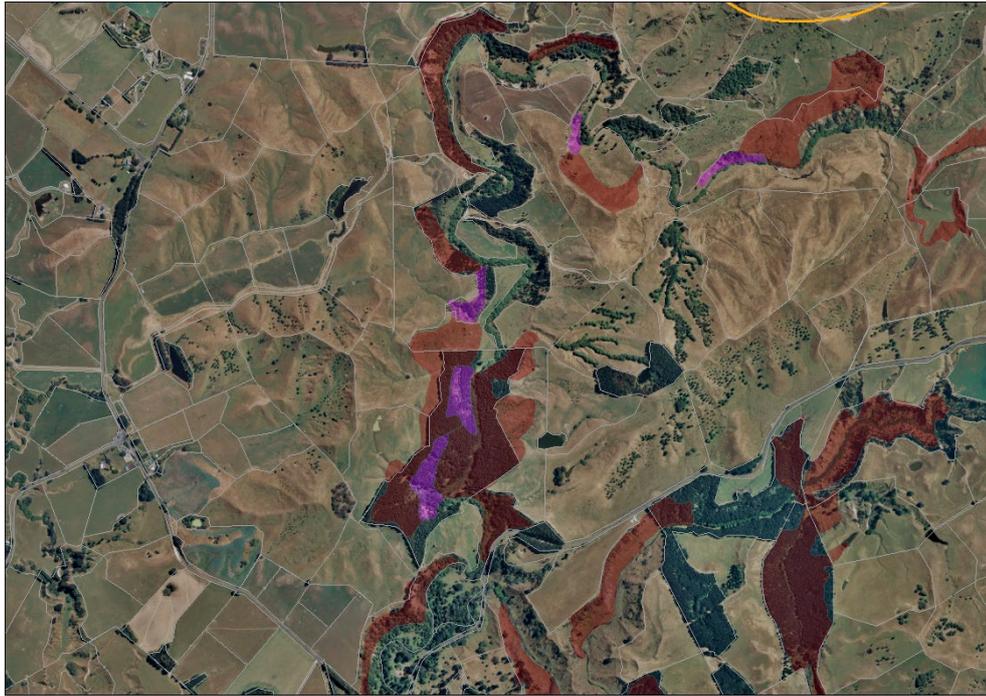


Figure 8.5: Restoration opportunities for Tōtara-titoki forest (red = LUC 7e, purple = LUC 8)



Figure 8.6: Restoration opportunities for Tōtara-titoki forest (red = LUC 7e)

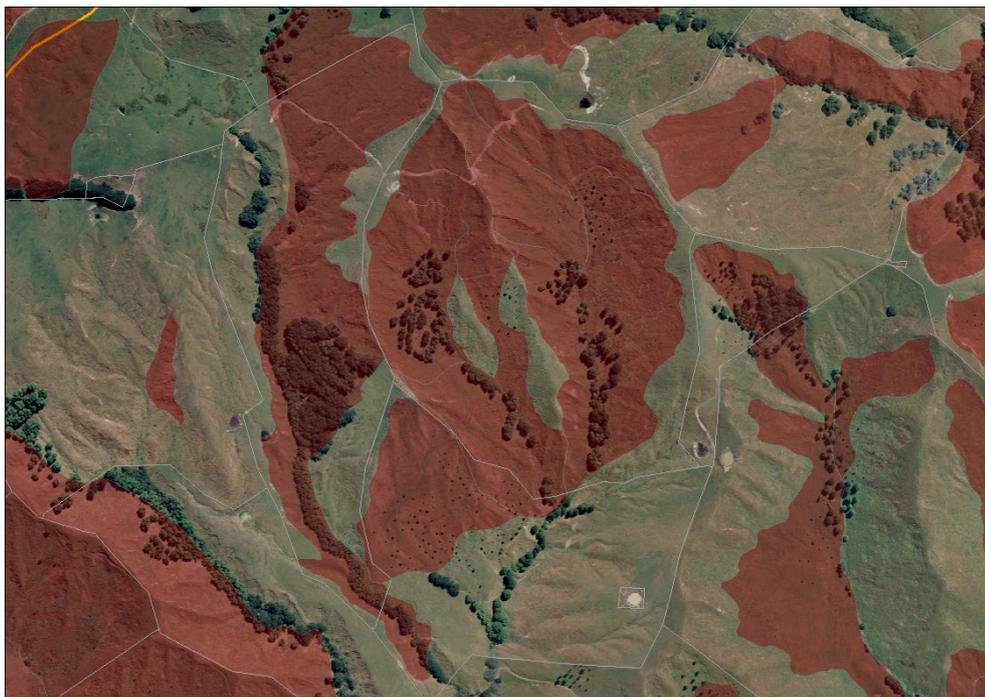


Figure 8.7: Restoration opportunities for Tōtara-titoki forest (red = LUC 7e)

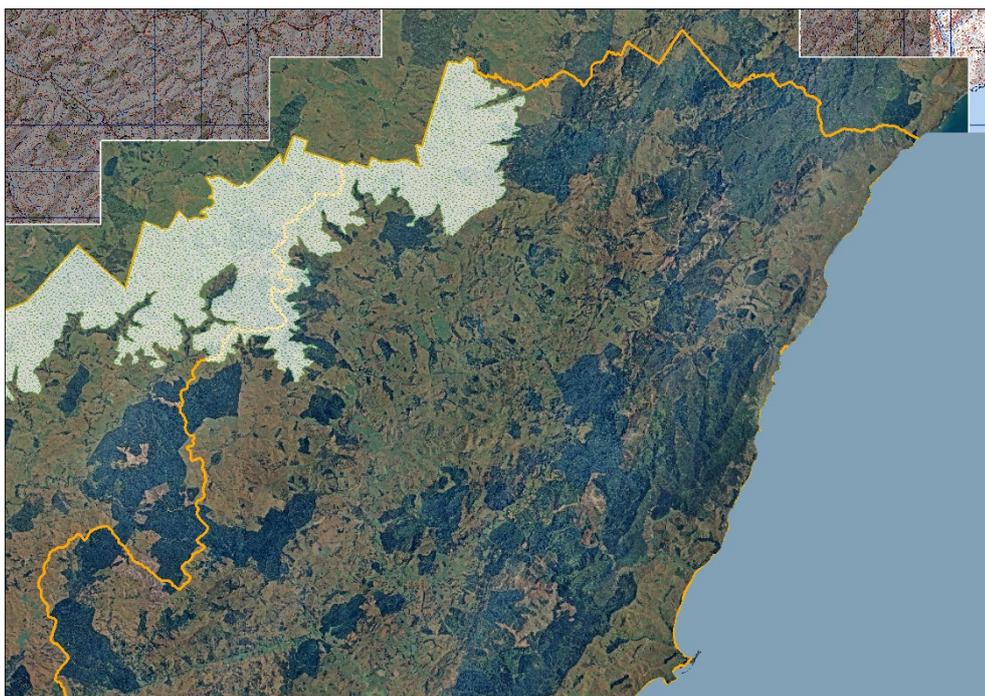


Figure 8.8: Original extent of Tawa-kamahi, podocarp forest in the Eastern Wairarapa Whaitua (3,686 ha). Note the range extends into the Ruamahanga Whaitua to the west.



Figure 8.9: Restoration opportunities for Tawa-kamahi-podocarp forest (red = LUC 7e, purple = LUC 8)

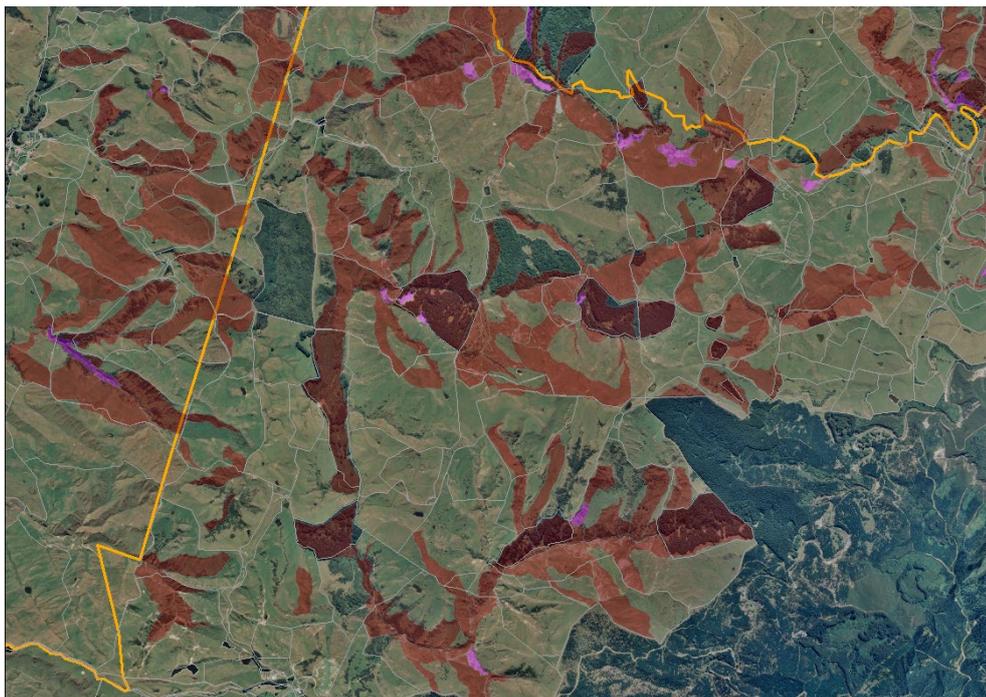


Figure 8.10: Restoration opportunities for Tawa-kamahi-podocarp forest (red = LUC 7e, purple = LUC 8)

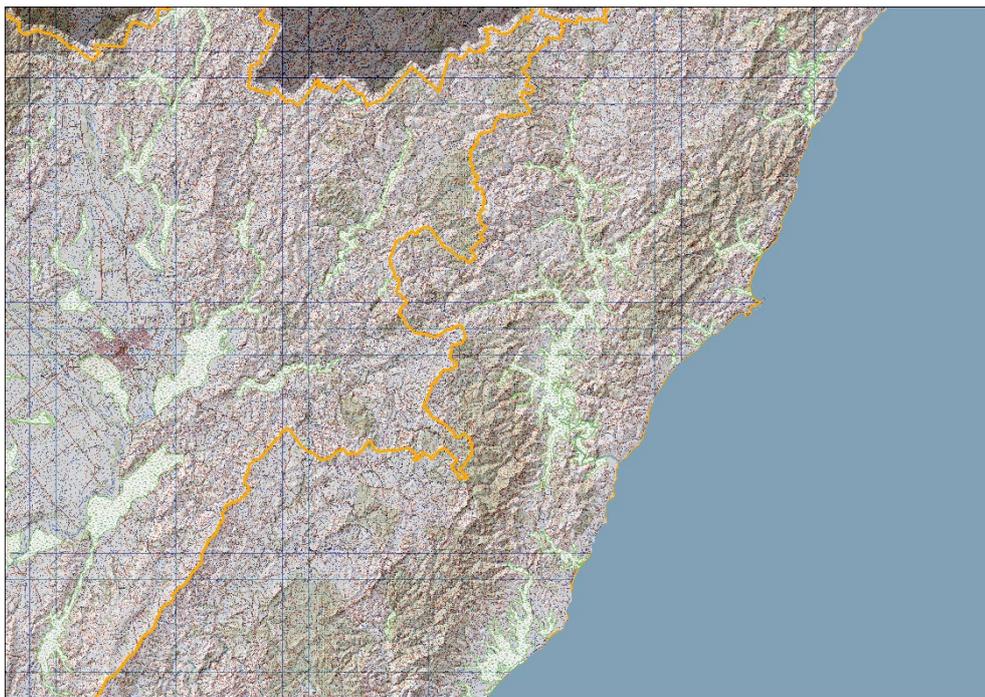


Figure 8.11: Original extent of Kahikatea-pukatea forest in Eastern Wairarapa Whaitua (8,110 ha)



Figure 8.12: Restoration opportunities for Kahikatea-pukatea forest along the Whareama River in the Eastern Wairarapa Whaitua

9. Conclusions

Greater Wellington's Regional Policy Statement (GWRC 2013) highlights the need to maintain and restore significant indigenous ecosystems and habitats. The remnant threatened forest types of the region provide a reservoir of ecosystem and species diversity that needs both protection and restoration effort to ensure that that taonga is not lost in the future. Increasing the extent of threatened forest types is a priority restoration activity that will enhance the viability of indigenous floral and faunal populations. Other benefits to this approach accrue in terms of slowing erosion, minimising sediment and contaminant loads in the region's freshwater environments and ultimately into the marine environment. An increase in forest extent would also increase the amount of carbon sequestered and stored in the trees, contributing to climate change mitigation. The information available provides an opportunity to take a strategic approach to forest restoration activities in the region that will provide multiple environmental benefits.

Restoration of these areas may involve retirement from grazing or large scale planting programmes. Nursery crops are important to the viability of planting programmes, as they provide shelter and aid ecosystem changes that will encourage natural regeneration. Mānuka and kānuka are key nursery crops, but the use of broadleaf species in the planting mix (in different ratios depending on the forest type) will provide early ecosystem benefits. Alterations in microclimate factors such as soil fertility, temperature, light availability and wind protection will occur over time as the forest develops. In general, forest canopy species such as totara or matai are best to be planted many years after the nursery crop if natural regeneration is not occurring.

There are a number of large-scale projects occurring within the region where restoration plantings or retirement projects makes the aim of achieving restoration of at least 10% of the historical extent of the threatened forest ecosystems achievable. These include the Regional Parks restoration/retirement projects, Wairarapa Moana, Waikanae ki Uta ki Tai, Flood Plain management plans, farm plans and whitua implementation plans. The use of appropriate species and a strategic regional approach will mean that real change in 'turning the tide' on biodiversity loss can occur.

10. Acknowledgements

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11. References

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